AN ANALYSIS OF POST-ADOPTION USAGE OF PERSONAL LEARNING SYSTEMS

TSUI LAI NA MIRIAM

M.Phil

The Hong Kong Polytechnic University

2017

The Hong Kong Polytechnic University

Department of Industrial and Systems Engineering

An Analysis of Post-Adoption Usage of Personal Learning Systems

TSUI Lai Na Miriam

A thesis submitted in partial fulfilment of the requirements

for the degree of Master of Philosophy

May, 2015

Certificate of Originality

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

_____ **(Signed)**

TSUI LAI NA MIRIAM **(Name of student)**

ABSTRACT

The consumerization of IT products has been very much characterized by bottom up user adoption in recent years. The advancement of broadband and wireless technologies has amplified the network effect. Learning is becoming more self-centric and network-based. Learners are personalizing their own way of learning as they have different learning competencies, preferences and objectives. A personal learning system (personal learning environment & network, PLE&N for short) is developed in order to, among others, integrate learning sources, foster ubiquitous learning activities and build up networks for co-learning and locating expertise. In summary, a PLE&N serves as a platform fostering self-regulated and network-based learning, resulting in enhancing one's knowledge in problem solving, collaboration, and innovation. The aim of this research is to identify and study factors that influence the continued usage (post-adoption) of a selected PLE&N. The research objective is to build and validate a research model explaining factors involved in the continued use of PLE&N tools.

A survey was conducted to validate the research model and the hypotheses for the continued usage of the PLE&N. 95 valid responses were collected from students and graduates of the Hong Kong Polytechnic University. The results from the present study show that intention is a significant and the highest loading predictor of continued usage. Compatibility and social influence are also found to be valid. Among all cognitive constructs, perceived usefulness, however, is non-significant. This unexpected result may be attributed to the context of this study, as learning is a long-term process and there is no well accepted indicator of successful or

unsuccessful learning. Respondents might find it hard to relate perceived usefulness to the PLE&N tools.

As regards the affective constructs, pleasure, which measures the cognitive judgment (good-bad), and arousal, which measures the intensity of the judgment (strong-weak), are found to posit positive influence on continued usage. Dominance, which measures the feeling of control and influence (active-passive), is also significant. Its impact on continued usage is negative, which infers that the subjects do not want to be controlled, submitted or guided in the use of PLE&N.

This study contributes to the information systems (IS) field by investigating continued usage in a personal context and incorporating the influence of unconscious factors (personal affects) on continued usage. This study does have limitations, including the small sample size, the possibility of response bias, and the weakness of a cross-sectional field study. Despite all the limitations, the author would encourage more research on how personal affects influence IS continuance, and more research work under different contexts or settings.

ACKNOWLEGEMENTS

I would like express my sincere gratitude to my two project supervisors, Professor Eric Tsui and Dr Eric Seeto. With their guidance and support, this project could be completed successfully. Prof Tsui and Dr Seeto have always given me timely and insightful feedback on my work.

I would like to thank my research classmates who have assisted me and provided me valuable feedback on my project along the way. Thanks should also be given to all the respondents for spending time and giving extra feedback for my questionnaire.

The Department of Industrial and Systems Engineering has given me generous administrative and coordinative support. The Knowledge Management and Innovation Research Centre (KMIRC) has also given me valuable opportunities to attend and organize a variety of conferences and events. Assistance and support given from the staff of these organizations are greatly appreciated.

The work described in this thesis was supported by the Research Committee of The Hong Kong Polytechnic University under student account code RTC7. Its support is gratefully acknowledged.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

Acceptance & Continued Usage

ECT – Expectation-Confirmation Theory

IDT – Innovation Diffusion Theory

IS – Information System

MPCU – Model of PC Utilization

PAD Model – Pleasure-Arousal-Dominance Model

SCT – Social Cognitive Theory

TAM – Technology Acceptance Model

TPB – Theory of Planned Behaviour

TRA – Theory of Reasoned Action

UTAUT – Unified Theory of Acceptance and Use of Technology

Personal Knowledge Management & Personal Learning Systems

KM – Knowledge Management

PIM – Personal Information Management

PKM – Personal Knowledge Management

PLE&N – Personal Learning Environment & Network

Methodologies

AMOS – Analysis of Moment Structures

SEM – Structural Equation Modelling

Others

PolyU – The Hong Kong Polytechnic University

CHAPTER 1 INTRODUCTION

This chapter begins with a general description of the current environment in workplaces and schools from an information system perspective. The contemporary challenges faced by individuals gave rise to the motivation for the research. This chapter is then followed by the research objectives and the significance of conducting the research. There is an overview of the thesis organization at the end of this chapter.

1.1 Motivation

The consumerization of information system (IS) products has been very much characterized by bottom-up user adoption in recent years. Employees and students are requesting to use IS products of their choice in the workplace and in school, which forms a demand for using personal IS products. The advancement of broadband and wireless technologies has amplified the network effect; a lot more dots are being connected and access to the internet is now ubiquitous and pervasive. Learning is becoming more learner-centric and network-based.

The 21st century is a knowledge work era with characteristics which include highly unstructured and fast-changing working conditions. Problems that knowledge workers have to tackle are novel and they have to learn constantly and search for information to support decision-making. The issues of changing conditions and information overload are unabated and they challenge people's abilities to learn. The traditional way of learning may not be effective enough to keep up with the pace of

the emerging knowledge. Learners need to develop their personal learning systems in order to integrate and foster learning activities. In brief, personal learning systems refer to any personal learning environment and network (PLE&N) which promotes self-regulated and network-based learning. PLE&N is a generic term and a concept instead of a specific software package. This study focuses on the continued use of a selected virtual PLE&N (Google + and Feedly) to support learning, and describes its benefits (please refer to "Appendix 1 – Setup Guide and Introduction of PLE&N" for the details of the PLE&N understudied of this research).

Learners have different learning competencies, preferences and objectives. To respond to this diversity, learning should be personalized. On the other hand, there is an increasing trend that people learn from trusted networks, as knowledge is distributed across connections (Dabbagh & Kitsantas, 2012; Jarche, 2010b). To meet the contemporary challenges and learning trends, a PLE&N is established. Changes in technology provide a variety of tools for people to develop their own learning systems. Many of these tools are Web 2.0 tools, including discussion forums, file/video sharing, RSS feeds and social networks. Learners can also use these tools to build up networks for co-learning and locating expertise. In general, a PLE&N serves as a platform fostering self-regulated and network-based learning, resulting in problem solving, collaboration, and innovation (Dabbagh & Kitsantas, 2012).

Knowledge workers adopt a variety of tools for varying periods of time to support learning. The selection of a particular tool relies on the both the acceptance decision and the usage experience which gives continued usage decision. The focus of IS

studies has been very much on acceptance (also known as adoption, pre-adoption or initial adoption) in an organizational context (Jasperson, Carter, & Zmud, 2005; Parthasarathy & Bhattacherjee, 1998). Conventionally, use of IT products in organizations is top-down. Organizations supply pre-selected IT products for employees. On the other hand, the conventional IT products authorized by organizations usually incur a large amount of initial cost in acquisition but minimal operating cost thereafter (Parthasarathy & Bhattacherjee, 1998). Hence, acceptance of these pre-selected IT products is of vital importance to organizations, and studies of accepting these products are supported by organizations.

Compared to the abundant research on IS acceptance, studies on continued usage of technology in a personal context are scant (Karahanna, Straub, & Chervany, 1999; Kim & Malhotra, 2005). Contrary to conventional IT products, many of the PLE&N tools are used at the individual and personal levels, and adopted in a bottom-up manner. Many of these tools are free of charge and revenue is mainly derived from advertisements and subscriptions to premier services. Regarding this kind of tool, the "long-term viability and its eventual success depend on its *continued* use rather than *first-time* use" (Bhattacherjee, 2001, p.352, emphasis in original). Continuance is essential and vital for the success of PLE&N tools. While there is a need to select the right tools to support work and continuous, active and lifelong learning, individual knowledge workers are generally not compelled to use any specific tool, so it is worthwhile to study factors that influence continued usage of a (set of) tool.

1.2 Research Objectives

This research aimed to identify and study factors that influence the continued usage of PLE&N tools in a personal context. Apart from cognitive and conscious factors, unconscious factors like personal affect were also investigated. Two research questions are proposed as follows.

1. What are the factors that lead to continuance intention and continued usage of PLE&N tools?
2. How do these factors influence continued usage of PLE&N tools?

The research objective was to build and validate a research model explaining factors in the continued use of PLE&N tools. By understanding more about continued usage, technology providers can design better adoption and retention strategies, while tool developers, for example lecturers in universities, can better predict usage.

1.3 Significance of the Research

In comparison with acceptance studies, studies on continued usage of IS are scant. Studies on continued usage of IS are largely based on acceptance studies, many of which are conducted in an organizational context. Continued usage based on personal context and the study of unconscious factors, such as personal affect, are under-explored. This study contributes to reveal how unconscious factors (personal affect) influence the continued usage of a PLE&N. To the best knowledge of the

author, this study is the first to incorporate a pleasure-arousal-dominance model into IS continued usage study.

1.4 Organization of the Thesis

The following chapters begin with the literature review on IS acceptance, IS continued usage and personal knowledge management & personal learning systems, followed by identifying the research gaps and discussion of the research model. Chapter 3 discusses the research methodologies used to fulfil the three research questions. Chapter 4 outlines the results and analysis of data collection. Chapter 5 is the discussion of the results with limitations and insights for future work stated and Chapter 6 outlines the conclusion of this research.

CHAPTER 2 LITERATURE REVIEW

This chapter begins with a review of acceptance (also known as adoption) and continued usage (also known as post-adoption) of information systems (IS). Major well-developed acceptance models are discussed. Models and common constructs of continued usage are also investigated.

A review of Personal Knowledge Management (PKM) and Personal Learning Environment & Network (PLE&N) is then followed. PLE&N serves as a platform in which learning and PKM-related activities are being carried out. Different definitions of PKM are given and discussed. The development of PKM is elaborated with four foci, with articulation with the corresponding papers and frameworks.

Finally, the chapter concludes by identifying, with evidence, the research gaps and the research objectives. The significance of narrowing the gaps is also stated.

2.1 Acceptance / Adoption

Studies on acceptance / adoption examine factors that motivate individuals to adopt a new information system (Bhattacherjee, 2001). A number of acceptance theories and models have been developed in information technology / information systems, psychology and sociology research (Venkatesh, Morris, Davis, & Davis, 2003). They aim to study the cognition associated with individuals' adoption activities, decisions

and behaviour and the diffusion of IT systems (Jasperson et al., 2005). Among different well-developed theories and models, this study focuses on four of them. They are (i) Theory of Reasoned Action, (ii) Technology Acceptance Model, (iii) Theory of Planned Behaviour, and (iv) Innovation Diffusion Theory. Each of the theories / models is discussed in the following section.

2.1.1 Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) was proposed by Fishbein & Ajzen (1975). It is grounded in social psychology and is used to predict and explain conscious and intended behaviour across a wide range of domains (Davis, Bagozzi, & Warshaw, 1989). The TRA model was in fact "designed to explain virtually any human behaviour" (Ajzen & Fishbein, 1980, p. 4), and hence it is considered a very general model.

The core constructs of the TRA are attitude toward behaviour, subject norm and behavioural intention. Attitude towards behaviour is "an individual's positive or negative feelings (evaluate affect) about performing the target behaviour" (Fishbein & Ajzen, 1975, p. 216); subject norm refers to "the person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302); behavioural intention is a measure of the degree of one's intention to perform a type of behaviour. Fishbein & Ajzen stated that attitude toward behaviour and subject norm predict behavioural intention, which in turn predicts actual behaviour (Figure 2.1).

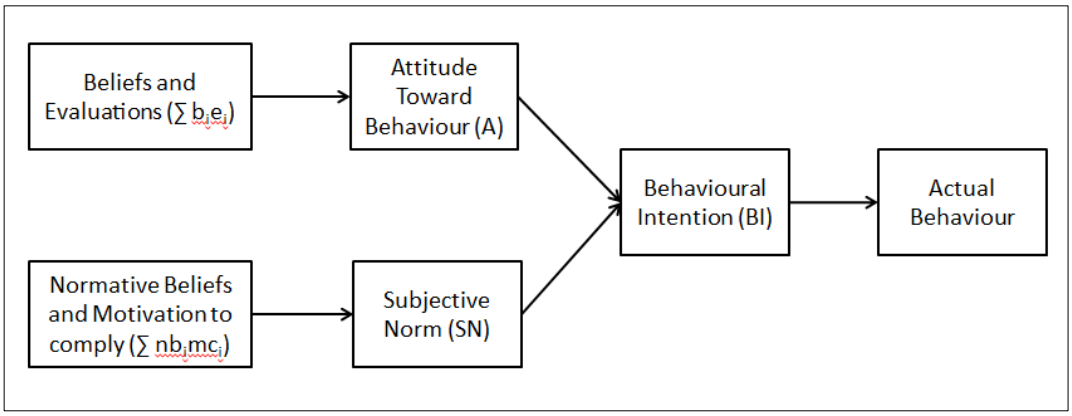


Figure 2.1 Theory of Reasoned Action (TRA)

(Adapted from Davis et al., 1989)

As shown in Figure 2.1, a person's attitude toward behaviour (A) is determined by his or her beliefs (b_i) and evaluations (e_i) of the consequences of performing the specified behaviour. Beliefs are individuals' subjective probability that performing the specified behaviour will result in consequence *i*, while evaluations refer to an evaluative response to the consequence *i* in an implicit way. Hence, attitude toward behaviour is the summation of the products of the salient beliefs and evaluations.

Subjective norm (SN) is determined by the summation of the products of normative beliefs (nb_i) and motivations (mc_i). An individual's normative beliefs refer to the perceived expectations of his or her referent groups while motivation refers to his or her degree of compliance with these expectations.

As the TRA is a general model, it does not specify any operative beliefs for any specific behaviour. Research work applying the TRA to investigate certain behaviour must identify the corresponding salient beliefs. The TRA, nevertheless, lays a strong foundation for predicting behaviour through attitude and subjective norm, and explaining how factors influence behaviour through indirect influence to attitude, subjective norm and their relative weights, in any field of studies. To put the TRA in IS, the TRA can be used to interpret internal psychological variables through a variety of external variables such as system design characteristics and organizational structure (Davis et al., 1989). The truth is, the TRA has been used as the foundation of another well-established acceptance model – the Technology Acceptance Model in the field of IS. The next section discusses the Technology Acceptance Model (TAM).

2.1.2 Technology Acceptance Model (TAM)

Davis (1986) applied the TRA to develop a model, the Technology Acceptance Model (TAM), for individual acceptance of information systems under an organizational context. TAM aims to predict and explain user behaviour across a range of end-user computing technologies, and to trace the impact of external factors on internal beliefs, attitudes and intentions (Davis et al., 1989).

Similar to the TRA, the TAM suggests that an individual's attitude towards using a tool affects acceptance via behavioural intention. Contrary to the TRA, subjective norm is removed while perceived usefulness and perceived ease of use are added in

the TAM. Perceived usefulness refers to a "user's subjective probability that using a specific application system will increase his or her job performance", while perceived ease of use is the degree to which a "user expects the target system to be free of effort" (Davis et al., 1989, p. 985). Perceived ease of use is viewed as the match between an individual's capabilities and the skills required to use a particular system developed by other researchers (Mathieson, 1991). The TAM also adds external variables explicitly in the model. The external variables include system design and characteristics of the tool under investigation. Figure 2.2 shows the relationship between pairs of constructs.

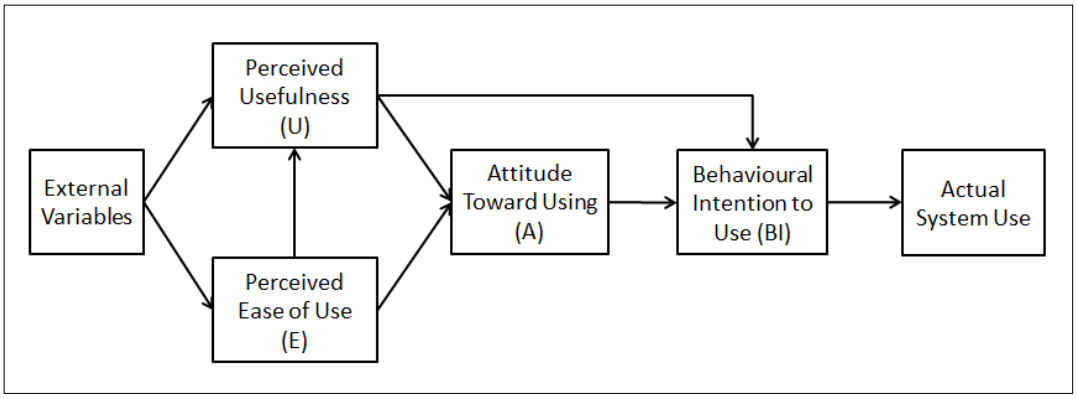


Figure 2.2 Technology Acceptance Model (TAM)

(Adapted from Davis et al., 1989)

Davis et al. (1989) posit that behavioural intention to use (BI) is jointly affected by attitude toward using (A) and perceived usefulness (U). The A-BI relationship is proved to be true in Fishbein & Ajzen's TRA model, as people intend to perform positively affected behaviour. The U-BI relationship is suggested to be valid in

organizational settings, as it is believed that the potential benefits of increased job performance of using a system outweigh the positive or negative feelings toward using that system. Hence, the TAM suggests that intention toward using computer systems is formed based on both attitude (affect) and perceived usefulness (potential achievements such as pay increase and promotion).

Attitude toward using (A) is jointly influenced by perceived usefulness (U) and ease of use (EOU). The U-A relation is proposed as the user's affect toward using a computer system is often increased when the outcome of using the system is valued as positive, and vice versa. On the other hand, when a computer system is found to be easy to use, the user will have a higher sense of efficacy and control, and hence gives a higher degree of positive attitude to the system, giving the A-EOU relation.

Perceived usefulness (U) and ease of use (EOU) are two "distinct but related constructs" (Davis et al., 1989, p. 987). U can be influenced by EOU. Improvements in EOU may contribute to increased performance. U and EOU are influenced by external factors. U can be influenced by external factors such as system design while EOU can be influenced by factors such as documentation and user support.

The TRA is the backdrop of the TAM but there are major differences for the two models. First, the TRA is generic and can be applied to a range of contexts, while the TAM is specific to acceptance end-user computing systems. Second, the TAM has

established a set of general and standard instruments, and hence provides a quick way to gather general information about individuals' perception about a particular system. On the other hand, measures of the TRA need to be developed for each context. This is more costly and time-consuming but more specific and detailed information can be gathered (Mathieson, 1991). Third, belief and evaluations in the TRA are multiplied and summed, while the belief constructs (i.e. U and EOU) in the TAM are disaggregated. The disaggregation makes it possible to diagnose information and trace the influence of each belief construct in the TAM.

Dishaw and Strong (1999) attempted to extend the TAM with some task-technology fit constructs. They argued that doing so would improve the explanation of variance of tool utilization of the TAM, as the TAM places no focus on the characteristics of tasks and functionality of tools. An integrated model (Figure 2.3) of the TAM and one task-technology fit model (TTF) was proposed by Dishaw and Strong (1999). The TAM provides a strong explanation of intention to use but much weaker explanation for actual use. On the other hand, task-technology fit focuses on the characteristics of tasks, functionality of tools and actual use. Dishaw and Strong (1999) suggested that there is possibility that the two models might supplement each other - perceived ease of use, perceived usefulness and actual tool use link the TAM with task-technology fit. Dishaw and Strong's work (1999) shows that the variance explained by the integrated model is higher than that by the TAM or the task-technology fit model alone. However, it cannot be ruled out that this might be a result of including more constructs. The sample size in Dishaw and Strong's (1999) study was 60, which is not strong enough to validate the integrated model. It is a

good attempt to supplement the TAM's weakness on utilization. More research could be done to further test, validate and refine this integrated model of the TAM and the task-technology fit.

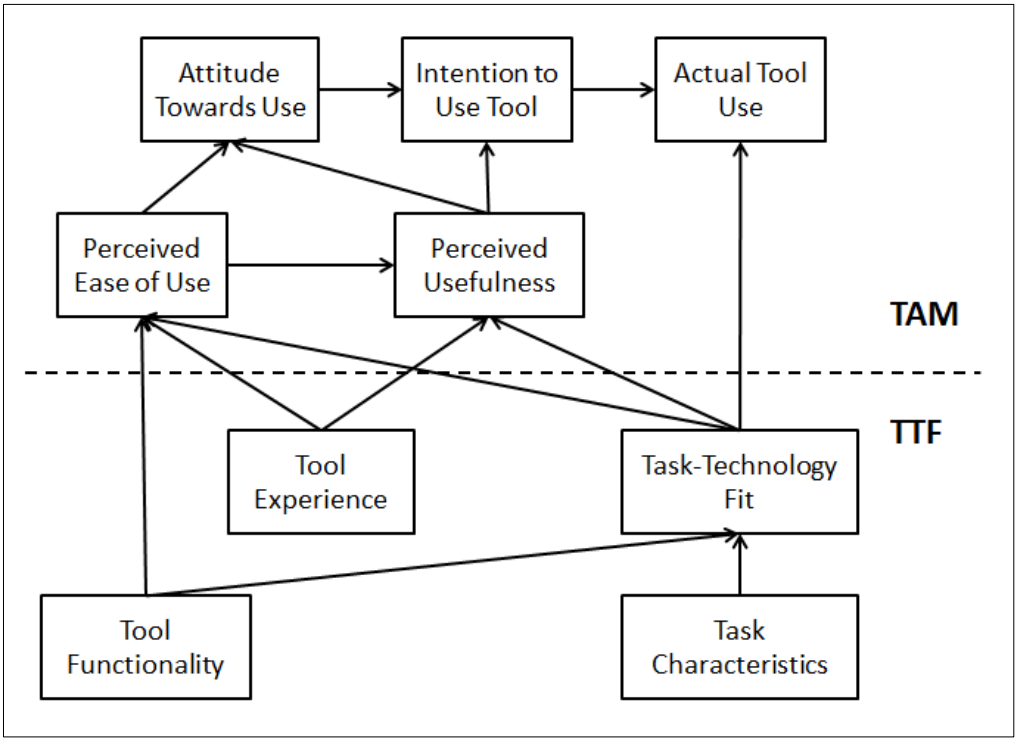


Figure 2.3 Integrated Model of the TAM and TTF

(Adapted from Dishaw & Strong, 1999)

Some researchers attempted to use TAM to study continued usage (Shiau & Chau, 2012; Venkatesh et al., 2003). For example, TAM was used to study continuance intention for blog usage (Shiau & Chau, 2012). Results of the empirical study show that TAM is capable of predicting IS continuance. Shiau & Chau compared TAM

with a post-adoption theory, expectation-confirmation theory, in their study. Results of the comparison will be discussed in section 2.2.4.

2.1.3 Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) extends the Theory of Reasoned Action (TRA) by adding one more construct, perceived behavioural control (Ajzen, 1991) (see Figure 2.4). Attitude toward behaviour and subjective norm remain and are adopted from the TRA.

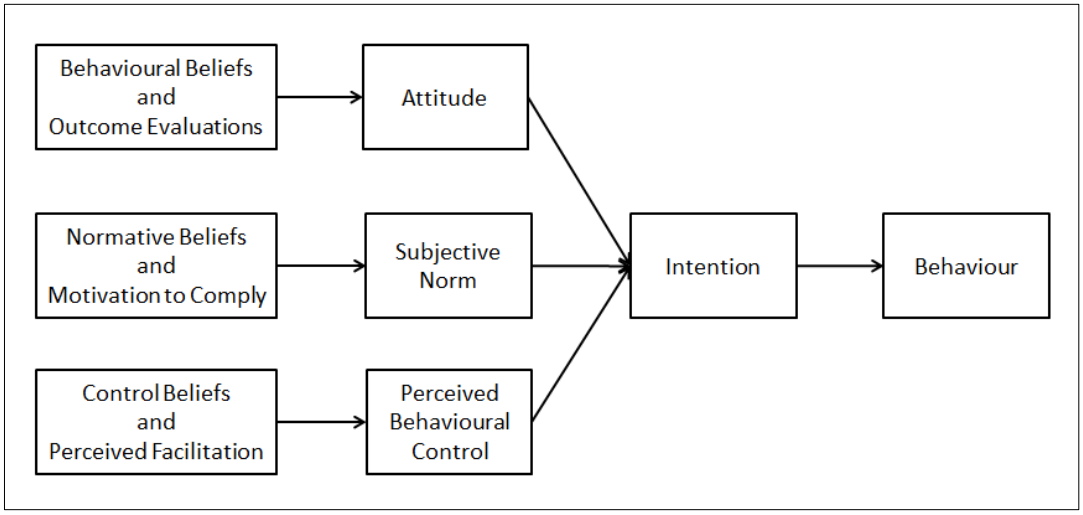


Figure 2.4 Theory of Planned Behaviour (TPB)

(Adapted from Mathieson, 1991)

Perceived behavioural control is defined as "the perceived ease or difficulty of performing the behaviour" (Ajzen, 1991, p. 188). Similar to the TRA, perceived

behavioural control is determined by beliefs and perceived facilitation. Control beliefs refer to an individual's perception of the availability of skills, resources and opportunities while perceived facilitation refers to his or her assessment of the importance of the resources to perform certain behaviour. Control beliefs can be situational *(external)*, such as access to a system, and personal *(internal)*, such as skills of using a system; it is suggested that perceived ease of use in the TAM corresponds to the *internal* factor of perceived behavioural control (Mathieson, 1991). Perceived behavioural control is the summation of products of control beliefs and perceived facilitation.

Other researchers have put efforts into investigating the TPB and found several moderators for this theory. It was found that the subjective norm becomes less significant with increased experience (Karahanna et al., 1999). The attitude toward behaviour is more salient for men than women whereas the subjective norm and perceived behavioural control is more significant for women in early usage of a system.

A decomposed version of the TPB as shown in Figure 2.5 was proposed by Taylor and Todd (1995). Unlike the TPB in which instruments for beliefs and evaluations have to be developed in each study, the decomposed TPB defines a set of beliefs which is targeted to be applied across a variety of settings. The attitudinal, normative and control beliefs are decomposed into several constructs which come from the TAM, the TPB and the Innovation Diffusion Theory (IDT). Taylor and Todd (1995)

believe that doing so can make the model relationships would become clearer and easier to be understood, and it can also overcome some disadvantages of operationalizing the model.

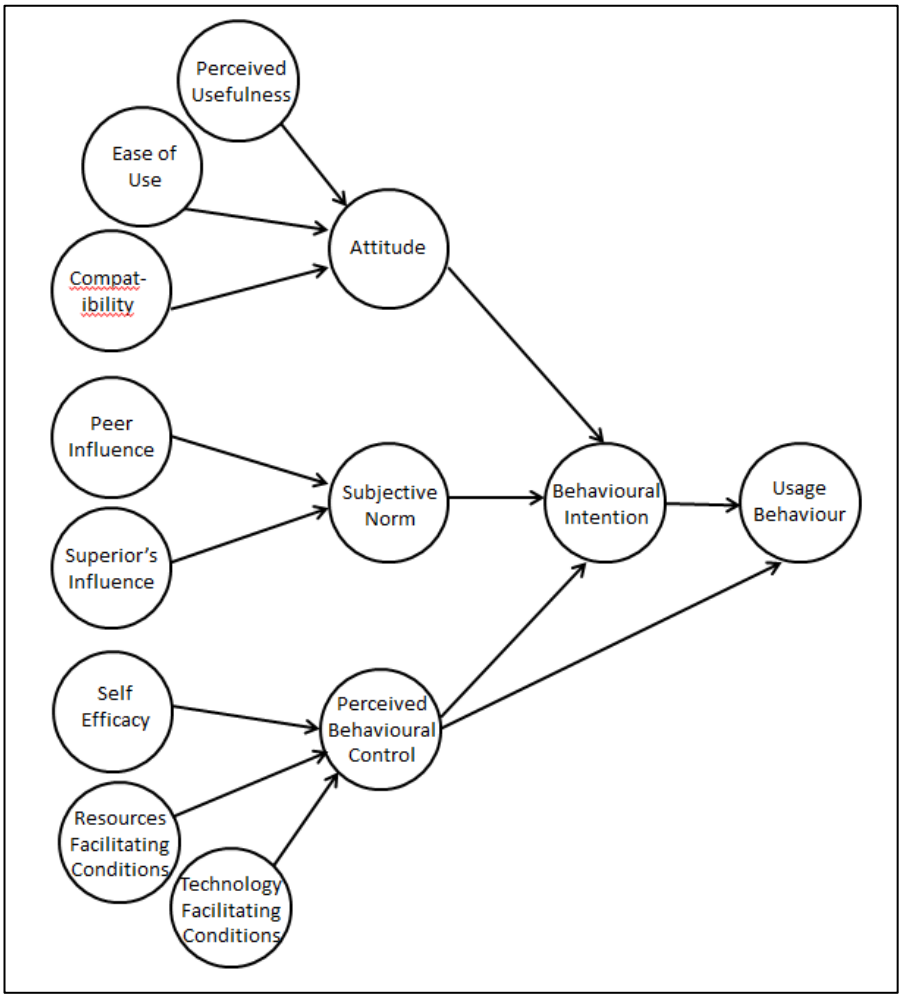


Figure 2.5 Decomposed Theory of Planned Behaviour

(Adapted from Taylor & Todd, 1995)

The attitude construct is decomposed into perceived usefulness, ease of use and compatibility, in which the definition and scale of perceived usefulness and ease of

use are obtained from the TAM, and those of compatibility from the IDT. The subjective norm construct is decomposed into influence of two referent groups, peers and superiors. It is suggested that peer influence and superior influence may wipe out the effect of each other when the two referent groups have opposing opinions. The perceived behavioural control construct is decomposed into self-efficacy, resource facilitating conditions and technology facilitating conditions. Self-efficacy is internal and refers to an individual's capability or ability to use an information system. Facilitating conditions are external resources constraints and are further broken down into two dimensions – the resources factors such as money and time, and technology factors such as access to and compatibility of information systems.

Table 2.1 shows the definitions of the core constructs of the TRA, TAM and TPB, namely attitude towards behaviour, subject norm, perceived behavioural control, perceived usefulness and perceived ease of use. In general, the TRA and TPB aggregate beliefs and are applied in a wide range of settings. The TAM disaggregates beliefs and adopts perceived usefulness and perceived ease of use as the core constructs, and is targeted to be applied in acceptance of IS.

2.1.4 Innovation Diffusion Theory (IDT)

The Innovation Diffusion Theory (IDT) was first proposed by Rogers (1995) in the 1960s. It is grounded in sociology and has been used to study a variety of innovations, ranging from agricultural tools to organizational innovation (Venkatesh et al., 2003). It is a process of how an individual processes initial knowledge of a

new innovation, form attitude (favourable or unfavourable) towards the innovation, makes a decision whether to adopt or reject the innovation, and follows by actual usage and confirmation of the attitude and reinforcement of the decision (Rogers, 1995). In the confirmation and reinforcement process, an individual might decide to continue to use the innovation, discontinue using it or adopt another new innovation. The stages leading to the adoption decision (i.e. initial knowledge processing, attitude formation and adoption decision) are referred to as acceptance or pre-adoption while those after adoption decision (i.e. actual usage and reinforcement of decision) are referred to as continued usage or post-adoption (Karahanna et al., 1999).

Table 2.1 Definitions of Core Constructs of TRA, TAM and TPB

Construct	**Definition**
Attitude towards behaviour *(TRA & TPB)*	"an individual's positive or negative feelings (evaluate affect) about performing the target behaviour" (Fishbein & Ajzen, 1975, p. 216)
Subject norm *(TRA & TPB)*	"the person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302)
Perceived behavioural control *(TPB)*	"the perceived ease or difficulty of performing the behaviour" " (Ajzen, 1991, p. 188)
Perceived usefulness *(TAM)*	"user's subjective probability that using a specific application system will increase his or her job performance" (Davis et al., 1989, p. 985)
Perceived ease of use *(TAM)*	the degree to which "user expects the target system to be free of effort" (Davis et al., 1989, p. 985)

Rogers (1995) identified a list of characteristics of an innovation which affect the diffusion rate of the innovation. Among all the characteristics, five of them are relative advantage, compatibility, complexity, observability and trialability. Moore and Benbasat (1991) adopted the IDT to study individual technology acceptance and refined these characteristics into a similar set of constructs. It is worth noting that the characteristics defined by Rogers are the perceptions of the innovation, but not the perceptions of using the innovation. Previous research work points out that attitude towards an object can be different from the attitude towards behaviour (Ajzen & Fishbein, 1980; Moore & Benbasat, 1991). In the study of IS acceptance and usage, it is the perception towards using an innovation which is of interest, as usage is the key to innovation diffusion. Nevertheless, the characteristics defined by Rogers can be easily redefined in terms of application of the innovation, and this can be done by changing "an innovation" to "applying an innovation" in the definition, which will be discussed subsequently.

Relative advantage is "the degree to which an innovation is perceived as being better than its precursor" (Moore & Benbasat, 1991, p. 195). Relative advantage is analogous to perceived usefulness in the TAM (Taylor & Todd, 1995). Both constructs are defined by the relative improvement in performance and the operation measurements are similar. Image enhancement is incorporated as an aspect of relative advantage in the IDT (Rogers, 1995). However, it is argued that the effects of image and relative advantage are different enough to make them two constructs (Moore & Benbasat, 1991). Hence, image is added and defined as "the degree to

which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991, p. 195).

Compatibility is "the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experience of potential adopters" (Moore & Benbasat, 1991, p. 195). It is the fit between using an innovation to an individual's values and capability. Complexity is "the degree to which an innovation is perceived as being difficult to use" (Moore & Benbasat, 1991, p. 195). It is inversely analogous to ease of use of the TAM.

Observability is "the degree to which the results of an innovation are observable to others" (Moore & Benbasat, 1991, p. 195). This characteristic can be interpreted as the results of applying an innovation being observable, as well as the innovation itself being observable. It is argued that innovations having more observability, such as hardware, have higher rates of adoption than those having less observability, such as software. To distinguish the results of using an innovation and the innovation itself, Moore and Benbasat suggested breaking down observability into two constructs, results demonstrability and visibility. Results demonstrability is "the tangibility of the *result*s of using the innovation, including their observability and communicability" (Moore & Benbasat, 1991, p. 203, emphasis added), while visibility is how physically visible an innovation is.

The last characteristic in the IDT is trialability. Triability is the degree to which an innovation may be experimented with before adoption (Moore & Benbasat, 1991, p.

195). This characteristic yields a low reliability score and seems to be a weak predictor of adoption in Moore and Benbasat's study. In the field of IS acceptance, trialability is not a commonly investigated construct.

Moore and Benbasat added one more construct in their work − voluntariness of use. Voluntariness of use is "the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore & Benbasat, 1991, p. 195). In some other studies, voluntariness of use is treated as a moderator instead of a predictor of behaviour (Venkatesh & Davis, 2000; Venkatesh et al., 2003).

2.2 Continued Usage / Post-adoption

The majority of prior IS studies are based on adoption and many of them focus on the reflective cognition during the acceptance and initial use of information systems in organizational settings (Jasperson et al., 2005; Parthasarathy & Bhattacherjee, 1998). However, some researchers have pointed out the importance of understanding IS continued usage (Son & Han, 2011; Taylor & Todd, 1995). It is suggested that a possible explanation for an IS failure might be the lack of focus on post-adoption stages (Jasperson et al., 2005). Researchers believe that continued usage is of both theoretical and organizational interest (Cho, Cheng, & Hung, 2009).

Studies on continued usage are relatively new and the development is at the early stage (Jasperson et al., 2005). During the development of continued usage studies,

acceptance theories and models act as the basis. Many of the studies on continued usage are extensions of acceptance theories and models; studies that do not rely on any of the acceptance theories and models are rare. Some, however, point out the importance of not relying on acceptance theories and models, as it is believed that acceptance and continuance are conceptually distinct (Bhattacherjee, 2001; Jasperson et al., 2005).

It is suggested that there are two streams of studies on continued usage (Choi, Kim, & Kim, 2011; Taylor & Todd, 1995). Choi et al.'s (2011) classification is that the first stream is supported by the expectation confirmation theory (Bhattacherjee, 2001), and includes factors used in acceptance research and compares the differences between acceptance and continued usage; the second stream is based on reasoned action theory and diffusion theory and posits a feature-centric view of technology as factors influencing continued use. On the other hand, Taylor and Todd (1995) suggest that the first stream adopts intention-based models (e.g. the TRA, TAM and TPB) and use behavioural intention to predict usage; the second stream examines adoption and usage of information systems from a perspective of Diffusion of Innovations (Rogers, 1995). In general, studies on continued usage exhibit a mix of the below characteristics.

1. Models and hypotheses built on acceptance models (*extension of acceptance theories and models, implying that continuance co-varies with acceptance*) (Karahanna et al., 1999; Parthasarathy & Bhattacherjee, 1998; Taylor & Todd,

1995; Thompson, Higgins, & Howell, 1991; Venkatesh & Davis, 2000; Venkatesh et al., 2003)

2. Evaluation of time or experience effect on the significance of constructs for acceptance models (Venkatesh & Davis, 2000; Venkatesh et al., 2003)

3. Comparison between acceptance behaviour and continued usage behaviour (Karahanna et al., 1999; Parthasarathy & Bhattacherjee, 1998; Venkatesh et al., 2003)

4. Evaluation of users' behaviour evolvement from acceptance and continued usage (Venkatesh & Davis, 2000; Venkatesh et al., 2003)

The studies on IS continued usage is relatively new as compared to IS acceptance studies. Nevertheless, the number of IS acceptance studies including continued usage as the topic of discussion is rising (Bhattacherjee, 2001; Cho et al., 2009). These studies are discussed. The corresponding commonly investigated constructs and moderators are extracted and discussed thereafter.

2.2.1 Model of PC Utilization (MPCU)

The Model of PC Utilization (MPCU) was developed to predict PC utilization by individuals in organizations (Thompson et al., 1991). The MPCU proposes that social factors affect perceived consequences (which includes complexity, job fit and

long-term consequences), and facilitating conditions are constructs influencing utilization of PCs (Figure 2.6).

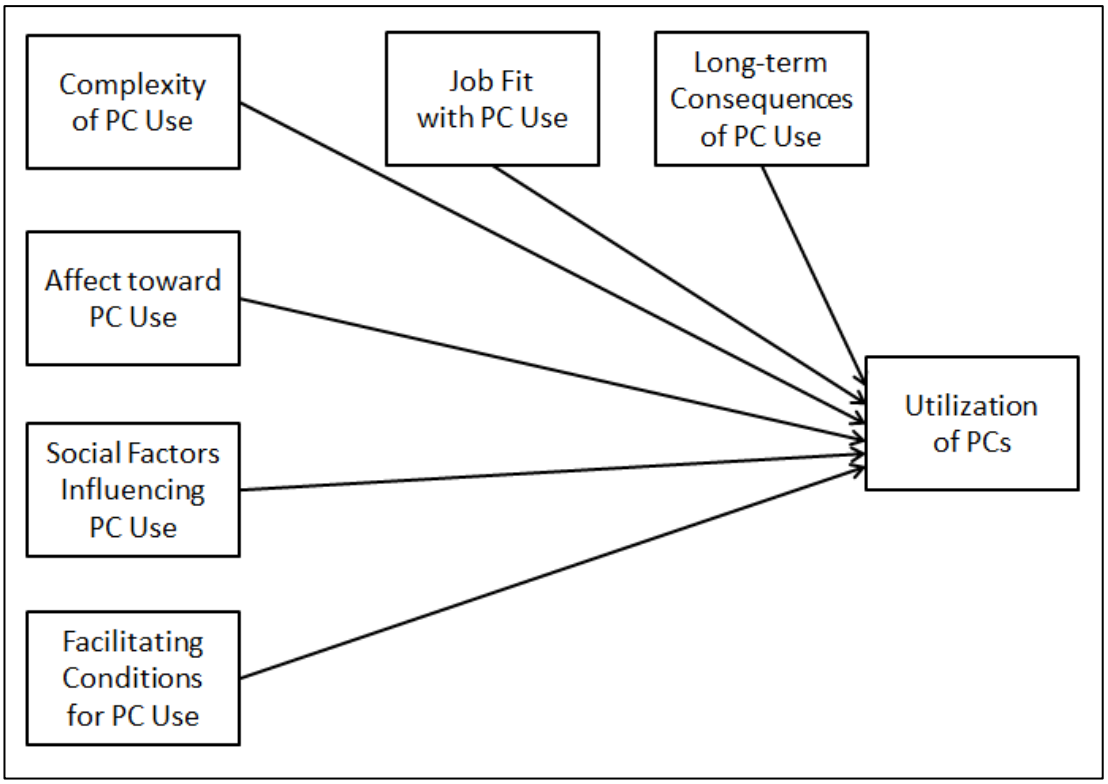


Figure 2.6 Model of PC Utilization (MPCU)

(Adapted from Thompson et al., 1991)

The MPCU's social factors are similar to the TRA's social norm, while complexity, job fit and long-term consequences are similar to the TAM's perceived ease of use (inversely), perceived usefulness and perceived usefulness in the long term. The contributing construct is affect. Thompson et al. (1991) argue that attitude is an imprecise term to describe an individual's feelings or beliefs. They propose that

attitude can be further classified into two components – affect and cognition. The affective component refers to an individual's feeling, which can be joy, pleasure, disgust or hate, towards a particular act; the cognitive component refers to the beliefs that an individual holds towards an object or an act. In other words, the affective and cognitive components of attitude are taken as individual and separate constructs. In the MPCU, the affective components only contain affect as the single construct while the cognitive components include complexity, job fit and long-term consequences.

Thompson et al.'s research (1991), however, does not support the affect-utilization linkage. The influence of affect on utilization is found to be low and insignificant. One possible reason is the low measurement strength for affect (Compeau & Higgins, 1995). There are also problems in the reliability and discriminant validity. The Cronbach's alpha of four constructs (out of eight) range from 0.60 to 0.65. Two items under social factors load more heavily on facilitating conditions. These problems might be attributed to the operationalization of constructs and the measurement scales. The scales might need to be revisited to enhance the reliability and validity. Nevertheless, the MPCU provides good insight into how potentially the affective components and cognitive components of attitudes can influence utilizations of IS systems.

2.2.2 Motivational Model (MM)

General motivation theory has been used to study the extrinsic and intrinsic factors that drive a variety of human activities. The motivation theory has been examined

and adopted for specific contexts. Davis, Bagozzi, & Warshaw (1992) adopted the motivation theory to study acceptance and usage of a new technology. The Motivational Model suggested that the acceptance and usage of new technology is based on extrinsic and intrinsic motivations. An extrinsic motivation is defined as "the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself" (Davis et al., 1992, p.1112). Examples of an extrinsic motivation are improved job performance and promotions. The reinforcement value of the consequence of performing the activity influences the behaviour. An intrinsic motivation is defined as "the performance of an activity for no apparent reinforcement other than the process of performing the activity per se" (Davis et al., 1992, p.1112). It relates to the perception of pleasure and joy from performing the activity. Perceived performance and enjoyment were the focus of investigation in Davis et al.'s study (1992). With the above definitions, perceived performance belongs to an extrinsic motivation while enjoyment is an intrinsic motivation.

Davis et al.'s study indicated that behaviour intention was jointly determined by perceived usefulness and enjoyment, with perceived usefulness having a greater and prominent effect on intention. A positive interaction was also observed between usefulness and enjoyment. This result is consistent with the context of study and the selection of the tool of study, as extrinsic motivations are expected in the use of computer tools in the workplace.

2.2.3 Social Cognitive Theory (SCT)

Compeau and Higgins (1995) adopted the Social Cognitive Theory (SCT) (Bandura, 1986) to investigate computer usage. The SCT is a theory well-known in the field of human behaviour. Self-efficacy is a key construct in this theory where it refers to the *belief* that an individual has the ability, or capability, to perform particular behaviour. The SCT posits that cognitive and personal factors, environmental factors, and behaviour influence each other reciprocally. In the context of computer utilization, Compeau and Higgins (1995, p.191) refined the definition self-efficacy and used the term computer self-efficacy, as defined it as "an individual's perceptions of his or her ability to use computers in the accomplishment of a task". It is noteworthy that this ability refers to the accomplishment of a more complicated task, such as using a software package for data analysis, instead of accomplishment of a simple task, such as using a specific software feature like changing margins. Self-efficacy is similar to self-esteem in that it reflects the belief and perception of one's ability, but not the actual ability, to perform a particular behaviour.

A research model (Figure 2.7) using the SCT was proposed (Compeau & Higgins, 1995). Encouragement by others, others' use and support are environmental factors. Others refer to an individual's referent groups. It is believed that individuals form judgments partly based on the opinions and observation of the actual behaviour of their referent group. This shares similarities with subjective norm in the TRA and social factors in the MPCU.

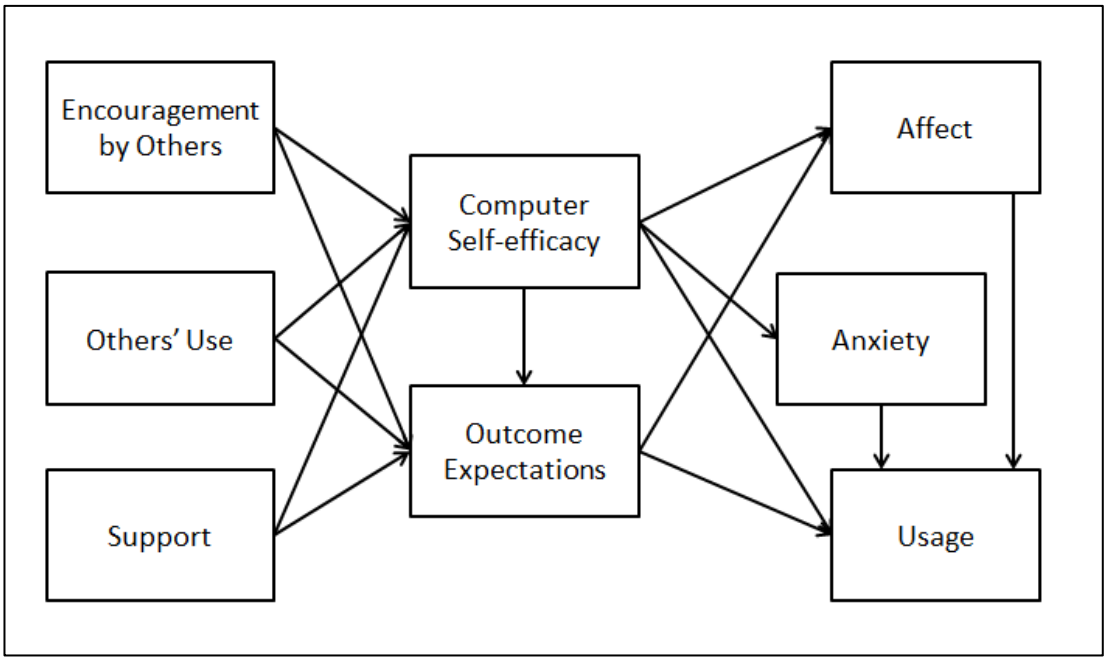


Figure 2.7 Research Model Using Social Cognitive Theory (SCT)

(Adapted from Compeau and Higgins, 1995)

Computer self-efficacy, outcome expectations, affect and anxiety are cognitive and personal factors. Outcome expectations are similar to perceived usefulness in the TAM, and job-fit and long-term consequences in the MPCU, in which all these constructs link to the expected favourable outcomes or rewards associated with using the technology. On the other hand, affect is believed to have the ability to exert a strong influence on behaviour, especially in the consumer behavioural studies.

2.2.4 TAM2

Venkatesh and Davis (2000) extended the Technology Acceptance Model (TAM) and included the subjective norm and a few other constructs to form TAM2 as shown

in Figure 2.8. The additional constructs in TAM2 are grouped into two categories – social influence processes, which include subjective norm, image and voluntariness, and cognitive instrumental processes, which include job relevance, output quality, result demonstrability and perceived ease of use. One of the aims of TAM2 is to study how users' behaviour is influenced by increased experience with a particular system. This study is a longitudinal field study, and hence some insights can be gained for continued usage of IS.

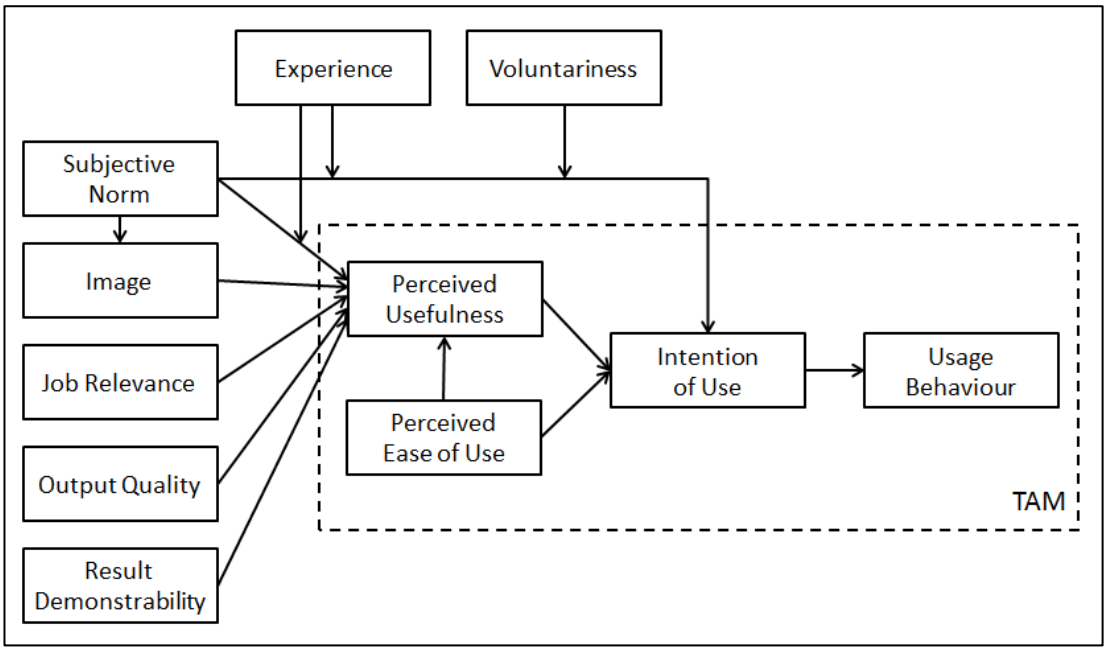


Figure 2.8 TAM2 – Extension of TAM

(Adapted from Venkatesh and Davis, 2000)

The effect of subjective norm on IS acceptance research has yielded conflicting results. Subjective norm was removed from the TRA in the TAM as it was found to

be non-significant (Davis et al., 1989). In TAM2, however, Venkatesh and Davis (2000) argue that subjective norm is significant under some situations – when people's important referents think that they should perform certain behaviour, they may be motivated to comply with the referents even if they do not favour the behaviour and its consequences. In other words, subjective norm may impose a significant effect on intention under mandatory settings. Subjective norm is also believed to have influence on perceived usefulness, as people may incorporate their important referents' beliefs into their own beliefs.

TAM2 suggests that image has an influence on perceived influence and it is in turn influenced by subjective norm. A higher degree of image, or status, is believed to have the ability to cause more power and influence, which forms the basis for greater productivity.

Job relevance, output quality and result demonstrability are mediators of perceived usefulness, as it is believed that people form perceptions of usefulness partly by cognitively comparing the capability of an IS with their job requirements (Venkatesh & Davis, 2000). Job relevance is how the specific system is applicable to an individual's job and matches his or her job goals; output quality is how the system performs tasks; result demonstrability is the tangible results of using the system (Moore & Benbasat, 1991; Venkatesh & Davis, 2000).

Experience, voluntariness and gender are found to be the moderators in TAM2. Subjective norm and perceived ease of use become insignificant with increased experience; subjective norm is salient only in mandatory conditions and with users of limited experience in system use. Empirical evidence also shows that perceived usefulness is more significant for men while perceived ease of use is more significant for women. Subjective norm is also found to be more salient for women in early usage of the system.

One of the insightful findings of TAM2 in relation to IS continued usage is that it shows a consistent decrease in the variance (R^2) of perceived usefulness as the experience with the system increases in all the four field studies (Venkatesh & Davis, 2000). This may be one of the cues for a need for theories or models of IS continued usage.

2.2.5 Expectation-Confirmation Theory (ECT)

Bhattacherjee (2001) adapted the Expectation-Confirmation Theory (ECT, see Figure 2.9) from consumer behaviour literature to propose a model of IS continuance (see Figure 2.10). The proposed model differs from other models and theories in that it embraces satisfaction with IS use and confirmation of expectation of prior IS use as the cognitive beliefs. According to Bhattacherjee (2001), ECT posits that an individual's repurchase intention is mainly determined by his / her satisfaction with the service or product. The ECT suggests that a consumer first forms an initial expectation of the service or product before he / she consumes it. Then the consumer

may accept and use that service or product and forms a perception of its performance. The perceived performance is then assessed based on the expectation of prior usage, which acts as the basis to determine the extent to which the expectation is confirmed. Then the consumer forms satisfaction according to the discrepancy of the confirmation level and the expectation of prior usage. Finally, a satisfied consumer is believed to form a repurchase intention, while an unsatisfied consumer will discontinue using the service or product.

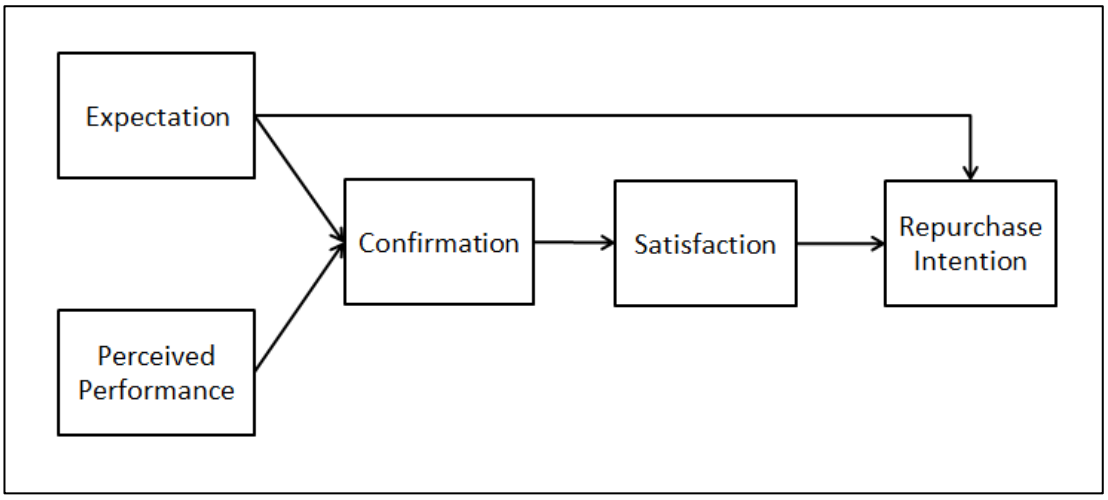


Figure 2.9 Expectation-Confirmation Theory (ECT)

(Adapted from Bhattacherjee, 2001)

The ECT was modified and a post-acceptance model was proposed under the context of IS continuance as shown in Figure 2.10. While ECT was originally used to study both pre-acceptance and post-acceptance behaviour, the modified model was adjusted to focus on post-acceptance and continuance variables. Perceived usefulness is used to represent perceived performance and post-expectation, as perceived

usefulness is a well-accepted and consistent construct that shows influence across the stage of IS acceptance and use.

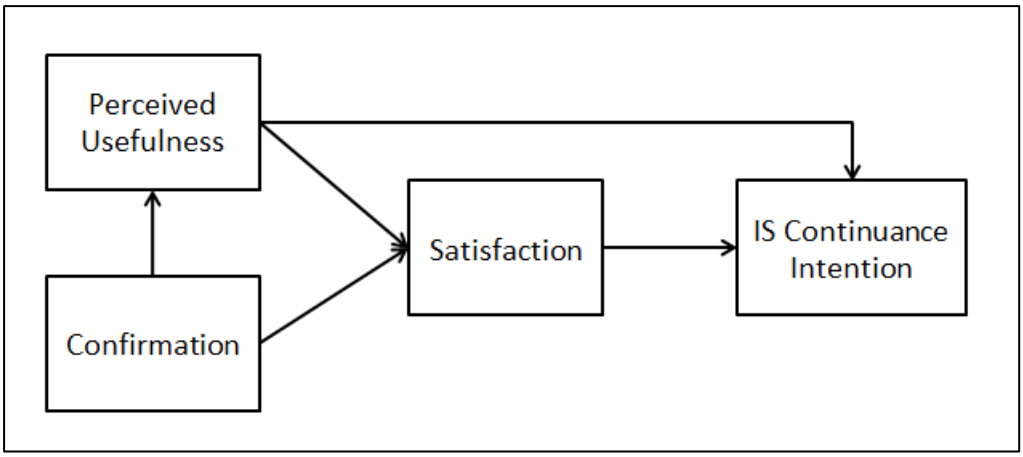


Figure 2.10 Post-Acceptance Model of IS Continuance based on ECT (Adapted from Bhattacherjee, 2001)

Shiau and Chau (2012) used TAM and the modified ECT to study blog continuance intention and compared their respective explanatory powers. The empirical study shows that ECT had greater explanatory power of continuance intention of blog usage than that of TAM. One interesting finding was noted on perceived usefulness. Perceived usefulness was found to influence continuance intention directly, and indirectly via satisfaction in Bhattacherjee's study (2001). In Shiau and Chau's study (2012), however, only the indirect effect was found to be significant. The plausible reason could be that the authors focused on a specific function of the blog instead of the holistic blog functions. The specific function, blog search, was used to construct the measurement of perceived usefulness and confirmation, which might not be a

sound reflection of the respondents' holistic view on the blog's usefulness and the respondents' confirmation to blog usage.

Though the ECT is common in consumer behaviour studies, it is the subject of several debates. One key debate is the diverse definitions of satisfaction and attitude. Some researchers view satisfaction as synonymous with attitude. On the other hand, there are researchers who suggest that satisfaction and attitude are two conceptually distinct constructs, in which satisfaction is a "transient, experienced-specific affect", while attitude is "a relatively more enduring affect transcending all prior experiences" (Bhattacherjee, 2001, p.354). The definition of satisfaction is linked to affect. It is defined as "an affective state representing an emotional reaction to the usage of a technology" (Cho et al., 2009, p.266). In other words, satisfaction can be treated as an evaluation of attitude.

Satisfaction is not a unique construct in ECT. There are studies that do not employ ECT but take satisfaction as one of the variables to study post-adoption behaviour. For example, satisfaction, together with the four dimensions of technology readiness, was used to study post-adoption behaviour of IPTV (Son & Han, 2011).

2.2.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh, Morris, Davis, & Davis (2003) reviewed and compared eight prominent models / theories of IS acceptance and continued usage, and formulated a unified

model that integrates these eight models / theories. The aim is to understand usage as the dependent variable and take the role of intention as a predictor of usage. The eight models / theories of IS acceptance that have been used in investigations are shown as follows.

1. Theory of Reasoned Action (TRA)
2. Technology Acceptance Model (TAM)
3. Motivational Model (MM)
4. Theory of Planned Behaviour (TPB)
5. A model combining the TAM and TPB
6. Model of PC Utilization (MPCU)
7. Innovation Diffusion Theory (IDT)
8. Social Cognitive Theory (SCT)

Most of the models / theories above, except for the motivational model and the model combining the TAM and TPB, have been reviewed in this study. In Venkatesh et al.'s research (2003), the similarities and differences of all the eight models / theories were assessed. It was found that these models / theories sometimes refer to a similar concept by using different terminologies; a similar set of measurements was also used for the similar concept. These models / theories were also tested and compared empirically using data collected from four organizations over a six-month period.

The unified model was formulated and called the Unified Theory of Acceptance and Use of Technology (UTAUT, as shown in Figure 2.11). The UTAUT classifies and simplifies the 32 constructs from the eight models / theories into several constructs and suggests that four have significant influence on behavioural intention or use behaviour. These four constructs are performance expectancy, effort expectancy, social influence and facilitating conditions. The UTAUT also suggests that gender, age, experience and voluntariness of use are moderators for these four constructs. The formulated model was validated using data collected from four organizations over six months with three points of measurement. The UTAUT was found to be able to account for about 70 percent of the variance in behavioural intention.

2.2.7 Other Studies

Taylor and Todd (1995) conducted a study to understand information technology usage using three acceptance models – the TAM, TPB and Decomposed TPB. The TAM, TPB and Decomposed TPB have been introduced in Section 2.1. Data were collected over a 12-week period, and hence the researchers believed that data for continued usage, instead of initial acceptance, were captured. The results showed that all the three models performed well in terms of model fit. The abilities of the three models to explain behaviour were similar. One contributing finding of this study was the significant influence of subjective norm on behavioural intention. Studies of IS acceptance show contrasting results for the significance of subjective norm. In Taylor and Todd's (1995) study, subjective norm was found to have a significant influence on behavioural intention. They suggested that the nature of the target behaviour (i.e. voluntariness and length of time) would affect the significance. This

study indicates that it would be worthwhile to include subjective norm in investigations despite the available contrasting findings.

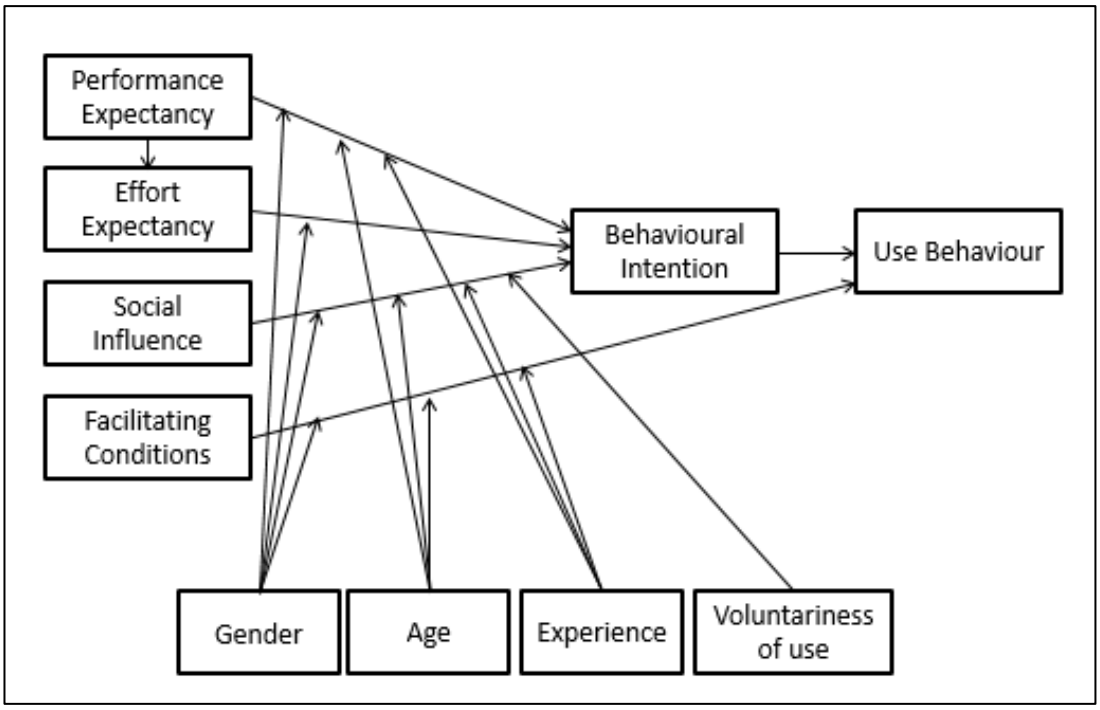


Figure 2.11 Unified Theory of Acceptance and Use of Technology (UTAUT) (Adapted from Venkatesh et al., 2003)

Jasperson, Carter, & Zmud (2005) conducted a comprehensive review of studies of IS continuance and proposed a conceptual model as shown in Figure 2.12. The model has two levels – organizational action level and individual cognition level.

Two significant contributions of this study are a model not built on IS acceptance theories or models, and the introduction of habit into investigations. It is suggested

that cognitive processing is mostly engaged in determining continuance intention or behaviour during the initial use of IS. Cognitive processing starts to dissipate when the use is repeated over time, leading to non-reflective and routinized behaviour (represented by the dotted line in Figure 2.12). An individual adjusts his / her usage when interventions occur and disrupt the non-reflective behaviour. One key challenge of incorporating habit as a factor influencing continued usage, however, is to establish a measure of habit independent of prior usage frequency. Most current studies use frequency as an (or the sole) indicator of habit (Jasperson et al., 2005). This may not be an appropriate scale as the correlation between frequency of prior and later usage can be viewed as merely an indication of stable behaviour over time.

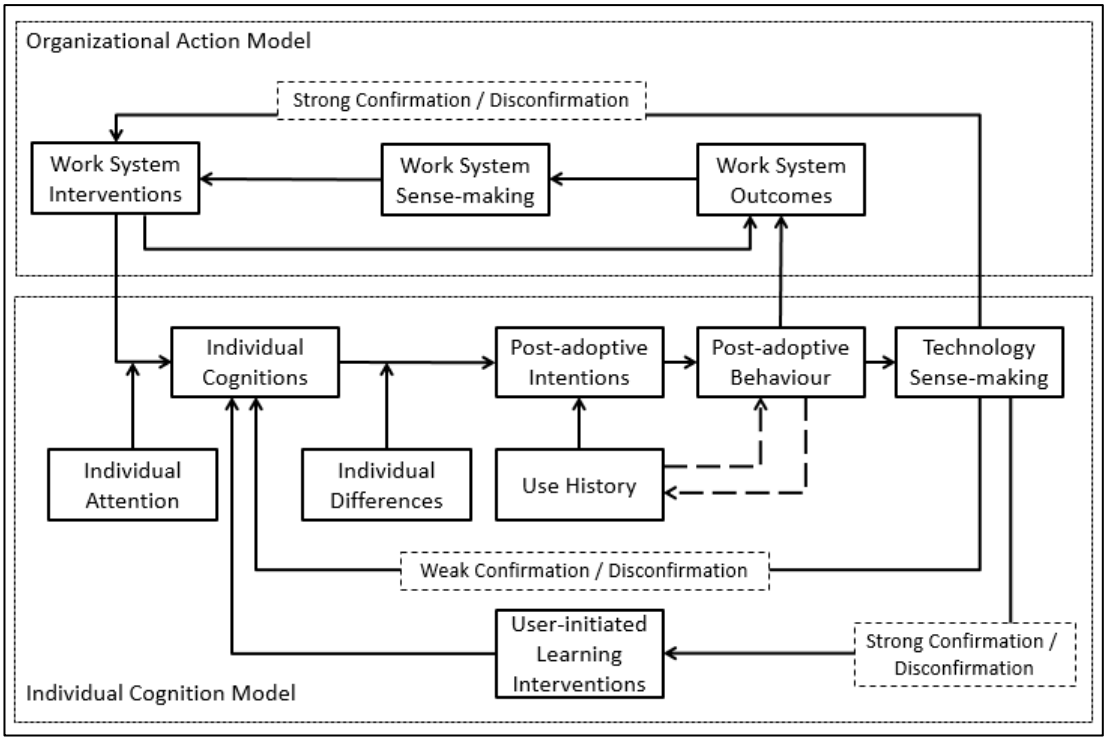


Figure 2.12 Conceptual Model of IS Continuance

(Adapted from Jasperson et al., 2005)

One key limitation of this study is the lack of instrumentation and data to validate the proposed model. The model is purely conceptual, and hence it is hard to assess the strength of this model.

Spiller, Vlasic, & Yetton (2007) studied post-adoption behaviour of internet service providers in term of service features, purpose of service, prior behaviour, demographics and competition among the providers. This study is not common in which it did not rely on any of the common acceptance or continuance theory or model. A key finding is that the continuance or discontinuance decision was not influenced by demographic characteristics.

2.2.8 Common Constructs

Constructs commonly discussed in post-adoption studies include (i) perceived usefulness, (ii) compatibility habit, (iii) social influence, (iv) personal affect, (v) past usage pattern, (vi) intention, and (vii) usage patterns. Each of the constructs is discussed as follows.

1. Perceived usefulness

   Studies (Davis et al., 1989; Karahanna et al., 1999; Taylor & Todd, 1995; Venkatesh et al., 2003) support that perceived usefulness remains significant over time. For example, in one of Davis et al.'s studies, the influence of perceived usefulness increased from the time of introducing the tool (β=0.48) to

14 weeks later (β=0.61) (Davis et al., 1989). It is also found that perceived usefulness is the strongest predictor of intention and it remains significant at different points of measurement in a longitudinal study in both voluntary and mandatory settings (Venkatesh et al., 2003).

Perceived ease of use, a construct which is related to perceived usefulness, is found to become insignificant over time (Davis et al., 1989). It is believed that when an individual gains experience with a particular IS, he / she learns how to use the system, and hence the ease of use will be of less and less concern.

2. Compatibility

Compatibility originated from the Innovation Diffusion Theory as a characteristic of an innovation which will affect the diffusion rate of the innovation (Rogers, 1995). It was then refined to study individual technology acceptance and to represent the fit between an individual's work style and the use of IS (Moore & Benbasat, 1991). Compatibility is found to be a significant predictor of both adoption and continued usage (Karahanna et al., 1999; Venkatesh et al., 2003).

3. Social Influence

Social influence refers to the influential power of members of a social network (Venkatesh & Brown, 2001). It is discussed in terms of a few names, which are subjective norm, image, social factors and social influence itself. In general,

researchers take subjective norm and image as subsets of social influence (Venkatesh & Davis, 2000).

Subjective norm is defined as "the person's perception that most people who are important to him think he should or should not perform the behaviour in question" in the TRA (Fishbein & Ajzen, 1975, p. 302). Venkatesh and Davis (2000) further class subjective norm as compliance with social influence and internalization of social influence. The compliance-based effect of subjective norm appears when people's important referents think that they should perform certain behaviour, regardless of whether the behaviour is favoured or disfavoured; internalization of social influence takes place when people incorporate their important referents' beliefs into their own beliefs.

Image is defined as "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991, p. 195). Image is viewed in relation to status, power and influence on others in the same social group. Social factors refer to an individual's internalization of referents' subjective culture (Thompson et al., 1991). Subjective culture consists of norms, roles and values.

Though social influence is commonly included in studies of IS continued usage, its effect on continued usage is controversial. The effect of subjective norm on IS acceptance research has yielded conflicting results. Subjective norm is found to be non-significant in the TAM (Davis et al., 1989). However, it has a

significant effect on perceived usefulness / intention / usage (Taylor & Todd, 1995; Venkatesh & Davis, 2000). Some studies suggest that subjective norm / social norm gradually become insignificant with increased experience but image remains significant as long as the social group continues to favour the behaviour (Davis, 1989; Karahanna et al., 1999; Venkatesh & Davis, 2000).

Studies suggest that the effect of social influence varies depending on the nature of the target behaviour or the contexts of the studies (Taylor & Todd, 1995; Venkatesh & Davis, 2000). It is found that social influence is significant in mandatory settings while non-significant in voluntary settings, and that an individual is more likely to comply with referent groups' expectation if they have the ability to give rewards or punishment (Venkatesh et al., 2003).

4. Personal Affect

Affect is not commonly included in the IS acceptance models or theories. In the study of continued usage, however, affect is gaining popularity. In the Model of PU Utilization the differences between the affective and cognitive components of attitude were reviewed (Thompson et al., 1991). It is suggested that affect is a more precise term than attitude to describe an individual's feelings towards a particular act. Affect encompasses feelings like joy, pleasure, disgust or hate. It is also suggested that attitude is a latent variable while affect and cognition are non-latent variables which can be observed directly and are measurable (Thompson, Higgins, & Howell, 1994). The relationship between attitude, affect and cognition is listed in Figure 2.13.

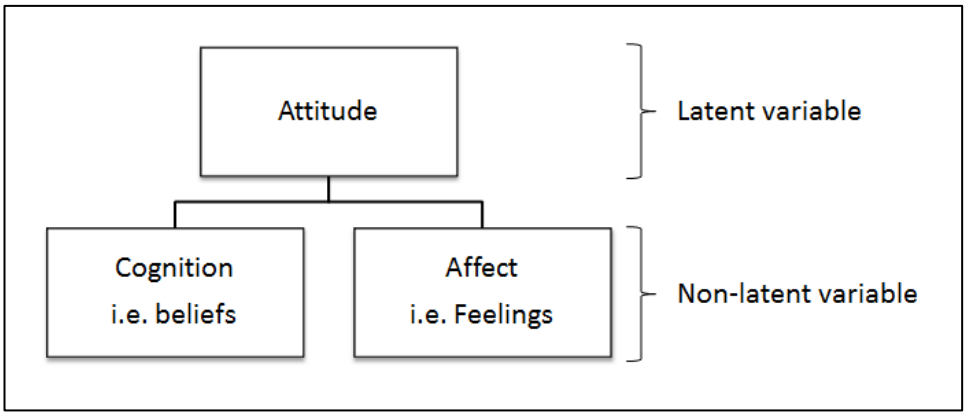


Figure 2.13 Relationship between Attitude, Cognition & Affect

It is suggested that affect does not have a significant influence on behavioural intention (Venkatesh et al., 2003). It is also believed by the researchers that affect influences usage directly, and without intention as a mediator. Satisfaction, a key construct of ECT, is often linked to affect as discussed in Section 2.2.5 Expectation-Confirmation Theory (ECT).

5. Intention

In the context of IS usage, intention is defined as "the extent to which people tend to perform behaviour (to use IS) automatically because of learning" (Limayem, Hirt, & Cheung, 2007). Models discussed in the acceptance section postulate that behavioural intention is the major determinant of usage behaviour (Ajzen, 1991; Davis, 1989). Studies in social psychology suggest that actual behaviour is best predicted by attitude or intention towards the behaviour (Fishbein & Ajzen, 1975). Factors influence behaviour through indirect influence of behavioural intention (Davis et al., 1989).

Some studies of continued usage also support the statement that intention is an important predictor of usage. Taylor and Todd (1995) conducted a study and tried to compare the predictive power of behaviour when keeping and removing behavioural intention in three models (TAM, TPB and Decomposed TPB). It was found that, in all the three models, the predictive power of behaviour decreased substantially when behavioural intention was excluded. In TAM2, the variance (R^2) of intention remains similar as the experience with the system increased in the four field studies (Venkatesh & Davis, 2000).

The above findings suggest that intention plays an important and significant role in predicting behaviour, even in the context of continued usage. On the other hand, it is claimed that the significance of intention declines when the behaviour becomes non-volitional or habitual (Karahanna et al., 1999). There are arguments that the influence of intention on future usage is overestimated if the impact of past usage, experience or habit is ignored (Kim & Malhotra, 2005; Wilson et al., 2005). For example, Kim & Malhotra's findings (2005) show that the influence of intention on usage was inflated substantially from 0.04 to 0.51 if the path of past usage on future usage was deleted from the research model. Past usage, experience and habit might be important constructs in the study of continued usage, however, a robust theoretical foundation and a good measure of past usage, experience and habit are vital, as the linkage between past usage and future usage might be a mere reflection of the fact that there exists a certain level of consistency and stability in usage across time (Limayem et al., 2007).

6. Usage Patterns

Usage patterns are described in terms of rate of use and variety of use (Shih & Venkatesh, 2004). Rate of use is in turn measured by the frequency and duration of use. It is suggested that less extensive utilization is more likely to lead to discontinuance (Parthasarathy & Bhattacherjee, 1998). Variety of use is described by innovative functions and basic functions. It is argued that a higher usage rate of innovative functions or basic functions leads to higher purchase intention of next-generation products (Choi et al., 2011). The measurement of variety of use, or usage patterns with regard to the system's features, is supported by other researchers (Jasperson et al., 2005).

Studies suggest that there is a positive effect of past use on future use (Jasperson et al., 2005; Venkatesh & Davis, 2000; Venkatesh et al., 2003). The self-perception theory states that people observe their own behaviour as an outsider (Kim & Malhotra, 2005). Hence, when people use an information system, the user behaviour would affect the intention / evaluation for future use.

7. Habit

When an initially novel behaviour is practiced, the performer would gain experience with the behaviour. When the behaviour is practiced again, the performer would have a tendency to engage in reflective thinking less frequently, and to rely more on previous experience to direct future behaviour. Habit is formed over time when the behaviour is practiced routinely under stable conditions (Jasperson et al., 2005; Ouellette & Wood, 1998). Habits refer

to non-reflective and repetitive behaviour (Ouellette & Wood, 1998). The self-perception theory states that people do not evaluate their routine behaviour until they are asked to do so (Kim & Malhotra, 2005). This implies that conscious awareness is not involved when performing routine tasks. Other studies also support that reflection or consciousness is not involved for routinized behaviour (Jasperson et al., 2005; Ouellette & Wood, 1998). Hence when a user routinely uses an information system, it is very likely that he / she will perform the task again without conscious awareness unless interventions appear to disrupt the routine.

It is argued that not only intention but habit influences the continued usage of IS (Limayem et al., 2007). Past behaviour is a powerful predictor of usage when the usage becomes habitual (Karahanna et al., 1999). In other words, habit moderates the influence of intention such that its significance decreases as the usage becomes routinized.

Habit is also believed to have correlations with other cognitive constructs. For example, if an individual perceives IS as highly useful, he / she would be more likely to use it in a routine manner and is less likely to experience discontinuance (Lippert & Forman, 2005). Ajzen (2002), however, pointed out that the correlation between frequency of prior behaviour and future behaviour is simply an indication of stabilized behaviour. The stability of behaviour may be attributed to the effect of cognitive and motivational factors that are present and remain unchanged when the behaviour is exercised. Hence, a measure of

habit which is independent of the frequency of prior behaviour is desired (Jasperson et al., 2005; Ouellette & Wood, 1998).

Some researchers attempted to develop measures for past usage, experience and habit. For example, Wilson, Mao, & Lankton (2005, p.414) developed the scale below for measuring the habit of using an IS / IT to conduct an activity.

(i) Not something I know how to do from habit, versus something I know how to do from habit

(ii) Hard to remember how to do, versus easy to remember how to do

(iii) Something I have to think about to remember how to do, versus something I've committed to memory

(iv) Difficult to think of the right way to do it, versus easy to think of the right way to do it

Habit is an unconscious and non-reflective factor. Question (i) might not be suitable as a subject is asked to reflect on his or her habit directly. Question (ii) to (iv) tested a subject's memory as there is a need to establish an empirical linkage between habit and memory. Other researchers measure past usage or experience in terms of length of use, frequency of use, rating of skills (Kim & Malhotra, 2005; Thompson et al., 1994). In general, an instrument which is more robust and well validated is needed to measure habit.

2.3 Personal Knowledge Management & Personal Learning Systems

There is a shift of interest of investigation from IS acceptance to IS continued use. More focus is put on the individual usage level under personal context. Affective and non-conscious factors are gaining popularity. This shift of interest may be attributed to the changes of working conditions and learning styles. Employees and students employ a bottom-up approach and use IT products of their choices in the workplace and in school. Learning is becoming more learner-centric and network-based. The issues of changing conditions and information overload are unabated and they challenge people's abilities to learn. The traditional way of learning may not be effective enough to keep up with the pace of the emerging knowledge. Learners need to develop their personal learning strategies and systems to cope with these issues. In the following section, personal knowledge management (PKM) and personal learning systems are discussed and reviewed how they could help people cope with the contemporary challenges.

2.3.1 Definitions PKM

A number of definitions of PKM exist and there is no single agreed definition. People have been practising PKM to learn better and to improve knowledge for a long time without articulating the term (Cheong & Tsui, 2010). Nevertheless, the numerous definitions of PKM can be categorised into skill-centric and technology-centric.

1. Skill-centric definitions

   - "A conceptual framework to organizing and integrating information" that forms part of personal knowledge base. PKM provides strategies transforming random pieces of information into systematic and applicable forms and in expanding personal knowledge (Frand & Hixon, 1999).

   - A personal self-awareness – "an understanding of how much they know, how to access the things they know, strategies for acquiring new knowledge and strategies for accessing new information as needed" (Avery, Brooks, Brown, Dorsey, & O'Conner, 2001, p.4).

   - A bottom up approach and an individual perspective to KM. The aim of PKM is "to allow individuals to choose what information to collect, how to structure it, and who to share it with. Individuals need to be able to manage their own information so that is meaningful, accessible when it needed, and can be easily exploited" (Jefferson, 2006, p.36).

2. Technology-centric definitions

   - "A range of relatively simple and inexpensive techniques and tools that anyone can use to acquire, create and share knowledge, extend personal networks and collaborate with colleagues" (Barth, 2004, p. 356).
   - The technique of using the tools of technology properly to enhance information, learning and inquiry skills (Garner, 2010).

As seen from the quoted definitions, there are some common phrases in the skill-centric and technology-centric definitions. These phrases include information, knowledge, and ways of accessing and processing information. As these terms appear often in PKM literature, it is beneficial to define these terms and discuss their relationships.

2.3.2 Data, Information and Knowledge

According to Davenport & Prusak (1998), data, information and knowledge are interdependent, but not interchangeable. Data are discrete, objective and factual descriptions about an event. Data are defined as factual records, such as measurements, which are used as a basis for understanding, discussion or problem solving. There is little, or even no, relevance between data. This suggests interpretation or judgement is needed to make data become relevant and meaningful. Examples of data are sets of phone numbers and transaction records.

Data are the foundation of information. Information is processed or structured data that has meaning, i.e. relevance and purpose. Davenport & Prusak (1998) view information as *contextualize, categorised, calculated, corrected, and condensed* data.

Knowledge is derived from information as information from data. To transform information into knowledge, information has to be contextualized. Contextualized information can be used to make comparisons and connections between past, current

and future events, to predict new situations, and to make decisions. Knowledge is a mix of contextualized information, experience, values, and insights; new experience and information are evaluated and incorporated into existing knowledge (Davenport & Prusak, 1998). Knowledge can be also viewed as the fundamental resources, including insights, truths, beliefs, understandings and practical know-how, that allow humans to function intelligently (Wiig, 1997). In other words, knowledge differs from information in that knowledge is more connected to values and understanding, and it is predictive and can be used to make decisions and guide actions.

The hierarchy relationship between data, information and knowledge is shown in Figure 2.14. The higher the position, the more contextualized, structured and complex it is. Further to data, information and knowledge, some researchers define one more term, wisdom or intelligence. Wisdom, or intelligence, is regarded as the ability to understanding and applying knowledge (Bouthillier & Shearer, 2002). It has one level above knowledge.

2.3.3 Development – Needs of PKM

PKM has a relatively short history. To the best of the writer's knowledge, the term PKM first appeared in the late 1990s. As it has a relatively short history of less than 20 years, it is not expected that clear, distinct lines of research direction can be observed in the development of PKM. Several foci, however, can be seen among various PKM papers. The foci include the needs of PKM, discrete PKM steps, PKM competencies and values, tools and technologies, and learning and networks.

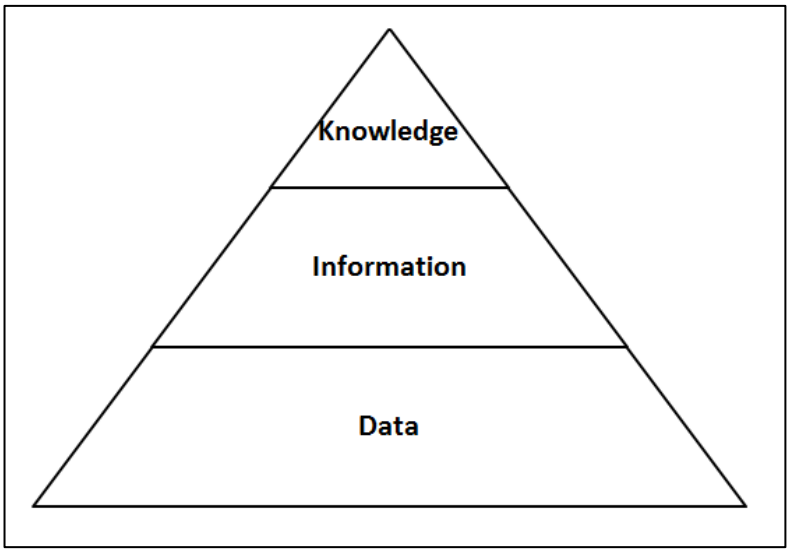


Figure 2.14 Data, Information and Knowledge Hierarchy

The first focus is the needs of PKM. They can be summarised as several points. The first one is the limitations of knowledge management. Barth (2004, p.350) states that employing an enterprise knowledge management system is "lengthy and expensive and contentious". On the other hand, the human factor is sometimes overlooked. Therefore, researchers proposed PKM as a complementary approach or the basis of deploying KM systems. It is also believed that if knowledge workers take the lead and responsibility for things they know, do not know and should know, then KM programmes would work best (Barth, 2000). PKM is closely related to responsibility, as it is assumed that individuals have self-awareness of their abilities and limitations, and the responsibility to manage their personal knowledge assets (Avery et al., 2001; Wiig, 1997).

The remaining reasons are closely related. They are the changes in technology, information overload and the unstructured and fast-changing work conditions. Personal digital devices such as mobile phones, tablets and notebooks are becoming common. It is believed that this trend gives rise to PKM (Caldwell, 2002). It takes little effort to get access to information. On the other hand, a huge amount of information is available, leading to the problem of information overload. This takes additional time for people to locate the right categories and digest the information. The work condition is becoming more unstructured and changes very quickly. People need to search for new information and learn constantly. Hence, there is a clear need to acquire skills and technologies that would facilitate people in processing information, learning and working more effectively.

2.3.4 Development – PKM Steps / Competencies and Value

The second focus of PKM studies is discrete PKM steps and PKM competencies and values. Research work at the early stage centred at discrete steps which are distinctive and definable. It shifted to competencies and values which are more complex and inter-related at the later stages of research.

Several researchers define PKM into discrete and definitive steps or skills. To the writer's best knowledge, Frand and Hixon (1999) were the first to do so. These steps are listed as follows.

- Searching / finding
- Categorizing / classifying
- Naming things / making distinctions
- Evaluating / assessing
- Integrating / relating

Avery et al. (2001) provided a seminal work on PKM steps. They proposed a 7 PKM step model which haas similar components to that of Frand and Hixon. These 7 steps are discussed as follows,

- Retrieving information

  Retrieving information is about locating, identifying and scanning data, records and documents. Apart from gathering information from print and electronic sources, this skill also involves experimentation and oral inquiry (Avery et al., 2001). Related skills include search-related activities, such as widening or narrowing a search, using Boolean operators and asking questions.

- Evaluating information

  Evaluating information is to find valuable and relevant information. Information technologies, such as the World Wide Web, have led to a significant increase in the quantity of information. However, the quality and relevance of the information is not guaranteed. Evaluation of information

depends more on skills than on tools. These skills include identifying and validating authentic sources. Processing a vast amount of retrieved information requires judgment. This skill is of great importance in today's information overload era.

- Organizing information

  Organizing information refers to the organisation of information to facilitate the process of connecting new and old information. Organizing information includes physically filing documents and mentally transforming the newly learnt information into understanding. This skill is important as effective organization of information enhances future information retrieval.

- Collaborating around information

  Collaborating around information is about transferring and communicating information from one party to other parties. It can facilitate each other's learning and problem solving.

- Analysing information

  Analysing information is about finding patterns, trends and relationships between the newly acquired information with the existing information and knowledge. This skill is important as it is the underlying process of transforming information into knowledge, which is more valuable (Avery et al., 2001).

- Presenting information

  Presenting information is how individuals explain and present information through effective communications, whether in a written or spoken manner. The skill of presenting information is closely related to the skill of collaborating around information, as both skills take effective communication into the account.

- Securing information

  Knowledge has value, and hence is worth protecting. Securing information is about keeping information free from viruses and hackers by encryption of sensitive information and other means.

It was suggested that much emphasis was put on retrieving, evaluating and organizing information, but not enough was put on collaborating around, securing and presenting information at that time (Avery et al., 2001). Pollard (2004) also gives brief descriptions of three PKM skills which are (i) information acquisition, (ii) information processing and (iii) social activities. These skills also share similar characteristics to those of Avery et al.'s suggested model. Information acquisition would be similar to retrieving information, information processing to evaluating and analysing information, and finally, social activities to collaborating around and presenting information.

At this stage, the discrete and definitive PKM skills tend to focus on personal information management (PIM). It is generally agreed that there are differences between PKM and PIM. Miller (2005) states that PKM is about *using* information to fulfil some purposes while PIM is about *organizing and controlling* information. Jarche (2010a) believes that PIM is the fundamental process of PKM in the way that the "process of seeking out information sources, making sense of them through some actions and then sharing with others to confirm or accelerate our knowledge are those activities from which we can build our knowledge". However, there are opposite views. Jones (2011) argues that PKM is only a subset of PIM that gives extra focus. He believes that there is no management of knowledge except through the management of information, as knowledge management generates and consumes information.

Studies of PKM shifted from discrete steps to competencies and values after some time. Competencies are viewed as having more value and practicality than steps. Barth (2004) evaluated Avery's 7 PKM steps with processes, values, skills and tools. Figure 2.15 shows Barth's conclusion. The columns principles processes and skills are similar to the steps mentioned in the earlier section. The column values add in new insights. Values include critical thinking, system thinking, narrative, trust, confidentiality and responsibility are matched with Avery's 7 PKM steps.

Wright (2005) proposed four types of competencies with four problem types. His framework focuses more on cognition, social and is specific to the IT industry. The

four competencies are (i) cognitive, (ii) information, (iii) social competencies, and (iv) learning and development while the four problem types are (i) routine problem, (ii) novel problem, (iii) discovery problem, and (iv) problem outside of expertise. He suggests that PKM is primarily an unconscious process and occurs naturally (cognition and intuition). Figure 2.16 shows the framework given by Wright.

PRINCIPLES	PROCESSES	VALUES	SKILLS
Accessing Information & Ideas	• Browse, buy, subscribe • Search (local, network, web) • Research • Asking & Listening • Learning	• Transparency • Concentricity (spiral out) • Learning & unlearning • Mobility • Persistence	• Question formation • Search techniques • Research strategies • Inquiry • "Know the map"
Evaluating Information & Ideas	• Attribute info & ideas • Vet sources • Confirmation • Testing • Question motives	• Objectivity • Quality and relevance • Message literacy	• Source identification, qualification & cultivation • Validation • Judgment • Intuition, feeling
Organizing Information & Ideas	• Capture, convert text & data • File, archive • Search automation • Map, categorize, index • Internalize & Integrate	• Availability & flexibility • Version control • Personal Area Networks • Narrative*	• Email filtering • Discard (carefully) • Outlining • Networking
Analyzing Information & Ideas	• Sense-Making • Hypothesis & Synthesis • Identify Trends	• Critical thinking • Systems thinking • Empathy • Narrative*	• Analytical techniques • Testing hypothesis • *This category is very practice-specific*
Conveying Information & Ideas	• Answering • Explaining • Presenting • Publishing • Teaching	• Clarity • Articulation • Context • Language • Narrative*	• Written word • Spoken word • What's left unspoken
Collaborating with Info & Ideas	• Messaging • Sharing docs • Workflow • Brainstorming • Meetings & conversations	• Trust • Teamwork, Compromise • Network ethics • Just-in-time collaboration • Gratitude, Generosity	• Emotional intelligence • Facilitation • Relationship management • Play • Leadership
Securing Information & Ideas	• Backup • Inoculation • Insulation • Encryption	• Confidentiality • Privacy • Need-to-know • Responsibility • Integrity & confidentiality	• Self-discipline • Threat awareness

Figure 2.15 Information Process, Skills and Tools

(Reprinted with permission from Barth, 2004)

Problem type	*Routine*	*Novel*	*Discovery*	*Outside of expertise*
Cognitive problem-solving competencies	Apply rapid problem-solving process including: -problem-scoping -pattern recognition -sense-making -problem analysis -heuristics -risk assessment -identification of solution options	*In addition*: Careful, systematic definition, diagnosis and analysis of problem Reflection and double loop learning Improviztion skills	*In addition*: Create prototypes of complex ideas to make tacit knowledge explicit Structured discussion and collaboration process to explore ideas	Cautious problem solving featuring slower pace of problem definition and pattern recognition
Information competencies	Access personal notes and relevant information Ability to access, search, store and organize key information resources	*In addition*: Access and assess quality of external information (sensing and sourcing) Consultations with community of practice and external networks	Knowledge (information, assumptions, values) embedded in prototypes and models	Seek additional insights by seeking discussions with new networks (dynamic information sources)
Social Competencies	Primarily a Solitary activity	Collaborative activity requiring communication and collaboration skills Extensive internal and external discussions. Team work processes	*In addition*: Use of shared space for collaborative discussions of prototypes Supported by use of 'shared space' technologies	Engage in wider search for ideas and insight Develop more extensive external networks Internal community used to vette external information
Learning competencies	Stronger problem definition capacity	Increased pattern recognition and sense-making. Stronger analytical skills	Creation of new knowledge through experiments and prototyping	Capacity for reflection
Individual, social and organizational context	Individual motivation to excel, learn, risk taking and innovation, collaboration and strong interpersonal skills Strong social capital, high trust, strong bonding networks, strong bridging networks, support of community of practice and strong collaborative abilities Organizational enablers including flexibility, high trust, tolerance for risk and innovation, autonomy, supportive leadership and challenging work			

Figure 2.16 Emergent PKM Framework

(Reprinted with permission from Wright, 2005)

A framework called PKM 2.0 has been recently proposed by Cheong and Tsui (2010). It integrates skill/competencies, DIKW (data, information, knowledge, wisdom) transformation, knowledge conversion and process according to four stages, namely Personal Information Management, Personal Knowledge Internalization, Personal Wisdom Creation and Inter-Personal Knowledge Transferring. Figure 2.17 gives a visual illustration. It states the respective skill/competence, DIKW transformation, knowledge conversion and KM process in each stage. These stages have a relationship similar to that of information, knowledge and wisdom. An

individual needs to proceed from Personal Information Management to Personal Knowledge Internalization, and finally to Personal Wisdom Creation. Inter-Personal Knowledge Transferring links individuals' PKM life cycles (see Figure 2.18).

In the development of PKM steps / competencies and value, there are added emphases on learning, problem solving, creativity and collaboration for studies focusing on competences and values. Among different PKM frameworks, Avery's model is primitive and this can be understood as it was developed at the earlier stage. Wright's framework and Cheong and Tsui's PKM 2.0 are considered to be more comprehensive, but require readers to have basic understanding on KM and PKM.

PKM 2.0 Components	Personal Information Management (PIM)			Personal Knowledge Internalization (PKI)			Personal Wisdom Creation (PWC)			Inter-Personal Knowledge Transferring (IKT)		
Skill / Competence	Retrieving	Evaluating	Organising	Analysis	Learning / Self Development	Reflection	Problem Solving	Creativity	Mental Agility	Securing	Presenting & Communication	Collaborating
DIKW Transformation Layer	Data ← → Information			Information ← → Knowledge			Knowledge ← → Wisdom			Information / Knowledge ← → Information / Knowledge		
Knowledge Conversion	Explicit ← → Explicit			Explicit → Tacit			Tacit ← → Tacit/Explicit			Explicit / Tacit ← → Explicit / Tacit		
KM Process	Capture / Locate			Create			Apply			Transfer / Share		

Figure 2.17 PKM 2.0

(Reprinted with permission from Cheong and Tsui, 2010)

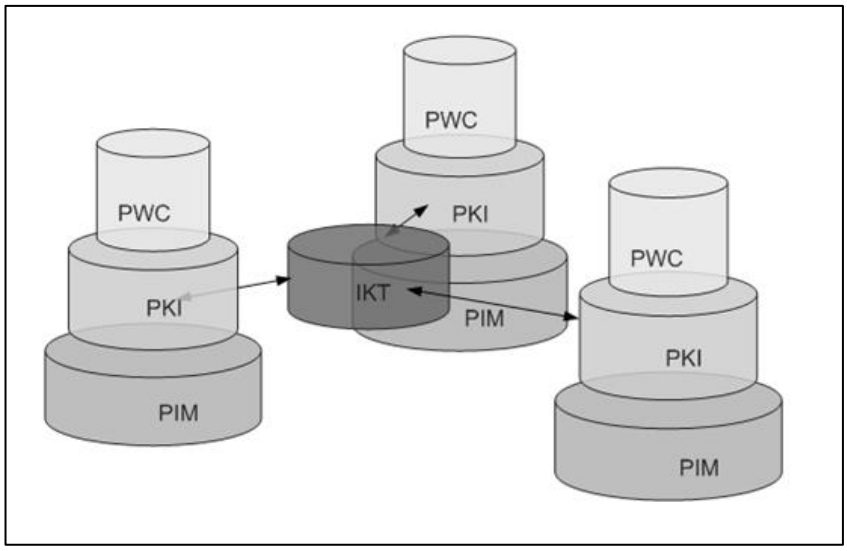


Figure 2.18 Interaction of PKM Components

(Reprinted with permission from Cheong and Tsui, 2010)

2.3.5 Development – PKM Tools and Technologies

The third focus is tools and technologies. Technologies are considered as facilitators for PKM, and selecting and using appropriate tools is essential for an effective PKM (Agnihotri & Troutt, 2009; Barth, 2004). There are a variety of PKM tools and technologies. Tsui (2002) describes several categories of PKM tools. Some of the examples are shown below.

- Index & Search – to index local and networked drives and facilitate searching thereafter
- Associative links – online dictionaries, hyperlinks or thesauri to web resources
- Information capture & sharing – to organise, structure and share information and documents

- Mind-map – to organise and connect different pieces of information, and to support individuals and teams in communal brainstorming
- E-mail management & unified messaging – they are applications that improve and incorporate communications systems
- Voice recognition tools – contrary to text-based tools, these tools accept voice commands and help users to convey instructions to their systems
- Collaboration & synchronisation tools – to support sharing of knowledge
- Learning tools – to facilitate users in learning process

The PKM tools and technologies mentioned by Tsui (2002) were dated back to late 1990s to early 2000s. There are later technologies on PKM, such as Web2.0 and Software-as-a-Service tools. Web 2.0 technologies refer to online applications, and they include file/video sharing, blogs, RSS Feeds, social networks, wikis and tagging. Web 2.0 technologies remain very popular for personal use. They created new opportunities in learning (Taraghi, 2012). Many organizations, however, started introducing Web 2.0 into business operations. Web 2.0 technologies can benefit an organization; their interactivities promise to bring more employees into physical contact at a daily basis and at lower cost (Pacalin, Chui, & Miller, 2009). When Web 2.0 technologies are used effectively, they can encourage participation in projects and idea sharing, and hence deepening an organization's knowledge. Web 2.0 technologies may also be used to strengthen relationships with customers and improve communications with suppliers and outside partners.

The rise of personal mobile devices is also another key issue. Mobile devices allow users to have access to learning resources and applications at any time, at any places and in different contexts, and hence supporting self-regulated learning (Taraghi, 2012). Self-regulated learning is the ability to recognize of the need for further learning and pursue learning proactively (Leone, 2013).

Software-as-a-Service (SaaS) refers to computer applications on the Internet (Garner, 2010). Example of SaaS is Google Docs. Users can Google Docs to generate document in real-time and in a collaborative manner. SaaS is also related to the cloud computing model.

Skills and technologies for PKM are both important. It is argued that the importance would rely on a proper skill-tool fit or a task-technology fit (Agnihotri & Troutt, 2009). Agnihotri & Troutt (2009) believes that there is a positive relationship between the available technologies and an individual's performance and unproductive PKM practices are usually resulted from lacking the proper skills of technology use. However, they admit some difficulties choosing the right tools to align with the tasks due to the problem of information overload. A variety of tools and technologies are available and the speed of launching new ones is usually faster than the speed of recognising them. The researchers also propose a conceptual skill-tool fit framework as shown in Figure 2.19.

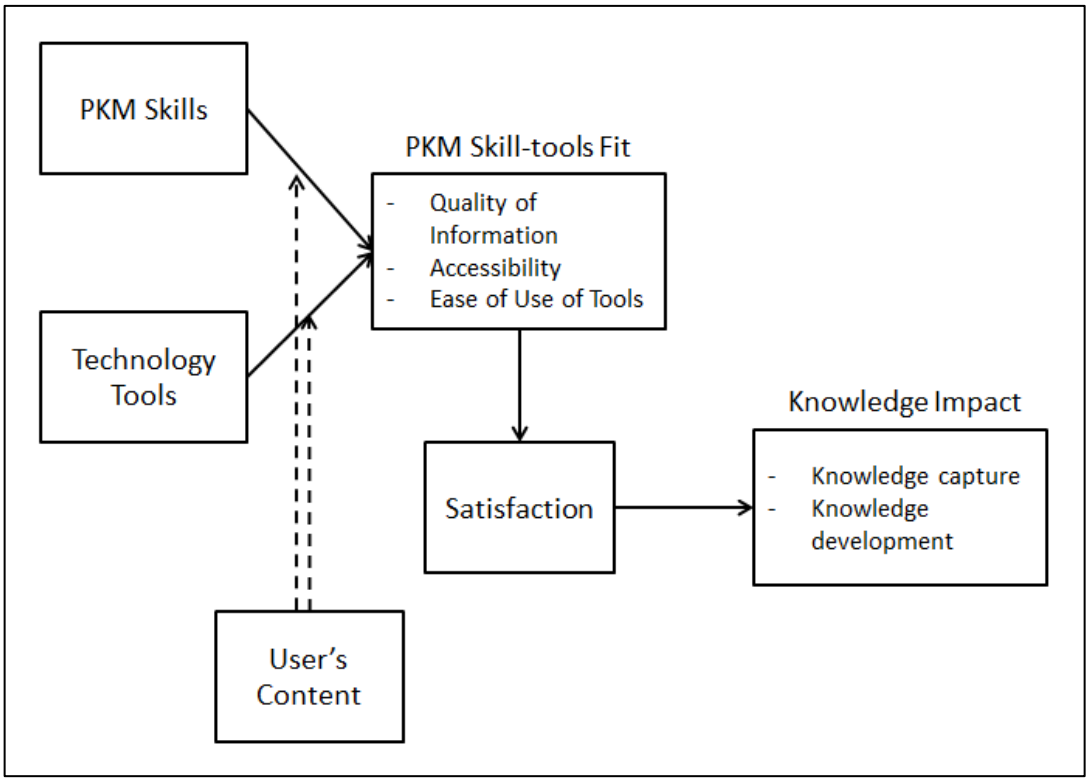


Figure 2.19 PKM Skill-tool Fit Framework

(Adapted from Agnihotri & Troutt, 2009)

The fit framework takes into consideration the quality of information, accessibility of information and ease of use of tools. It is suggested that task characteristics (skills) and technology characteristics (technology tools) predict the skill-tool fit, which in turn predict the utilization and finally impact on the knowledge capture and development. The skill-tool fit is moderated by the user's context. This is only a conceptual framework and no data have been collected to validate the hypotheses.

2.3.6 Development – Learning and Networks

The final focus is learning and networks. At this stage, emphasis is made on self-regulated learning and connecting with the right people, rather than getting the right knowledge.

Jarche (2010b) also proposed a Seek-Sense-Share framework (see Figure 2.20). The model describes three activities: seek, sense and share. Seek is finding, filtering and validating information. Sense is converting information to knowledge and creating new knowledge. Share includes mutual engagement, formalizing information and evaluating challenges. Jarche suggests that information / knowledge going through these three processes would have higher value. Seek and sense is in the shape of an inverted triangle where sense is at the bottle-neck position. This may imply that information is sought among a huge pool of information, and only a small portion is selected and sensed. Sensing requires action, regular practice and experience. After sharing and using the ideas, the value of the ideas is enlarged and reaches a great number of people. Community plays a key role as Jarche believes that the value ideas are only manifested when they are shared. When communities, relationships, trust and networks are built, it becomes easier to locate the subject matter expertise.

Cloud technologies are of raising attention. One typical usage of cloud technologies is data storage. Tsui, Cheong, & Sabetzadeh (2011) proposed cloud-based usage as a service for Personal Knowledge Management. This service allows users to have access to consultation from subject-matter experts in a cloud community.

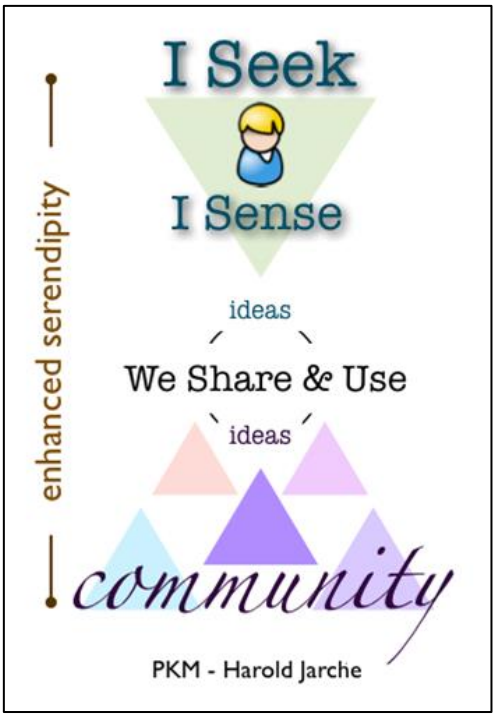


Figure 2.20 Seek-Sense-Share Model

(Reprinted with permission from Jarche, 2010b)

2.3.7 Personal Learning Environment & Network (PLE&N)

Learning is an act of obtaining knowledge or skill through study, instruction, or experience (Wehmeier, 1998). Personal learning environment & network is a learner-centric platform fostering self-regulated and network-based learning (Dabbagh & Kitsantas, 2012). It is learner-centric in a sense that an individual learner would choose and develop his / her own learning systems; it is networked learning as people learn through social contact, which has been fostered by the advancements in technology. Another definition is that personal learning environment is the "combination of different tiny applications" that is "within a framework and with strong relationship to learning aspects" (Taraghi, 2012, p.7). PLE&N is a generic term and a concept instead of a specific software package. As such, many different

variants of PLE&N systems, like personal knowledge environment (Dabbagh & Kitsantas, 2012; Leone, 2012) and personal knowledge networks (Caldwell, 2002; Mohamed, 2012), exist in studies of PLE&N.

One of the key foci of PLE&N is the use of technologies. Advancements in technology provide a variety of tools for people to develop their own learning systems in order to suit their learning needs. Many of these tools include Web 2.0 tools, which are pervasive, ubiquitous and bottom-up. Learners have the freedom and responsibilities to decide and select which tools best fit their learning purposes and preferences. They can also use tools to build up networks for co-learning and locating expertise.

Learners have different learning competencies, preferences and objectives. To respond to this diversity, learning should be personalised. On the other hand, there is an increasing trend that people learn from trusted networks, as knowledge is distributed across connections. To meet the contemporary challenges and learning trends, a PLE&N is established. Advancements and changes in technology provide a variety of tools for people to develop their own learning systems. Many of these tools are Web 2.0 tools which are pervasive, ubiquitous and bottom-up. The Web 2.0 tools include discussion forums, file/video sharing, RSS feeds and social networks. Learners have the freedom and responsibilities to decide and select which tools best fit their learning purposes. They can also use tools to build up networks for co-learning and locating expertise.

Continuance intention is the focus of some research studying e-learning tools (Chiu, Sun, Sun, & Ju, 2007; Cho et al., 2009; Lee, 2010; Roca, Chiu, & Martínez, 2006). It is pointed out that the occurrence of acceptance-discontinuance anomaly of e-learning tools is common (Lee, 2010).

2.4 Research Gap & Objectives

The majority of studies on information systems (IS) focus on acceptance (also known as adoption, pre-adoption or initial adoption) in the organizational context. It is suggested that conventional IT products incur a large amount of initial cost in acquisition but minimal operating cost thereafter (Parthasarathy & Bhattacherjee, 1998). On the other hand, conventional IT products are largely authorized by organizations, which may be willing to support studies on IS acceptance. Hence research on acceptance is important in the field of IS.

While acceptance of an information system is an important step, "long-term viability of an IS and its eventual success depend on its *continued* use rather than *first-time* use" (Bhattacherjee, 2001, p.352, emphasis in original). Many of the contemporary tools and technologies, such as Web 2.0 tools, are free of charge and used in a bottom-up approach; the revenue mainly comes from advertisements and subscriptions to premier services. IS continuance at the individual user level has also become vital to the survival of these business-to-consumer electronic firms.

However, studies on continued usage in a personal context are scant. Kim and Malhotr (2005) stated that little systematic effort has been put into continued information systems use over time. The adoption process at individual adaptor level has also been ignored in most studies investigating user beliefs and attitudes (Karahanna et al., 1999).

A search test was conducted by the author to compare the number of papers on IS acceptance and IS continuance from ten major information systems journals using Web of Science. These ten journals were composed of eight from Senior Scholars' Basket of Journals, with an additional of two journals[1]. One set of search string was used to estimate the number of acceptance studies[2]. For continuance studies, two sets of search strings were used[3]. Search string 1 contains two more key words (usage and utilization) comparing with search string 2. The search coverage of string 1 is higher

[1] The eight journals from Senior Scholars' Basket of Journals are European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems and MIS Quarterly. The additional two journals are Information & Management and Decision Support Systems.

[2] The search string was "acceptance" or "adoption" or "pre-acceptance" or "pre-adoption".

[3] Search string 1 contained "continuance" or "continued usage" or "usage" or "utilization" or "post-acceptance" or "post-adoption". Search string 2 contained "continuance" or "continued usage" or "post-acceptance" or "post-adoption".

but there is also possibility to cover non-targeted papers. Both title and topic searches were conducted. Results are shown in Table 2.2.

Table 2.2 Number of Returned Papers on Pre-adoption and Post-adoption[4]

	Acceptance	**Continuance** – search string 1	**Continuance** – search string 2
Title search	334	143	50
Topic search	1334	665	128

The results show that the number of papers on IS continuance ranges from less than one-tenth (search string 2) to about half (search string 1) of that of acceptance. This shows that there is a big difference between the number of acceptance and continuance studies. This study hoped to narrow the gap by identifying factors that influence IS continued usage and proposing an IS continuance framework.

As discussed in earlier sections, studies of continued usage based on personal context and the investigation of unconscious factors, such as personal affect, are under-explored. This study also aimed to contribute to the influence of unconscious factors

[4] The search date was 18 Nov 2016.

(personal affect) on the continued usage of a personal learning system (PLE&N tools in particular) under a personal context.

Two research questions and one research objective are proposed as follows.

1. What are the factors that lead to continuance intention and continued usage of PLE&N tools?
2. How do these factors influence continued usage of PLE&N tools?

Research objective: to build and validate a research model explaining factors in the continued use of PLE&N tools.

2.5 Research Model & Hypothesis Development

A research model (Figure 2.21) is proposed. The influence of cognitive or belief constructs on usage via intention, in particular on continued usage via continued usage intention, has been validated by a number of researches (Limayem et al., 2007; Taylor & Todd, 1995; Venkatesh et al., 2003; Wilson et al., 2005). Perceived usefulness, compatibility and social influence are the cognitive constructs taken into investigation in this study. There are some factors, such as satisfaction and confirmation from ECT and motivations from MM, which show significant influence on intention or usage but are not included into the research model. The key reason is that some of the constructs share high similarity in terms of definition and measurement scale, and they can be grouped into subsets of constructs. Venkatesh et

al. (2003), for example, grouped perceived usefulness and extrinsic motivation as performance expectancy, and intrinsic motivation and affect as attitude toward using technology. It is also argued that satisfaction is linked to affect as discussed in Section 2.2.5 Expectation-Confirmation Theory (ECT). A good theory should explain phenomena with few constructs (Shiau & Chau, 2016). To simplify the research model, not all the constructs reviewed are incorporated into the research model.

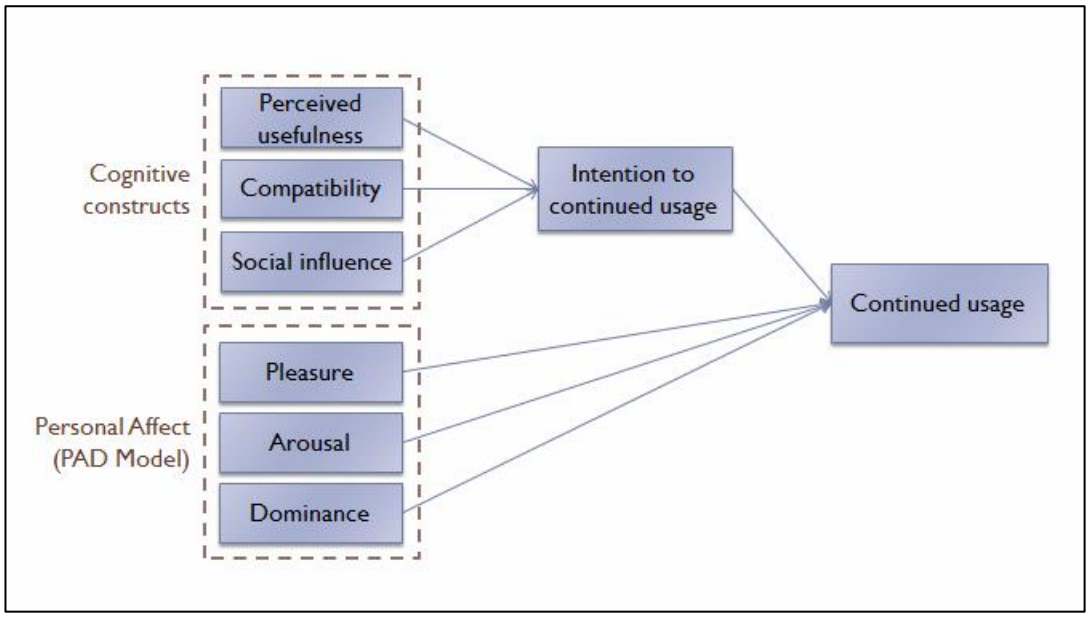


Figure 2.21 The Research Model

The research model also consists of another set of constructs under personal affect. Affect is a non-conscious construct. Affect is believed to influence usage directly (Venkatesh et al., 2003). The pleasure-arousal-dominance model (PAD model) (Mehrabian & Russell, 1974) is used to represent and measure personal affect.

Traditional scales for affect in IS acceptance or continued usage are found to be weak, and hence affective factors from psychology are used.

- Influence of intention on usage

  Models discussed in the acceptance section postulate that behavioural intention is the major determinant of usage behaviour (Ajzen, 1991; Davis, 1989). Studies of continued usage also support the statement that intention is an important predictor of usage (Limayem et al., 2007; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh et al., 2003). Studies in social psychology suggest that actual behaviour is best predicted by attitude or intention towards the behaviour (Fishbein & Ajzen, 1975).

  H1: individuals' continued usage of the PLE&N is positively associated with their IS continuance intention.

- Influence of perceived usefulness on intention

  Perceived usefulness is found to be a significant and important construct in both acceptance and continuance studies (Davis et al., 1989; Karahanna et al., 1999; Taylor & Todd, 1995; Venkatesh et al., 2003). Its influence does not ease with the experience of technology. Hence, hypothesis 2 was proposed.

  H2: individuals' intention to continue usage is positively associated with their perceived usefulness of using the PLE&N.

- Influence of perceived compatibility on intention

  Compatibility refers to the fit between an individual's work style and the use of IS (Moore & Benbasat, 1991). Similar to perceived usefulness, compatibility is found to be a significant predictor in both acceptance and continuance studies, though the significance is usually less than that of perceived usefulness (Karahanna et al., 1999; Venkatesh et al., 2003). Hypothesis 3 was proposed as below.

  H3: individuals' intention to continue usage is positively associated with their perceived compatibility of using the PLE&N.

- Influence of perceived compatibility on intention

  Social influence is a collective term for subjective norm, image and social factors. Its influential power is debatable. Some studies have found significant influence of social influence on intention while some have not. Studies suggest that the effect of social influence varies depending on the nature of the target behaviour or the contexts of the studies (Taylor & Todd, 1995; Venkatesh & Davis, 2000). For example it is found that an individual is more likely to comply with referent groups' expectation if they have the ability to give rewards or punishment (Venkatesh et al., 2003). Social network and collaboration play an important role in the context of this study. Hence, social influence was included in this study, leading to hypothesis 4.

H4: individuals' intention to continue usage is positively associated with the social influence of their referent groups associated with the use of PLE&N.

- Influence of personal affect on usage

  Affect is the feelings like joy, pleasure, disgust or hate. It is not commonly included in most of the IS acceptance models or theories, but it is gaining popularity in the study of continued usage. It is argued that affect is a more precise term than attitude to describe an individual's feelings towards a particular act. Affect influences usage directly, and without intention as a mediator (Venkatesh et al., 2003). The pleasure-arousal-dominance (PAD) model (Mehrabian & Russell, 1974) is used to represent personal affect, and hence affect is further broken down into three constructs, pleasure, arousal and dominance. Pleasure measures cognitive judgment (good-bad); arousal measures the intensity of the judgment (strong-week); dominance measures the feeling of control and influence (active-passive). Details of the PAD model are explained in section 3.2 Development of Instruments.

  H5: individuals' continued usage of the PLE&N is positively associated with their feeling of pleasure derived from using the PLE&N.

  H6: individuals' continued usage of the PLE&N is positively associated with their feeling of arousal derived from using the PLE&N.

H7: individuals' continued usage of the PLE&N is positively associated with their feeling of dominance derived from using the PLE&N.

2.6 Summary

The main stream information system (IS) literature focuses on acceptance of a technology in organization settings. More focus has been put on continued usage of a technology in the last one to two decades, and continued usage is considered to play an important role in the success of a technology. The shift of interest of investigation from IS acceptance to IS continued usage indicates that more focus is put on the individual usage level under personal context. The review on personal knowledge management and personal learning systems literature shows the demands to develop personal learning strategies and systems to cope with the issues of complex working condition and fast pace of emerging knowledge, and to meet the needs of learner-centric and network-based learning. A set of IS continued usage constructs under personal contexts, including affective and non-conscious factors, have been discussed and they constitute the research model. The next chapter discusses the methodologies chosen to investigate the research model.

CHAPTER 3 RESEARCH METHODOLOGY

After reviewing the literature on acceptance, continuance, personal knowledge management and personal learning systems, and identifying the research gap and proposing the research model, this chapter introduces the methodology employed to answer the research questions. This chapter begins with the descriptions of the context of study, followed by the development of the instruments and the methods used for data collection and data analysis.

3.1 Context of Study – PLE&N

This study investigated the relationship between continued usage factors and the usage of PLE&N tools. Data were collected in natural environment with minimum interference. The respondents were students or graduates of The Hong Kong Polytechnic University (PolyU) who are using or have used the PLE&N tools introduced by lecturers. The PLE&N tools are Feedly and Google+ to be exact. Feedly is a cloud-based news aggregator application. It garners news feeds and alerts from various online sources for the user to personalize and share with others. The users do not have to check the websites for new contents manually as Feedly pulls new articles and aggregate them. This would be very beneficial if the users need to read new article from multiple sources. Information from Feedly can also be shared and exported to Google+. Google+ a cloud-based social networking tool. It allows the user to share links, videos, pictures and other contents, and facilitate discussions of the contents. A graphical illustration (Figure 3.1) is used to shown the interactions of different individuals' PLE&N. Each individual has his / her own PLE&N. The

icons out of the circle refer to information and data, and the overlapped areas refer to the community or connection between different individuals. Each individual gets information and data through his / her own PLE&N. The information will then be evaluated, analysed and filtered, and shared among communities and connections. This PLE&N system promotes collaborative learning and gives the synergy effort of combating information overload from different individuals. The detailed usage of Feedly and Google+ is illustrated in the below sections.

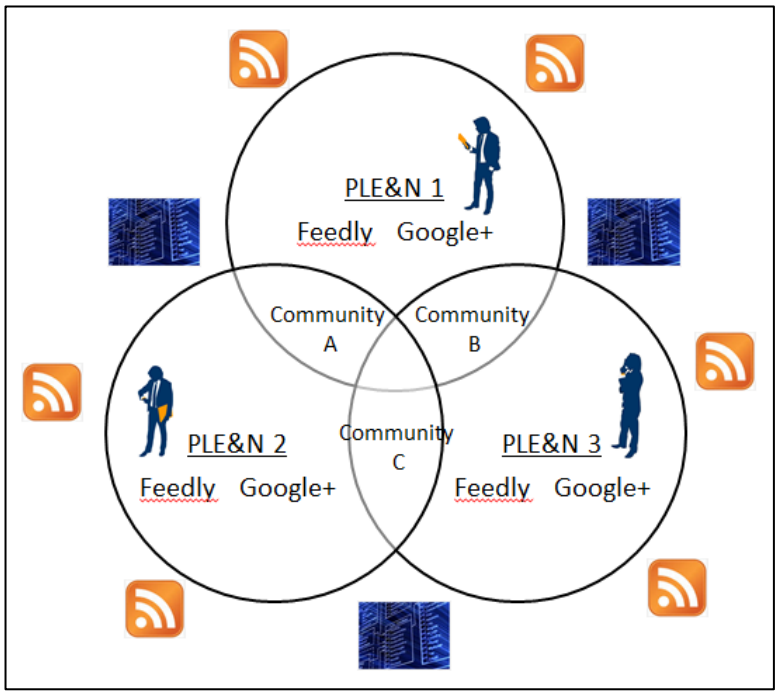


Figure 3.1 The PLE&N System

3.1.1 Feedly

The PLE&N contains pre-calibrated RSS (Rich Site Summary, also called Really Simple Syndication) feeds. The feeds are selected by the lecturers from quality sources and are relevant to the subject that the respondents are taking. The

respondents can add, delete, re-arrange and customize the feeds in a way that suit their learning preferences (Figure 3.2). Feedly pulls new articles and aggregate them from the selected sources to the users such that they do not have to check the websites for new contents manually (Figure 3.3). The articles are rated which can be used as a reference point for the quality and insight of the article. The articles can also be shared from Feedly to other media and tools such as Google+ (Figure 3.4). People of the user's community can then reply to and have discussions on the shared article.

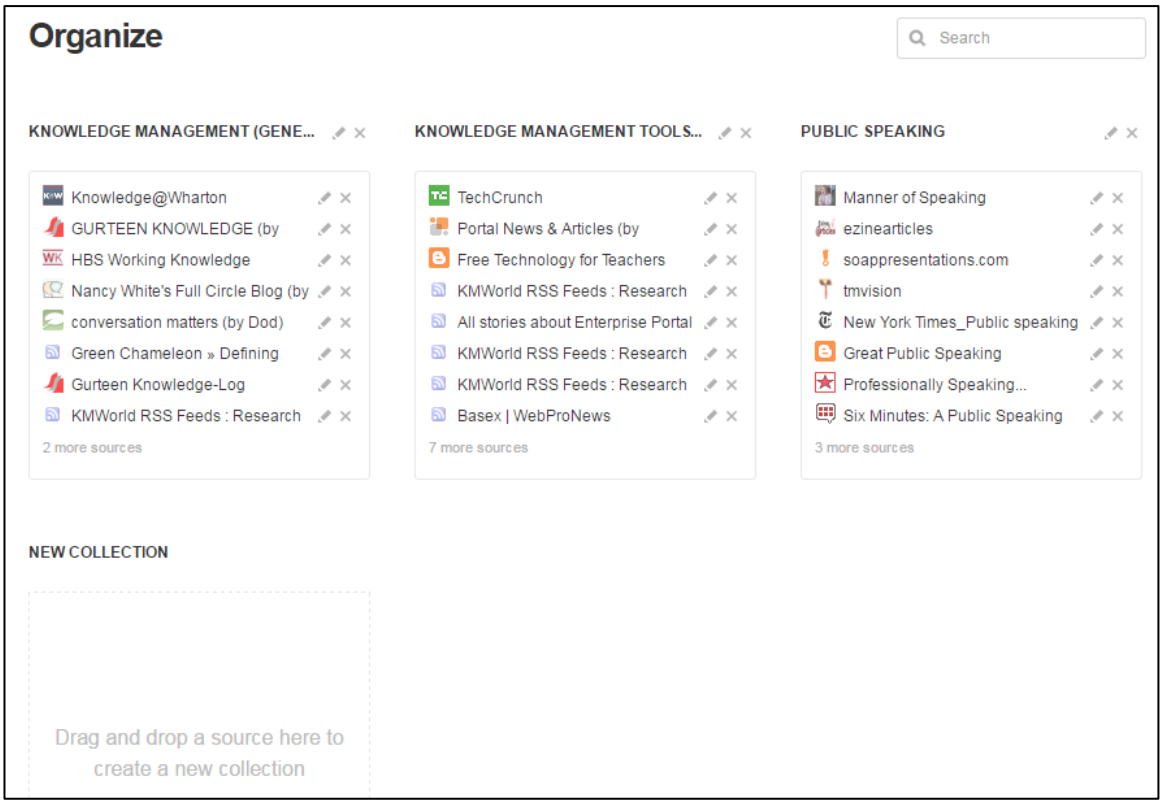


Figure 3.2 Pre-calibrated RSS Feeds

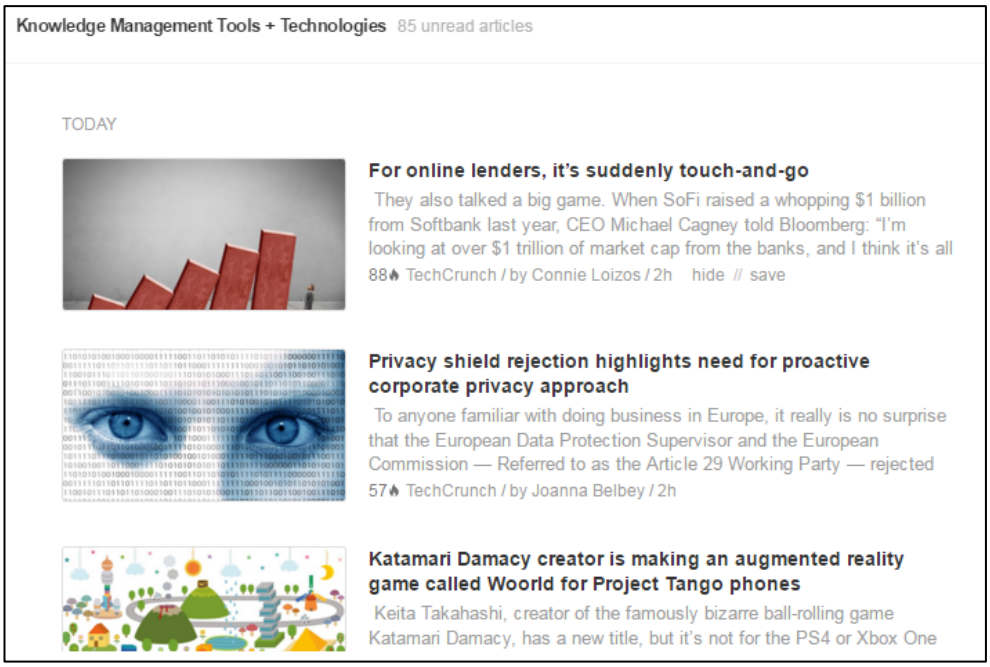


Figure 3.3 New Articles from RSS Feeds

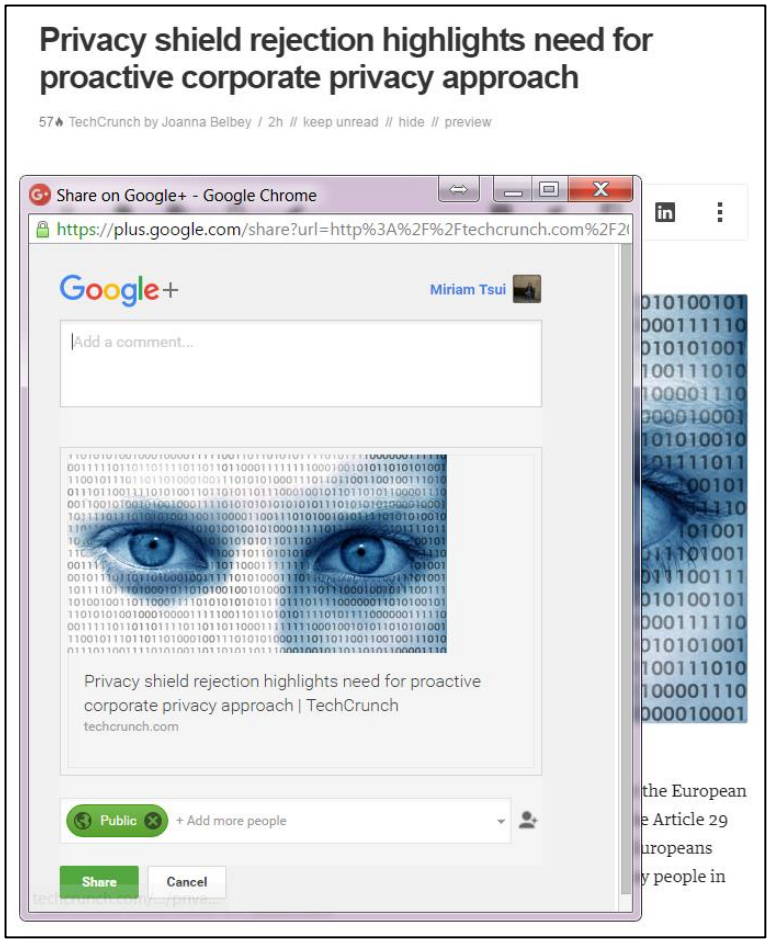


Figure 3.4 Sharing a Feed to Google+

3.1.2 Google+

Google+ is used to facilitate sharing and discussion of contents. In order to ensure that information is reached to the correct targets, the subject code is taken as the name of the circle / community. The lecturers, students and some graduates are members of the circle / community. Information sharing and discussions are made within members of the circle / community. The subject code is also used as a hashtag for each posting to facilitate efficient searching. ISE543, for example, was used as a hashtag while the author was taking that subject and participating in the PLE&N (Figure 3.5, see red-highlighted box).

Figure 3.5 illustrates how Google+ facilitates information sharing and discussions. The author read an article which she found to be useful to the subject. The article was posted and other members responded to the article. A thread of discussion was followed. This might stimulate members thinking about the article, and arouse others' interest in this article.

Some incentives are required to entice students to adopt and contribute to this PLE&N as the concept of using it as a learning tool in a formal class is relatively new. As such, 10% of the assessment is reserved for constructive and consistent contributions in the PLE&N for subjects that operate with the PLE&N (Tsui & Sabetzadeh, 2014). However, participants in the PLE&N did not stop once the subject ended. Discussions among members lasted until 2014 (Figure 3.6, see red-highlighted box).

Figure 3.5 A Post in Google+

In general, this PLE&N allows students to participate and contribute to the shared knowledge base by creating posts, recommending feeds, and reviewing and commenting others' posts. Participants of the PLE&N include lecturers, students, graduates, field experts and field practitioners. The PLE&N is a customizable

personal and group learning platform. It is extendable to other tools and supports lifelong learning since the tools are not confined to a semester.

Figure 3.6 A Post in Google+

Please refer to "Appendix 1 – Setup Guide and Introduction of PLE&N" for more details of the setup of PLE&N tools.

3.2 Development of Instruments

Existing well-validated questions were used to form the questionnaire. All questions were retrieved from IS adoption literatures (Davis et al., 1989; Jasperson et al., 2005; Moore & Benbasat, 1991; Taylor & Todd, 1995; Thompson et al., 1991; Venkatesh et al., 2003), except for the personal affect construct. The questions and the corresponding literature are listed as follows.

Perceived Usefulness (Davis et al., 1989; Moore & Benbasat, 1991)

1. Using the PLE&N would improve my learning performance.
2. Using the PLE&N would improve my productivity.
3. Using the PLE&N would enhance my effectiveness on learning.
4. Using the PLE&N would make it easier to learn.
5. I would find the PLE&N useful.
6. Using the PLE&N would improve the quality of my learning.
7. Using the PLE&N would enable me to accomplish tasks more quickly.

Compatibility (Moore & Benbasat, 1991)

1. Using the PLE&N is compatible with most aspects of my learning.
2. Using the PLE&N is completely compatible with my current situation.
3. Using the PLE&N fits well with the way I like to learn.
4. Using the PLE&N fits into my learning style.

Social influence (Taylor & Todd, 1995; Thompson et al., 1991)

1. People who influence my behaviour think that I should use the PLE&N.
2. People who are important to me think that I should use the PLE&N.
3. I use the PLE&N because of the proportion of peer who use it.
4. The lecturer has been helpful in the use of the PLE&N.
5. The lecturer is very supportive of the use of the PLE&N.
6. In general, the department has supported the use of the PLE&N.

Usage Pattern (Moore & Benbasat, 1991; Thompson et al., 1991)

1. The intensity of the PLE&N use.
2. The frequency of the PLE&N use.
3. The context of the PLE&N use - locations & devices

Intention (Venkatesh et al., 2003)

1. I intend to use the PLE&N in the next 3 months.
2. I predict I would use the PLE&N in the next 3 months.
3. I plan to use the PLE&N in the next 3 months.

As for the personal affect construct, the pleasure-arousal-dominance (PAD) instrument from Mehrabian & Russell (1974) was used. The PAD model is a semantic differential scale. The use of a semantic differential scale can distinguish the PAD scale from other constructs that use Likert scales (Bhattacherjee, 2001). The

instrument consists of 18 items, with six each under pleasure, arousal and dominance respectively (Table 3.1). Pleasure measures cognitive judgment (good-bad); arousal measures the intensity of the judgment (strong-week); dominance measures the feeling of control and influence (active-passive). Studies confirm that combinations of the three emotional response factors account for about 60% of variations in human responses (Mehrabian & O'Reilly, 1980; Mehrabian, 1996; Bradley & Lang, 1994; Osgood, Suci, & Tannenbaum, 1957; Osgood, 1952). To illustrate, boredom can be expressed in terms of low pleasure, arousal and dominance; excitement in terms of high pleasure, arousal and dominance; anxiety in terms of high arousal, low pleasure and dominance; relaxation in terms of high pleasure and dominance and low arousal (Mehrabian & Russell, 1974).

Table 3.1 PAD Model from Mehrabian & Russell (1974)

Pleasure	**Arousal**	**Dominance**
Unhappy – Happy	Relaxed – Stimulated	Controlled – Controlling
Annoyed – Pleased	Calm – Excited	Influenced – Influential
Unsatisfied – Satisfied	Sluggish – Frenzied	Cared for – In control
Melancholic – Contented	Dull – Jittery	Awed – Important
Despairing – Hopeful	Sleepy – Wide awake	Submissive – Dominant
Bored – Relaxed	Unaroused – Aroused	Guided – Autonomous

Some of the terms used in the PAD model are not commonly used in the daily life of Chinese society. To facilitate understanding of these terms in Chinese society, all the terms of the PAD model were translated into Chinese. Two professional translators and an English lecturer at PolyU were asked to help translate the terms. Back translation was used to ensure the accuracy of the translation (Saunders, Lewis, & Thornhill, 2007). The two professional translators were asked to translate the terms of the PAD model into Chinese. The English lecturer was then asked to translate all the Chinese terms back into English. The original English terms and the translated English terms were then compared. If the original and translated English terms were exactly the same, the corresponding Chinese term was used without any uncertainty. If the original and translated English terms were close but not exactly the same, a Chinese term was chosen according to the author's judgment of closest meaning and suitability. The final set of translated terms of the PAD model is shown in Table 3.2. For the details of the translation work done by the three professionals, please refer to Appendix 2.

Even though the instruments used were well-validated ones from the literature, additional measures were adopted to further validate the scale. Q-sorting or card sorting can help assess construct validity (Moore & Benbasat, 1991; Petter, Straub, & Rai, 2007; Taylor & Todd, 1995). A non-PolyU student with no knowledge of this study was asked to sort the questions into unlimited or unspecified categories. The categorized questions were similar to, and even more refined than, the grouping of the existing instruments. This shows that the instruments can measure the items that they were intended to measure.

Table 3.2 Translated Terms of the PAD Model

Pleasure	**Arousal**	**Dominance**
Unhappy (不快樂) Happy (快樂)	Relaxed (輕鬆) Stimulated (刺激)	Controlled (被控制) Controlling (控制別人)
Annoyed (惱火) Pleased (高興)	Calm (平靜) Excited (激動)	Influenced (受到影響) Influential (有影響力)
Unsatisfied (不滿) Satisfied (滿意)	Sluggish (庸懶) Frenzied (忙亂)	Cared For (照料) In Control (掌握之中)
Melancholic (鬱鬱不樂) Contented (心滿意足)	Dull (沉悶無聊) Jittery (焦躁不安)	Awed (敬畏) Important (重要)
Despairing (感到絕望) Hopeful (充滿希望)	Sleepy (昏昏欲睡) Wide Awake (完全清醒)	Submissive (順從) Dominant (主導)
Bored (厭煩無聊) Relaxed (輕鬆)	Unaroused (死氣沉沉) Aroused (生氣勃勃)	Guided (受引導) Autonomous (獨立自主)

One of the concerns of adopting a self-report survey is common method variance (CMV) (Doty & Glick, 1998). The results of an empirical study comparing available CMV assessment methods suggest that "CMV-adjusted structural relationships and explained variance are close to the original estimates" (Malhotra, Kim, & Patil, 2006, p.1870), and hence it could be said that CMV is present within IS research but it is not substantial. Though CMV is found to be not substantial within IS research, some measures have been adopted to reduce the possibility of biases resulting from CMV. For example, some questions were phrased in a negative form to help assess the degree of common method variance.

3.3 Data Collection

Reviewing of the literature helps identify possible factors that influence continued usage of PLE&N tools. A research model and several hypotheses have been proposed. A survey (online questionnaire) was used as the main data collection method to collect data and validate the research model. Besides, unstructured interviews were also deployed to fine-tune the questionnaire and have a deeper understanding of the continued usage of PLE&N tools. In general, both quantitative and qualitative methods were used while quantitative was the main one.

3.3.1 Preparation for & Pre-test of Questionnaire

A questionnaire is defined as a data collection technique in which each respondent is asked to respond to the same set of questions in a predetermined manner (De Vaus, 2002). The use of a questionnaire provides an efficient way of collecting responses from a large sample as each respondent is asked to respond to the same set of questions. It works best with standardized questions which can be interpreted the same way by all respondents, and hence a questionnaire can be used for descriptive, explanatory or analytical research (Saunders et al., 2007). The use of questionnaires to collect data does have limitations and might introduce bias. However, there are outweighed benefits of using questionnaires. Questionnaires can be used to reach a large number of people. There is no or little geographical limitation for electronic or mailed questionnaires. Data can be collected fairly easily and coding of responses is not difficult. If the use of questionnaires is well-validated, the benefits outweigh the limitations.

The questionnaire was put online on a platform called Qualtrics. PolyU has subscribed for the service of Qualtrics and PolyU students are entitled to use this service upon request.

A pre-test of the questionnaire (Appendix 3 – Pre-test Version of Questionnaire) was conducted to collect feedback on the questions and measures. The questionnaire invitation was sent by the researcher and 12 responses were collected. A few respondents were interviewed to develop a deeper understanding of their comments and feelings of the questionnaire. A number of suggestions were made regarding the wording, sequence of questions and overall structure of the questionnaire. These suggestions were incorporated into the revised measurement.

3.3.2 Pilot of Questionnaire

A pilot study (Appendix 4 – Pilot Version of Questionnaire) was conducted to gain additional feedback about the questionnaire instrument and the reliability and validity of the measurement model. The questionnaire invitation was sent by the lecturer who deployed PLE&N tools in his classes; 27 completed and valid responses were collected.

3.3.3 Final Launch of the Questionnaire

The final version of the questionnaire is listed in Appendix 5 – Final Launch Version of Questionnaire. Unlike the pre-test and the pilot, at least one question under each construct was worded negatively to assess for response biases. The questionnaire

invitation was sent by the same lecturer who did so in the pilot. Target respondents who received the invitation to participate in the pilot were excluded from this round of data collection.

3.4 Data Analysis

3.4.1 Treatment of Missing Data

Missing data are not uncommon from data collected from self-administered questionnaires. Individuals may choose to respond to certain questions only, hence resulting in missing observations. Missing data can affect the valid sample size, and properties of estimators and interferences.

Missing data can be classified as Missing Completely At Random (MCAR), Missing At Random (MAR), and Missing Not At Random (MNAR). MCAR refers to data that are missing independent of both observed and unobserved data; it is the most restrictive among the three types of missing data. MAR refers to data that are missing independent of unobserved data only. In other words, it infers that the missing data could be linked to variables that are observed in the study. MAR is less restrictive than MCAR. MNAR exists when the missing data are dependent on unobserved data, which suggests that the nature of missing data is systematic. MNAR is the least restrictive type of missing data, and also the most serious because there is no known statistical treatment for MNAR and it can impede the findings seriously (Blunch, 2008; Byrne, 2001).

Samples that have data missing for all questions under any single construct should be abandoned. As for constructs that contain "partial" missing data, there are a few simple methods to overcome the shortcomings raised by missing data. They include complete case analysis (also known as listwise deletion) and replacement of missing data by simple imputation. Complete case analysis (listwise deletion) excludes samples that have any missing data; only samples without any missing data are used for data analysis. This method is inefficient, and suggested only if the sample size is large, as this method can greatly reduce the number of samples. Complete case analysis has the possibility of generating biased results if the missing data are not completely random.

The second simple method is replacement of missing data by simple imputation. Series mean, regression mean, median of nearby points, linear interpolation and linear trend at points are available examples of simple imputation to replace missing data in SPSS. Replacement of missing data by mean contributes no bias to the results, but it may affect the accuracy of the data. It is also not inappropriate for categorical variables. Replacement of missing data by nearby points and trends is only suitable for longitudinal studies.

The above simple methods may yield more uncertainties than the missing data themselves. Hence, more advanced methods are recommended and multiple regression imputation is one of the solutions. With multiple regression imputation, the incomplete data set serves as the dependent variables while the complete data set serves as the predictors. Cases with complete data are used to generate a regression

equation which is subsequently used to postulate the missing values for cases with incomplete data (Byrne, 2001).

3.4.2 Reliability & Validity

Reliability is the extent to which the data collection techniques yield consistent findings. The reliability of each construct is assessed using Cronbach's Alpha value, factor analysis and composite reliability. Cronbach's Alpha measures the internal consistency. It is suggested that the minimum acceptance level should be 0.7 (Nunnally & Bernstein, 1994). Factor analysis examines the extent to which the observed variables are linked to their underlying latent constructs. The factor loadings, which are the regression paths from the constructs to the observed variables, show the extent to which observed variables are generated by the underlying latent variables. The factor loadings can also give insights on the reliability of the scale. Composite reliability is a measure of the overall reliability of a set of items loaded on a latent construct. It is suggested that values of composite reliability greater than 0.70 reflect good reliability, while values between 0.60 and 0.70 are also acceptable if other indicators are good (J. F. Hair, 2006).

Validity refers to the extent to which the data collection techniques accurately measure what they are intended to measure. When using a questionnaire, content validity, criterion validity and construct validity are usually the traditional key validity indicators. Content validity assesses the degree to which the measurement questions cover different aspects of the concept being measured; it is usually assessed through literature. Criterion validity concerns the ability of the measurement

questions to predict respondents' behaviour. Construct validity refers to the degree to which the measurement questions measure the presence of constructs that are intended to be measured. The criterion validity can be assessed using statistical analysis such as correlation.

There are also two commonly used techniques, convergent validity and discriminant validity. Convergent validity is the degree to which each measurement item correlates to its assumed theoretical construct. Items that are indicators of a construct should share a high ratio of variance in common. The below three criteria were suggested to evaluate convergent validity (Fornell & Larcker, 1981):

1. All measurement factor loadings must exceed 0.50, and ideally 0.7 or higher
2. Construct reliabilities must exceed 0.70
3. Average Variance Extracted (AVE) by each construct must exceed 0.50

Discriminant validity is the degree to which a construct is genuinely distinct from other constructs. A latent variable should explain better the variance of its own indicators than that of other latent variables. Discriminant validity compares the square root of AVE of each construct and the correlations between all other constructs. The validity holds true if the square root of AVE is larger than the correlations (J. F. Hair, 2006).

3.4.3 Structural Equation Modelling

Structural Equation Modelling (SEM) is a multivariate technique which estimates a series of inter-related causal relationships simultaneously. SEM is a suitable data analysis technique when latent variables with multiple indicators are involved, and when it is not possible to separate the constructs and test each construct individually. Latent variables, such as beliefs, intentions, and feelings, cannot be measured directly. Latent variables are measured indirectly through indicators which are called manifest variables. SEM is good at testing an entire system of variables in simultaneous analysis (Byrne, 2001). It integrates and assesses the measurements (the measurement model) and the hypothesized causal paths (the structural model) simultaneously (Gefen, Rigdon, & Straub, 2011). SEM is a common and popular data analysis technique in the field of IS, marketing and social science.

There are two main streams of SEM, partial least square (PLS) and covariance-based SEM. PLS estimates relationships in an iterative sequence of ordinary least squares linear regression and aims to maximize the explained variance in the dependent constructs. It is good for exploratory research which requires no assumption of normally distributed sample. The sample size requirements are of ordinary least squares linear regression (Gefen et al., 2011). On the contrary, covariance-based SEM "estimates model parameters so that the discrepancy between the estimated and sample covariance matrices is minimized" (J. Hair, Sarstedt, Ringle, & Mena, 2012, p.415). It is good for confirmatory research and requires data to be normally distributed and a reasonable large sample size. One multivariate statistics reference book suggested a sample size of $N > 50 + 8m$, where N is sample size and m is predictor variables (Tabachnick & Fidell, 2007). In general, PLS's weaknesses are

the strengths of covariance-based SEM, and vice versa (J. Hair et al., 2012, p.415). Common PLS SEM software includes SmartPLS and WarpPLS, while covariance-based SEM is AMOS of SPSS and Lisreal.

This study involved latent variables with multiple indicators. It is not possible to separate the latent variables and test each of them individually. Hence, SEM was chosen as the technique to analyse the collected data. This study attempted to explore the relationship between three personal affect constructs and continued usage. Considering the nature of the study and the small sample size, PLS SEM is a more suitable SEM technique and it was chosen. Among the PLS software, WarpPLS was chosen.

3.5 Summary

This chapter outlines the development of the measurement instruments and the questionnaire. It also discusses the techniques used to collect and analyse data. The next chapter focuses on analysis of the data and the corresponding findings.

CHAPTER 4 RESULTS & DISCUSSION

This chapter presents the results of data collected from the questionnaire and discusses the findings. It starts with some general descriptions of the data, followed by analysis using Structural Equation Modelling (SEM).

4.1 General Descriptions of Data

4.1.1 Number of Responses

A total of 100 responses were collected; 95 valid responses remained after removing samples with missing data for all questions under any single construct, and monotone data that had no variance across all answers. The valid response rate was 95 percent.

There were 8 samples with a total of 19 data points missing. The missing percentage was 11.6 percent in terms of number of samples. 11 missing data points belong to demographical questions. The 8 non-demographical data points were filled using multiple regression imputation. The software used was WarpPLS.

4.1.2 Demographic Information of Respondents

Table 4.1 shows the gender distribution of the 95 valid responses. Three respondents (3.2 percent of the total sample) were unwilling to disclose their gender. The gender distribution was said to be even with 46.7 percent male and 53.3 percent female.

Table 4.1 Gender Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	43	45.3	46.7	46.7
	Female	49	51.6	53.3	100.0
	Total	92	96.8	100.0	
Missing	Value	3	3.2		
Total		95	100.0		

Table 4.2 shows the age distribution range. Five respondents (5.3 percent of the total samples) were unwilling to disclose their age. The majority of the respondents were aged from 20 to 49. Please refer to Appendix 6 – Age Distribution of Questionnaire for the exact distribution of age (ungrouped).

Table 4.2 Age Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20 - 29	34	35.9	37.7	37.7
	30 - 39	32	34.0	35.5	73.3
	40 - 49	14	15.0	15.5	88.9
	50 - 59	10	10.6	11.0	100
	Total	90	94.7	100.0	
Missing	Value	5	5.3		
Total		95	100.0		

Table 4.3 outlines the education distribution. Two respondents (2.13 percent of the total samples) were unwilling to disclose this information. Most of the respondents held a master's degree.

Table 4.3 Education Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor	11	11.6	11.8	11.8
	Master	80	84.2	86.0	97.8
	Doctor	2	2.1	2.2	100.0
	Total	93	97.9	100.0	
Missing	Value	2	2.1		
Total		95	100.0		

Table 4.4 shows the occupation distribution. The occupations with the highest number of respondents were manager / supervisor (23 respondents, 24.2 percent of the total), and students (21 respondents, 22.1 percent of the total).

4.1.3 Usage of PLE&N

As shown in Table 4.5, over half of the respondents (61 respondents, 64.2 percent of the total) had taken subject(s) which involved PLE&N for one semester only. The second majority involved five semesters, with 13 respondents and 13.7 percent of the total. The maximum number of semesters taken was eight. 36 respondents were

enrolled in a current class which required the use of the PLE&N as part of the assessment. These 36 samples were taken out in the SEM analysis as only voluntary continued usage should be involved.

Table 4.4 Occupation Distribution of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Administrator	5	5.3	5.3	5.3
	Associate/Analyst	3	3.2	3.2	8.4
	Consultant	5	5.3	5.3	13.7
	Director/General Manager	7	7.4	7.4	21.1
	Engineer	6	6.3	6.3	27.4
	Lecturer/Professor/Teacher	2	2.1	2.1	29.5
	Librarian	2	2.1	2.1	31.6
	Manager/Supervisor	23	24.2	24.2	55.8
	Officer	5	5.3	5.3	61.1
	Others	7	7.4	7.4	68.4
	Programmer	2	2.1	2.1	70.5
	Project Manager	4	4.2	4.2	74.7
	Student	21	22.1	22.1	96.8
	Technician	3	3.2	3.2	100.0
	Total	95	100.0	100.0	

Table 4.5 shows the number of semesters that the respondents took subjects that involved the use of PLE&N. The number was counted on the basis of semesters, not subjects. The number of semesters was one of the indicators of usage experience of the PLE&N tools. If a respondent was taking two subjects that involve the use of PLE&N simultaneously within one semester, the usage experience of history was counted as one semester, which usually lasts for about four months. As shown in Table 4.5, over half of the respondents (61 respondents, 64.2 percent of the total) had taken subject(s) which involved PLE&N for one semester only. The second majority involved five semesters, with 13 respondents and 13.7 percent of the total. The maximum number of semesters taken was eight. 36 respondents were enrolled in a current class which required the use of the PLE&N as part of the assessment. These 36 samples were taken out in the SEM analysis as only voluntary continued usage should be involved.

Table 4.5 Number of Semesters Using PLE&N by Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	61	64.2	64.2	64.2
	2	5	5.3	5.3	69.5
	3	2	2.1	2.1	71.6
	4	8	8.4	8.4	80.0
	5	13	13.7	13.7	93.7
	6	4	4.2	4.2	97.9
	8	2	2.1	2.1	100.0
	Total	95	100.0	100.0	

Table 4.6 outlines the current usage status of the PLE&N tool by the respondents. About 75 percent of the respondents were still using the PLE&N at the time they responded to the questionnaire. As mentioned, however, 36 respondents were enrolled in a current class which required the use of the PLE&N as part of the assessment. To better reflect the current usage of the PLE&N under voluntary conduction, these 36 samples were taken out and another analysis was conducted. The frequency was computed as shown in Table 4.7. Nearly 60 % of the respondents were still using the PLE&N after the mandatory condition, using it as part of the assessment, was removed.

Table 4.6 Current Usage of PLE&N by Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Using	71	74.7	74.7	74.7
	Not Using	24	25.3	25.3	100.0
	Total	95	100.0	100.0	

Table 4.7 Current Usage of PLE&N by Respondents (36 Samples Taken Out)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Using	35	59.3	59.3	59.3
	Not Using	24	40.7	40.7	100.0
	Total	59	100.0	100.0	

Table 4.8 lists the usage frequency of the PLE&N tools by the respondents according to two periods, the assessment period and the non-assessment period. The assessment period refers to the time when the respondents could receive potential rewards (e.g. marks for the subject) from the lecturer for any participation in the PLE&N, while the non-assessment period refers to the time when the respondents were not receiving any rewards from the lecturer for any participation in the PLE&N. Respondents who were yet to enter into the non-assessment period, or did not use the PLE&N tool during the non-assessment period, were asked not to answer for the non-assessment period.

Table 4.8 Usage Frequency of PLE&N by Respondents

		Assessment Period		Non-assessment Period	
		Frequency	Percent	Frequency	Percent
Valid	Less than once per week	7	7.4	31	32.6
	Once to twice per week	37	38.9	19	20.0
	Three to four times per week	23	24.2	15	15.8
	About once per day	14	14.7	6	6.3
	More than once per day	13	13.3	8	8.4
Missing	Value	1	1.1	16	16.8
Total		95	100.0	95	100.0

From Table 4.8, we can see a higher frequency usage during the assessment period, probably attributed to the reward system. After the assessment period, respondents had the freedom to choose whether to continue using the PLE&N tool or not. Their usage of the PLE&N tool was based on their beliefs and preferences.

Similar to the usage frequency, Table 4.9 lists the usage duration of the PLE&N tools by the respondents during the assessment period and the non-assessment period. The respondents tended to use the PLE&N tools for a shorter period of time during the non-assessment period. This is believed to be attributed to the removal of the reward system.

Table 4.9 Usage Duration of PLE&N by Respondents

		Assessment Period		Non-assessment Period	
		Frequency	Percent	Frequency	Percent
Valid	Less than 15 mins	14	14.7	24	25.3
	15 mins to 30 mins	24	25.3	24	25.3
	30 mins to 1 hour	28	29.5	10	10.5
	1 hour to 2 hours	15	15.8	5	5.3
	More than 2 hours	11	11.6	6	6.3
Missing	System	3	3.2	26	27.4
Total		95	100.0	95	100.0

4.2 Factor Analysis

Factor analysis was conducted using SPSS. It was found that there were eight items with eigenvalues higher than one (Table 4.10). This suggests that all the items could be grouped into eight categories. Rotated Component Matrix analysis (Table 4.11) suggests that some constructs could be further broken down into different concepts. This is not surprising as certain items are taken from the literature and grouped into the same. For example, the six questions under social influence are taken from Taylor & Todd (1995) and Thompson et al. (1991). It was also suggested that the perceived usefulness instrument developed by Moore & Benbasat (1991) could be further broken down into two to three concepts (Petter et al., 2007). The results of this factor analysis might perhaps support Petter et al.'s proposition, and this might be worth investigating.

Apart from insights into the number of constructs, factor analysis also gives insights into the degree of common method variance of the data. The test is called Harman's single factor test. The factor analysis is run with one extra constraint – fixing the number of factors at one. Common method variance is said to be not significant if the "% of Variance" is less than 50 percent for the first component, i.e. the first component accounts for less than 50 percent of all variables in the model. The "% of Variance" of the first component was 42.060 (Table 4.12). Hence, it can be concluded that common method variance was not significant in this study.

Table 4.10 Factor Analysis – Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.983	42.060	42.060	15.983	42.060	42.060
2	3.802	10.006	52.066	3.802	10.006	52.066
3	2.340	6.158	58.224	2.340	6.158	58.224
4	1.719	4.523	62.747	1.719	4.523	62.747
5	1.467	3.860	66.607	1.467	3.860	66.607
6	1.373	3.612	70.219	1.373	3.612	70.219
7	1.261	3.319	73.538	1.261	3.319	73.538
8	1.116	2.938	76.476	1.116	2.938	76.476
9	.867	2.282	78.758			
10	.768	2.021	80.778			
11	.722	1.900	82.678			
12	.640	1.685	84.363			
13	.590	1.553	85.916			
14	.565	1.488	87.404			
15	.483	1.270	88.674			
16	.431	1.135	89.809			
17	.418	1.101	90.910			
18	.368	.967	91.878			
19	.345	.908	92.786			
20	.296	.779	93.564			
21	.279	.733	94.298			
22	.250	.659	94.956			
23	.247	.651	95.608			
24	.231	.608	96.215			
25	.214	.564	96.779			
26	.203	.533	97.313			
27	.161	.423	97.736			
28	.142	.374	98.110			
29	.129	.340	98.449			
30	.116	.306	98.755			
31	.102	.269	99.025			
32	.093	.246	99.271			
33	.077	.201	99.472			
34	.063	.166	99.638			
35	.051	.133	99.771			
36	.045	.119	99.890			
37	.033	.088	99.977			
38	.009	.023	100.000			

Extraction Method: Principal Component Analysis.

Table 4.11 Factor Analysis – Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
PU_1	.626				.494			
PU_2	.569							
PU_3					.775			
PU_4	.619							
PU_5	.562							
PU_6					.781			
PU_7	.714							
COM_1	.492		.466					
COM_2	.463		.445					
COM_3	.522		.537					
COM_4	.535		.445		.416			
SI_1				.776				
SI_2				.795				
SI_3				.740				
SI_4	.470						.534	
SI_5							.761	
SI_6							.851	
PA_P_1	-.798							
PA_P_2	-.809							
PA_P_3	-.882							
PA_P_4	-.847							
PA_P_5	-.842							
PA_P_6	-.858							
PA_A_1						.876		
PA_A_2						.843		
PA_A_3						.615		.500
PA_A_4						.488		.406
PA_A_5	-.421	.447						.497
PA_A_6	-.437	.561						.450
PA_D_1		.597						
PA_D_2		.758						
PA_D_3		.845						
PA_D_4		.643						
PA_D_5		.825						
PA_D_6		.816						
INT_1			.826					
INT_2			.721					
INT_3			.834					

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 10 iterations.

Table 4.12 Harman's Single Factor Test

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.983	42.060	42.060	15.983	42.060	42.060
2	3.802	10.006	52.066			
3	2.340	6.158	58.224			
4	1.719	4.523	62.747			
5	1.467	3.860	66.607			
6	1.373	3.612	70.219			
7	1.261	3.319	73.538			
8	1.116	2.938	76.476			
9	.867	2.282	78.758			
10	.768	2.021	80.778			
11	.722	1.900	82.678			
12	.640	1.685	84.363			
13	.590	1.553	85.916			
14	.565	1.488	87.404			
15	.483	1.270	88.674			
16	.431	1.135	89.809			
17	.418	1.101	90.910			
18	.368	.967	91.878			
19	.345	.908	92.786			
20	.296	.779	93.564			
21	.279	.733	94.298			
22	.250	.659	94.956			
23	.247	.651	95.608			
24	.231	.608	96.215			
25	.214	.564	96.779			
26	.203	.533	97.313			
27	.161	.423	97.736			
28	.142	.374	98.110			
29	.129	.340	98.449			
30	.116	.306	98.755			
31	.102	.269	99.025			
32	.093	.246	99.271			
33	.077	.201	99.472			
34	.063	.166	99.638			
35	.051	.133	99.771			
36	.045	.119	99.890			
37	.033	.088	99.977			
38	.009	.023	100.000			

Extraction Method: Principal Component Analysis.

4.3 Reliability

Two reliability analyses, namely Cronbach's Alpha and composite reliability, were conducted. Cronbach's Alpha was computed using SPSS while composite reliability was computed using WarpPLS. Cronbach's Alpha value is used to assess the internal consistency for each construct, while composite reliability is a measure of the overall reliability of the set of items loaded on a latent construct. The Cronbach's Alpha values, ranging from 0.793 to 0.961, and the composite reliability values, ranging from 0.851 to 0.970 were all higher than 0.7 (Table 4.13). It could be concluded that the constructs had satisfactory reliability.

Table 4.13 Reliability Statistics

	Cronbach's Alpha	Cronbach's Alpha[5]	Composite Reliability[6]	Number of Items
Perceived usefulness	0.889	0.917	0.938	7
Compatibility	0.912	0.924	0.948	4
Social influence	0.793	0.805	0.869	6
Pleasure	0.961	0.961	0.970	6
Arousal	0.780	0.763	0.851	6
Dominance	0.885	0.909	0.930	6
Intention	0.886	0.833	0.904	3

[5] 36 respondents enrolling in a current class which required the use of the PLE&N as part of the assessment were taken out from the analysis.

4.4 Validity

The AVE values (Table 4.14) were computed by WarpPLS. The 36 respondents enrolling in a current class which required the use of the PLE&N as part of the assessment were taken out from the analysis. The only value which was lower than 0.5 was arousal but the value (0.497) was very close to 0.5. Table 4.15 shows the correlation among constructs. The diagonal values represented the square root of the average variance shared with measures, that is, the square root of AVE values as shown in Table 4.14. The off-diagonal entries represented the correlations between constructs. For sufficient discriminant validity, the diagonal entry should be greater than the entries in the corresponding rows and columns. The square root of AVE of perceived usefulness was slightly lower than the correlation between perceived usefulness and compatibility. There were concerns for perceived usefulness (PU) and compatibility (COM) loading on each other. In general, the validity of the constructs should be improved but the results were not too dissatisfactory that further analyses should be stopped.

Table 4.14 AVE of each Construct

	AVE	Number of Items
Perceived usefulness	0.685	7
Compatibility	0.820	4
Social influence	0.530	6
Pleasure	0.843	6
Arousal	0.497	6
Dominance	0.689	6
Intention	0.764	3

Table 4.15 Correlation among Constructs

	PU	COM	SI	PA_P	PA_A	PA_D	INT	USA
PU	*0.828*							
COM	0.880	*0.905*						
SI	0.633	0.579	*0.728*					
PA_P	-0.812	-0.721	-0.556	*0.918*				
PA_A	-0.552	-0.520	-0.268	0.470	*0.705*			
PA_D	-0.613	-0.517	-0.346	0.604	0.689	*0.830*		
INT	0.684	0.736	0.556	-0.622	-0.357	-0.398	*0.874*	
USA	0.317	0.364	0.316	-0.262	-0.132	-0.317	*0.664*	*1.000*

The diagonal shows the square root of the average variance shared with measures.

Abbreviations: PU – perceived usefulness, COM – compatibility, SI – social influence, PA_P – pleasure, PA_A – arousal, PA_D – dominance, INT – continued usage intention and USA – continued usage

4.5 Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) was carried out using WarpPLS. The 36 respondents enrolling in a current class which required the use of the PLE&N as part of the assessment were taken out from the analysis. The results are shown in Figure 4.1. The proposed model explained 54 percent of the variance in continued usage (USA), and 59 percent of the variance in continued usage intention (INT). Compatibility (COM, $\beta = 0.630$, $p < 0.001$) and social influence (SI, $\beta = 0.183$, $p = 0.069$) predicted continued usage intention. However, perceived usefulness (PU, $\beta = 0.009$, $p = 0.472$) was found to be non-significant on predicting continued usage intention. Pleasure (PA_P, $\beta = 0.365$, $p = 0.001$), arousal (PA_A, $\beta = 0.257$, $p = 0.017$), and dominance (PA_D, $\beta = -0.384$, $p < 0.001$) were all significant predictors of continued usage. Intention (INT, $\beta = 0.830$, $p < 0.001$) also predicted continued usage.

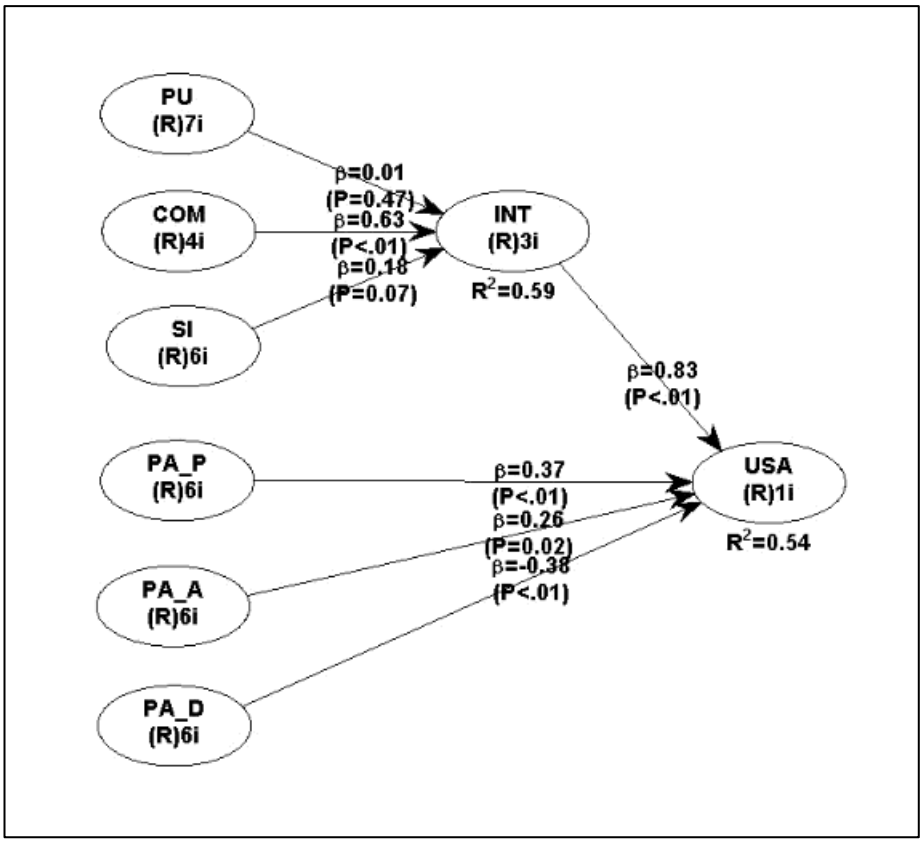


Figure 4.1 SEM Using the WarpPLS

Table 4.16 to Table 4.19 shows the path coefficients, p values, standard errors for path coefficients and effect sizes for path coefficients respectively.

Table 4.16 Path Coefficients

	PU	COM	SI	PA_P	PA_A	PA_D	INT
INT	0.009	0.630	0.183				
USA				0.365	0.257	-0.384	0.830

Table 4.17 P Values

	PU	COM	SI	PA_P	PA_A	PA_D	INT
INT	0.472	<0.001	0.069				
USA				0.001	0.017	<0.001	<0.001

Table 4.18 Standard Errors for Path Coefficients

	PU	COM	SI	PA_P	PA_A	PA_D	INT
INT	0.130	0.104	0.122				
USA				0.114	0.119	0.114	0.097

Table 4.19 Effect Sizes for Path Coefficients

	PU	COM	SI	PA_P	PA_A	PA_D	INT
INT	0.006	0.473	0.106				
USA				0.096	0.034	0.122	0.551

The averaged path coefficient, the average R^2 and the average adjusted R^2 as below. WarpPLS also provided several fit indexes such as average block VIF (AVIF) and average full collinearity VIF (AFVIF). The AVIF and AFVIF met the preferred level and accepted level respectively.

- Average path coefficient (APC) = 0.380, $p < 0.001$
- Average R^2 (ARS) = 0.564, $p < 0.001$
- Average adjusted R^2 (AARS) = 0.536, $p < 0.001$
- Average block VIF (AVIF) = 2.957, acceptable if <= 5, ideally <= 3.3
- Average full collinearity VIF (AFVIF) = 3.627, acceptable if <= 5, ideally <= 3.3

The indirect effects of perceived usefulness, compatibility and social influence on continued usage via continued usage intention are shown in Table 4.20

Table 4.20 Indirect Effects on Continued Usage

	PU	COM	SI
Indirect Effects	0.008	0.523	0.152
P value	0.467	< 0.001	0.043
Standard Errors	0.092	0.077	0.087
Effect Sizes	0.002	0.190	0.048

4.6 Explaining the Research Model

4.6.1 Intention to Continue Usage

Consistent with the findings from the literature review that intention is a significant predictor of behaviour (Ajzen, 1991; Davis, 1989), intention was a significant and indeed the highest loading predictor of continued usage in this study. The path

coefficient and the effect size of intention on continued usage were 0.830 and 0.551, which were the highest among all the items.

However, there are arguments that the influence of intention on future usage is overestimated if the impact of past usage, experience or habit is ignored (Kim & Malhotra, 2005; Wilson et al., 2005). For example, Kim & Malhotra's findings (2005) show that the influence of intention on usage was inflated substantially from 0.04 to 0.51 if the path of past usage on future usage was deleted from the research model. Past usage, experience and habit might be important constructs in the study of continued usage, however, a robust theoretical foundation and a good measure of past usage, experience and habit are vital, as the linkage between past usage and future usage might be a mere reflection of the fact that there exists a certain level of consistency and stability in usage across time (Ajzen, 2002; Limayem et al., 2007).

4.6.2 Cognitive Constructs

Compatibility had the highest factor loading on intention. Compatibility is defined as the fit between an individual's work style and the use of IS (Moore & Benbasat, 1991). As for the context of this study, it is believed that individuals have the freedom to select the tools they intend to continue to use, and to personalize the tools in a way that fits them the best. Hence compatibility, the fit, plays a vital role in the continued usage of IS.

Social influence was found to be significant at the confidence level $\alpha = 0.10$. As mentioned in the literature review chapter, social influence is a debated construct in the field of IS acceptance and usage. The effect of social influence varies depending on the nature of the target behaviour or the context of the studies (Taylor & Todd, 1995; Venkatesh & Davis, 2000). It is found that social influence is significant in mandatory settings and non-significant in voluntary settings (Venkatesh et al., 2003). Though continued usage was voluntary in this study, the author thought that the features of the social network functions of the PLE&N tools would make social influence as a significant predictor of intention. Some respondents connect with the lecturers and the classmates using the social network functions of the PLE&N tools. If the majority of classmates are continuously using the PLE&N tools, an individual may feel pressure to follow this behaviour. However, the findings do not support this proposition. One of the reasons that this assumption is not valid may be due to the measurements used in the questionnaire. Existing well-validated questions were used in this survey. These questions which were set some years ago do not reflect the current features of social networks. Another possible reason is that the PLE&N is entirely online. Under such a virtual world environment, therefore, there may be little peer pressure or shadow effect for an individual to comply with peers or the lecturer.

Perceived usefulness was found to be non-significant. This is a surprising result as previous studies all found that perceived usefulness is a significant and dominating predictor of intention, and its influence remains valid over time (Davis et al., 1989; Karahanna et al., 1999; Taylor & Todd, 1995; Venkatesh et al., 2003). This result may be attributed to the context of this study. Choosing personalized platforms and tools to enhance self-regulated and network-based learning was the key background

of this study. While learning is a long-term process and there is no well accepted indicator of successful or unsuccessful learning, respondents might find it hard to relate perceived usefulness to the PLE&N tools.

4.6.3 Affective Constructs

It is proposed that personal affect has a direct effect on continued usage. To the best knowledge of the author, this study was the first to incorporate a pleasure-arousal-dominance model into IS continued usage study. All the three affect constructs were found to be significant predictor of continued usage. Pleasure, which measures cognitive judgment (good-bad), and arousal, which measures the intensity of the judgment (strong-weak), were found to posit positive effects on continued usage. Dominance, which measures the feeling of control and influence (active-passive), was significant but posited a negative effect on continued usage ($\beta = -0.384$). .

The results suggested that pleasure and arousal had positive impacts on continued usage. The higher the degree of cognitive judgment (e.g. pleased, happy, etc.) of the PLE&N, the higher the continued usage would be. Similarly, the higher the degree of intensity of the judgment (e.g. stimulated, excited, etc.) of the PLE&N, the higher the continued usage would be. Dominance had a negative impact on continued usage. This means that the subjects did not want to be controlled, submitted or guided for the use of PLE&N. In the contrary, the subjects wanted to be passive. These results of pleasure and arousal are not surprising as the use of PLE&N is subject to personal preference. The results of dominance, however, were unexpected as it was believed that the subject would want to be influential or in control in using the PLE&N. The

effect of dominance on continued usage is higher than that of pleasure on continued usage. This contradicts to the existing literature which suggests that dominance accounts for the least variation in human responses (Mehrabian & Russell, 1974).

In summary, six hypotheses (H1, H3 to H7) were found to be significant. One hypotheses (H2) was not supported from this study. Summary of the seven hypotheses is summarized in Table 4.21.

Table 4.21 Summary of Hypotheses

Hypothesis Number	Dependent Variable	Independent Variable	Significance
H1	Continued usage	Intention to continued usage	Yes
H2	Intention to continued usage	Perceived usefulness	No
H3	Intention to continued usage	Compatibility	Yes
H4	Intention to continued usage	Social Influence	Yes
H5	Continued usage	Pleasure	Yes
H6	Continued usage	Arousal	Yes
H7	Continued usage	Dominance	Yes but in negative direction

4.7 Limitations

There are limitations to this study which restrict the generalisation of its results. The primary limitation is the limited responses collected. SEM analysis requires a considerable large sample size to give robust results. Despite much effort, there remained only 95 samples that were valid in the study. In order to study the continued usage of the PLE&N under voluntary condition, 36 samples were further withdrawn from the SEM analysis. Though the SEM analysis could be conducted using WarpPLS, the small sample size might affect the results. Caution is warranted in interpreting the results and more data are needed to give more accurate and reliable results.

Another limitation is the potential for response bias. Respondents were asked to recall their past usage behaviour and / or beliefs in using the PLE&N. Although questions used in the questionnaire were well-validated and specific, the possibility of recall bias cannot be ruled out. A respondent might recall prior events with bias in favour of current events (Venkatesh & Brown, 2001). It is believed, however, that this bias is not severe as the usage of the PLE&N was within one to two years from the time of responding to the questionnaire for the most respondents. Apart from the current usage, respondents have used the PLE&N for at least one semester (i.e. four months) and over several semesters for some respondents. Hence, the usage experience is more likely to be endured experience and not short interactions with the PLE&N. This would help reduce bias in recall memory as the experience tends to be more overall than sporadic.

This study adopted a cross-sectional field study and many subjects of the questionnaire provided their responses in a retrospective manner. A longitudinal field study would provide more robust data to validate the research model. Like Venkatesh et al.'s Unified Theory of Acceptance and Use of Technology (UTAUT) (2003), the model collected data at three different points in time: post-training of the IS, one month after implementation of the IS and three months after implementation of the IS. Data on actual usage behaviour were collected over the six-month implementation period. In such a way, data collected could reflect subjects' responses at the time of completing the questionnaire.

4.8 Suggestions for Future Work

This work studies the continued usage of selected PLE&N tools in a personal context and in a university environment. Studies of other types PLE&N tools in other contexts and environment are encouraged. This would enrich the research findings, and allows the comparison of different types of PLE&N in different contexts and environments.

This work also incorporate personal affects into the study and provided basic findings and explanations to the effect of personal affects on IS continued usage. More studies are suggested to explore more in depth findings and explanations. The flow theory and gamification effect may provide insights and justify the effect of personal affect on IS continued usage.

The effect of habit on continued usage of IS technologies has been reviewed. However, it was not further investigated. The author would encourage more studies on the effect of habit on IS continued usage and the development of robust instruments to measure the effect of habit on IS continued usage.

4.9 Summary

The general descriptions of the data have been covered. Several analyses, including factor analysis, reliability test and validity test, were conducted. SEM analysis was conducted using WarpPLS. The findings are also discussed with respect to intention, cognitive constructs (perceived usefulness, compatibility and social influence) and affective constructs (pleasure, arousal and dominance). Six out of the seven hypotheses were found to be significant. The limitations and the implications for future work are also covered in this chapter.

CHAPTER 5 CONCLUSIONS

The consumerization of IT products has been very much characterized by bottom up user adoption in recent years. Employees and students use IT products of their choice in the workplace and in school. The advancement of broadband and wireless technologies has amplified the network effect. There is an increasing trend that people learn from trusted networks, as knowledge is distributed across connections. Learning is becoming more self-centric and network-based. On the other hand, the issues of changing conditions and information overload are unabated and they challenge people's abilities to learn and adapt. The traditional ways of learning, like mass lectures and tutorial classes, may not be effective enough to keep up with the pace of the emerging knowledge. Learners need to develop their personal learning systems in order to, among others, integrate learning sources and foster ubiquitous learning activities. In general, personal learning environment & network (PLE&N) serves as a platform fostering self-regulated and network-based learning, resulting in enhancing one's knowledge in problem solving, collaboration, and innovation.

This research has attempted to identify and study factors that influence the continued (post-adoption) use of a selected PLE&N. A research model has been developed as shown in Figure 2.21. There are a total of seven hypotheses in this study.

- H1: individuals' continued usage of the PLE&N is positively associated with their IS continuance intention.

- H2: individuals' intention to continue usage is positively associated with their perceived usefulness of using the PLE&N.
- H3: individuals' intention to continue usage is positively associated with their perceived compatibility of using the PLE&N.
- H4: individuals' intention to continue usage is positively associated with the social influence of their referent groups associated with the use of PLE&N.
- H5: individuals' continued usage of the PLE&N is positively associated with their feeling of pleasure derived from using the PLE&N.
- H6: individuals' continued usage of the PLE&N is positively associated with their feeling of arousal derived from using the PLE&N.
- H7: individuals' continued usage of the PLE&N is positively associated with their feeling of dominance derived from using the PLE&N.

A survey was conducted to validate the research model and the hypotheses, and 95 valid responses were collected. The results from the present study show that H1 is valid, and intention is a significant and the highest loading predictor of continued usage. H2 is found to be non-significant. This is a surprising result as previous studies all reported that perceived usefulness is a significant and dominating predictor of intention, and its influence remains valid over time (Davis et al., 1989; Karahanna et al., 1999; Taylor & Todd, 1995; Venkatesh et al., 2003). This unexpected result may be attributed to the context of this study. Choosing personalized platforms and tools to enhance self-regulated and network-based learning is the key background of this study. While learning is a long-term process

and there is no well accepted indicator of successful or unsuccessful learning, respondents might find it hard to relate perceived usefulness to the PLE&N tools. H3 is found to be valid. Compatibility has the highest factor loading on intention. H4 is significant at the confidence level $\alpha = 0.10$. Social influence is a debated construct in the field of IS acceptance and usage. The effect of social influence varies depending on the nature of the target behaviour or the contexts of the studies (Taylor & Todd, 1995; Venkatesh & Davis, 2000).

The other three hypotheses are related to three affective constructs – pleasure, arousal and dominance. The study has confirmed that H5, H6 and H7 are significant. Pleasure, which measures the cognitive judgment (good-bad), is found to be a significant predictor of continued usage. It has a positive impact on continued usage and the direct factor loading is the highest. Arousal, which measures the intensity of the judgment (strong-weak), is found to posit a positive effect on continued usage Dominance, which measures the feeling of control and influence (active-passive), is also significant. Its impact on continued usage is negative, which infers that the subjects did not want to be controlled, submitted or guided for the use of PLE&N.

To the best knowledge of the author, this study is the first to incorporate a pleasure-arousal-dominance model into IS continued usage study. Apart from incorporating the influence of unconscious factors such as personal affect on continued usage, this study also contributes to the field by investigating information systems IS continued usage under a personal context. In comparison with acceptance (pre-adoption) studies, studies on the continued use of IS are scant. Such research largely based on

acceptance studies, many of which are conducted in organizational contexts. The study of continued usage based on personal context and unconscious factors is under-explored. This study contributes to the influence of unconscious factors (personal affect) on the continued usage of a PLE&N under a personal context.

Inevitably, this study does have limitations. The primary limitation is the limited sample size. Despite much effort, there were only 95 valid samples in this study. Though SEM analysis could be conducted using WarpPLS, the sample size might affect the results. Caution is warranted in interpreting the results and more data are needed to give more accurate and reliable results. Another limitation is the possibility of having response bias. Respondents were asked to recall their past usage behaviour and / or beliefs in using the PLE&N. Although questions used in the questionnaire are well-validated and specific, the possibility of recall bias cannot be ruled out. A respondent might recall prior events with bias in favour of current events. Secondly, this study has adopted a cross-sectional field study and many subjects have provided their responses in a retrospective manner. A longitudinal field study would provide more robust data to validate the research model. Despite all the limitations discussed here, the author would encourage more research on how personal affect influences IS continuance. Findings on how personal affect influences IS continuance from this study are still basic. More research work under different contexts or settings is also encouraged.

APPENDICES

Appendix 1 – Setup Guide and Introduction of PLE&N[6]

Personal Learning Environment & Network (PLE&N) 3.0

A guide to setting up Google + and Feedly

The Personal Learning Environment & Network (PLE&N) is developed based on two tools – Google+ and Feedly. This document guides you to set up your PLE&N. Firstly, you must have a **Gmail Account** (not a Google Account) in order to login Google+ and Feedly

Setup Steps

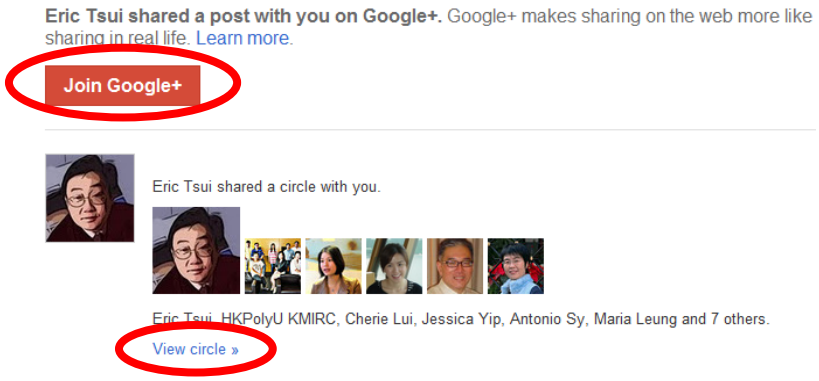
1. **Share your Gmail address**

   In order to create a circle so that you may share material with all ISEXXX classmates in Google +, please provide your Gmail address to the Subject Coordinator who will consolidate all the addresses, create the circle and share with the class. If you do not have a Gmail account yet, please create one. Again, you **MUST** create a **Gmail address** i.e. XXX@gmail.com

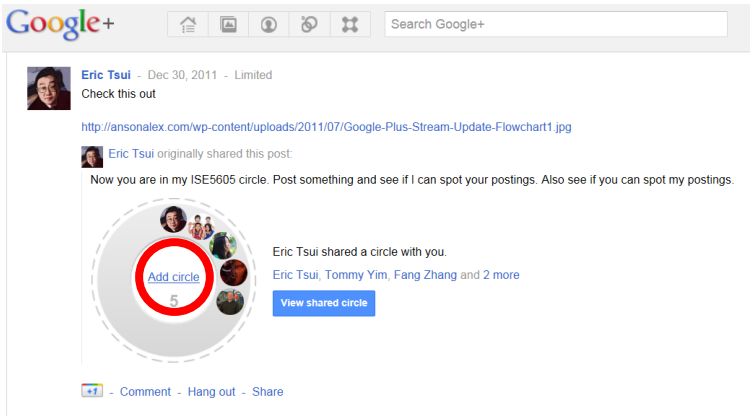
[6] Materials are provided by the lecturer and not part of this research.

2. Add an ISEXXX Circle in Google+

You need to add an "ISEXXX"[7] circle before you can start to read, contribute and share with other members of the Circle. You will receive an invitation in Google+ from your Subject Coordinator with members' names in the Circle. If you have not yet registered with Google+, click **'Join Google+'.** Otherwise, please click **'View circle'.**



And then **'Add circle'.**

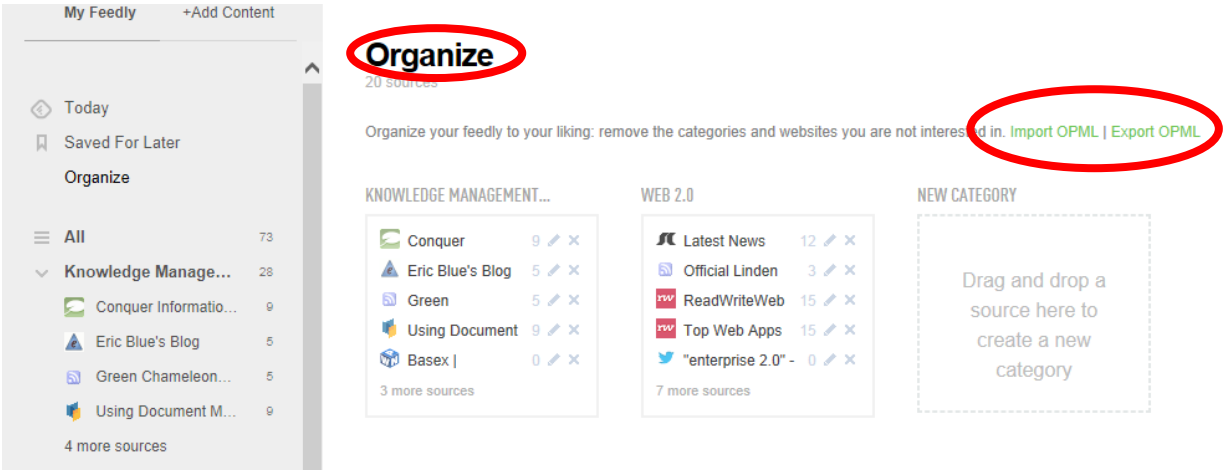


[7] Since this circle name is entirely for your own use, you may like to choose a shorter name e.g. 531 for the sake of simplicity

3. Setup Feedly and import RSS feeds

You need to set up your **Feedly** by going to www.feedly.com. You can login to Feedly with your Google. When you have logged-in Feedly, you should import the KM_OPML.xml file given to you.

After you have logged in Feedly, go to "**Organize**" in the left hand bar, Click "**Import OPML/Export OPML**" tab, select the KM_OPML (.xml) file given to you to import your pre-selected subscriptions.



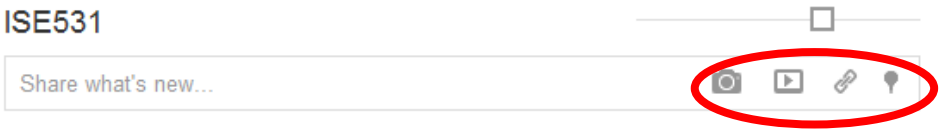
You can now view your RSS feeds in Feedly.

4. How to contribute and share

You may contribute in four ways. Firstly, you may contribute by **creating** a new posting. Secondly, you can **'+1'** or **comment** on an existing posting. Thirdly, you can **re-share** a posting from another circle into the current circle. Finally, you may **share** an article from your **Feedly** with members in a different circle.

A. Create a new posting

In **Google+**, you will find a box, like the one shown below. You may create a new posting by inserting **Photo/ Video/ Link/ Location/ Text Message** in the provided box.



B. Like or Comment on an existing posting

In Google+, if you like a post, please click **'+1'**. You may also click on the **'comment'** button to post a comment.

C. Re-share a posting from another circle

When you've found a posting from another circle that you'd like to share in ISEXXX circle, click **'Share'** and **select ISEXXX circle**.

D. Share from Feedly

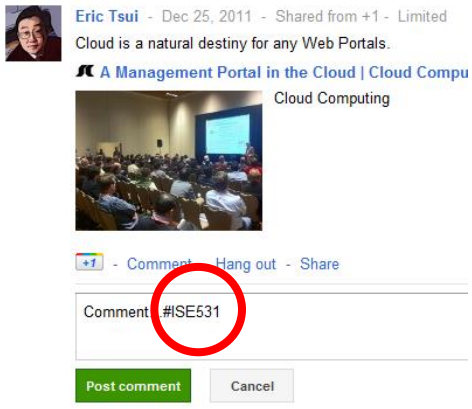
In **Feedly,** when you encounter a posting which you'd like to share with other ISEXXX classmates, you may click the Google + icon underneath the title of the article**.** You need to select **'ISEXXX'** and share.

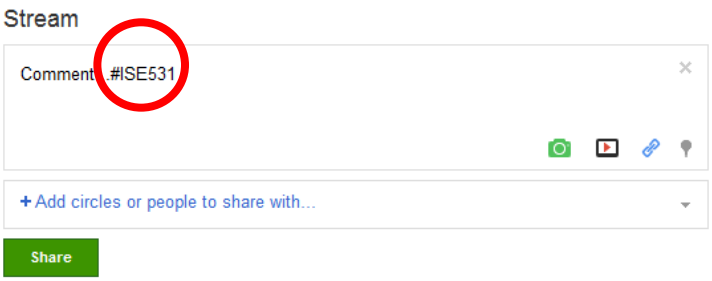
Sometimes, you may also like to share the article with your other Google+ circles; you can also do so by adding the circles you want to share with.

5. **Tag a posting in Google+**

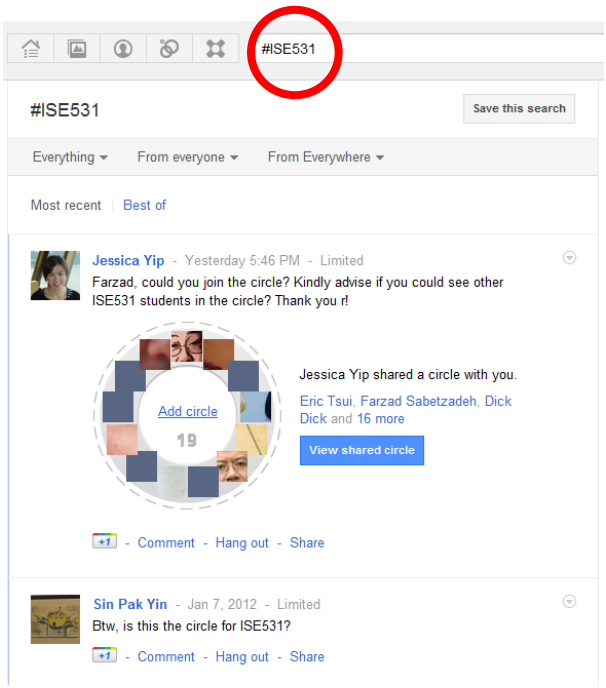
To facilitate **efficient searching** for yourselves and other members, **tagging is highly encouraged** when you create new postings or comment in Google+.

In **Google+**, in order for the Subject Coordinator to allocate your marks for the PLE&N at end of semester, you **MUST** add a **hashtag (**i.e. a **"#"** before a tag). For example, to tag a new posting or comment, you should type **#ISEXXX (NOT ISEXXX or ISE XXX)** in the provided text boxes. You may also insert additional hashtags to your posting.





Now, when you **search #ISEXXX** in Google+, all relevant postings would be retrieved.



Congratulations!! You have set up your Personal Learning Environment & Network (PLE&N) for this subject/topic. Thank you for your efforts. You may continue to use this to share and collaborate with your peers even after the semester is over. You are welcome to provide feedback and/or suggestions to improve this guideline and the PLE&N.

Experience sharing of using the PLE&N by some past students:

http://www.slideshare.net/eric_yh_tsui/personal-learning-environment-network-plen (English)

http://www.slideshare.net/eric_yh_tsui/user-experience-of-the-personal-learning-environment-network-plen (Chinese)

Project Leader
Prof. Eric Tsui
Phone: +852 2766
Email:Eric.Tsui@

Project Assistant
Wang Yu
Phone: + 852 6574
Email: wangyouyuyu@

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

KMIRC 知識管理及創新研究中心
Knowledge Management and Innovation Research Centre

2/9/2013

Appendix 2 – Translation of the PAD Model

1. Translation done by first professional translator

Pleasure

Unhappy 不快樂	happy 快樂
Annoyed 惱火	pleased 高興
Unsatisfied 不滿	satisfied 滿意
Melancholic 鬱鬱不樂	contented 心滿意足
Despairing 感到絕望	hopeful 充滿希望
Bored 厭煩無聊	relaxed 輕鬆愉快

Arousal

Relaxed 輕鬆	stimulated 刺激
Calm 平靜	excited 激動
Sluggish 提不起勁	frenzied 忙亂
Dull 沉悶無聊	jittery 焦躁不安
Sleepy 昏昏欲睡	wide awake 完全清醒
Unaroused 死氣沉沉	aroused 生氣勃勃

Dominance

Controlled 受支配/被控制	controlling 强勢/控制別人
Influenced 易受外界影響的	influential 有影響力的
Cared for 照料	in control 掌握之中
Awed 令人驚歎	important 重要的
Submissive 順從的	dominant 佔支配地位的
Guided 受引導的	autonomous 獨立自主的

2. Translation done by second professional translator

Pleasure

Unhappy 不快樂	happy 快樂
Annoyed 惱火	pleased 高興
Unsatisfied 不滿	satisfied 滿意
Melancholic 鬱鬱不樂	contented 心滿意足
Despairing 絕望	hopeful 希望
Bored 無聊	relaxed 輕鬆

Arousal

Relaxed 輕鬆	stimulated 刺激
Calm 平靜	excited 激動
Sluggish 庸懶	frenzied 狂熱
Dull 沉悶	jittery 坐如針氈
Sleepy 昏睡	wide awake 清醒
Unaroused 興趣缺缺	aroused 燃起興致

Dominance

Controlled 克制	controlling 頤指氣使/控制欲強的人
Influenced 受到影響	influential 有影響力
Cared for 照料	in control 掌握之中
Awed 敬畏	important 重要
Submissive 順從	dominant 支配
Guided 受引導	autonomous 獨立自主

3. Translation done by PolyU English Lecturer

Pleasure

不快樂 happy	快樂 happy
惱火 annoyed	高興 glad
不滿 dissatisfied	滿意 satisfied
鬱鬱不樂 downcast	心滿意足 fulfilled/content
感到絕望 desperate	充滿希望 hopeful
厭煩無聊 bored	輕鬆愉快 cheerful

Arousal

輕鬆 relaxed	刺激 excited
平靜 calm	激動 agitated
提不起勁 listless	忙亂 frantic
庸懶 lethargic	狂熱 fanatical
沉悶無聊 dull	焦躁不安/坐如針氈 edgy
昏昏欲睡 sleepy	完全清醒 fully awake
死氣沉沉 lifeless	生氣勃勃 vibrant
興趣缺缺 unresponsive/disinterested	燃起興致 enthusiastic

Dominance

受支配/被控制 manipulated	强勢/控制別人 dominating
克制 restrained	指氣使/控制欲強的人 domineering
易受外界影響的 vulnerable	有影響力的 influential
照料 caring	掌握之中 under control/ controlling
令人驚歎/敬畏 awe-inspiring	重要的 important
順從的 submissive	佔支配地位的 imposing/controlling
受引導的 guided	獨立自主的 independent

Appendix 3 – Pre-test Version of Questionnaire

Context of personal learning environment & network (PLE&N): the one created by Prof Tsui

Q1 Please select the time using the PLE&N per week.

- ❍ Less than 15 mins (1)
- ❍ 15 mins to 30 mins (2)
- ❍ 30 mins to 1 hour (3)
- ❍ 1 hour to 2 hours (4)
- ❍ More than 2 hours (5)

Q2 Please select the frequency of using the PLE&N.

- ❍ Less than once per week (1)
- ❍ Once to twice per week (2)
- ❍ Three to four times per week (3)
- ❍ About once per day (4)
- ❍ More than once per day (5)

Q3 Please select the location(s) that you normally use the PLE&N (multiple answers allowed).

- ❑ Campus (1)
- ❑ Home (2)
- ❑ Workplace (3)
- ❑ Outdoor (4)
- ❑ No specific location (5)
- ❑ Other (6) _____

Q4 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N would improve my learning performance. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would improve my productivity. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would enhance my effectiveness on learning. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would make it easier to learn. (4)	❍	❍	❍	❍	❍	❍	❍
I would find the PLE&N useful. (5)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would improve the quality of my learning. (6)	❍	❍	❍	❍	❍	❍	❍

Q5 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N is compatible with most aspects of my learning. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N is completely compatible with my current situation. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N fits well with the way I like to learn. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N fits into my learning style. (4)	❍	❍	❍	❍	❍	❍	❍

Q6 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
People who influence my behavior think that I should use the system. (1)	❍	❍	❍	❍	❍	❍	❍
People who are important to me think that I should use the system. (2)	❍	❍	❍	❍	❍	❍	❍

Q7 Please select the position close to the adjective which you believe describes your feelings about using the PLE&N.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Unhappy (不快樂):Happy (快樂) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Annoyed (惱火):Pleased (高興) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unsatisfied(不滿):Satisfied (滿意) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Melancholic (鬱鬱不樂):Contented (心滿意足) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Despairing (感到絕望):Hopeful (充滿希望) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Bored (厭煩無聊):Relaxed (輕鬆) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q8 Please select the position close to the adjective which you believe describes your feelings about using the PLE&N.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Relaxed (輕鬆):Stimulated (刺激) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Calm (平靜):Excited (激動) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sluggish (庸懶):Frenzied (忙亂) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Dull (沉悶無聊):Jittery (焦躁不安) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sleepy (昏昏欲睡):Wide Awake (完全清醒) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unaroused (死氣沉沉):Aroused (生氣勃勃) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q9 Please select the position close to the adjective which you believe describes your feelings about using the PLE&N.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Controlled (被控制):Controlling (控制別人) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Influenced (受到影響):Influential (有影響力) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Cared For (照料):In Control (掌握之中) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Awed (敬畏):Important (重要) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Submissive (順從):Dominant (主導) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Guided (受引導):Autonomous (獨立自主) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q10 How long have you been using the PLE&N?

❍ Six months or shorter (1)

❍ More than six months (2)

If “Six months or shorter” is selected, then skip to “Please select the option that best de...” If “More than six months” is selected, then skip to “Are you using the PLE&N at the mo...”

Q11 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
I intend to use the PLE&N in the next 3 months. (1)	❍	❍	❍	❍	❍	❍	❍
I predict I would use the PLE&N in the next 3 months. (2)	❍	❍	❍	❍	❍	❍	❍
I plan to use the PLE&N in the next 3 months. (3)	❍	❍	❍	❍	❍	❍	❍

Q12 Are you using the PLE&N at the moment?

- ❍ Yes (1)
- ❍ No (2)

Q13 Please select the category that you belong to (choose the most updated status if more than one suits you)

- ❍ Undergraduate student or graduate (1)
- ❍ MSc KM student or graduate (2)
- ❍ Research degree student or graduate (3)
- ❍ Other (4) _____

Q14 Please select your gender.

- ❍ Male (1)
- ❍ Female (2)

Q15 Please input your year of birth.

Q16 Please input your Google + account name (optional).

Q17 Please feel free to give comments on this questionnaire. Thank you very much for your help.

Appendix 4 – Pilot Version of Questionnaire

Q1 Introduction: Individual learners adopt a variety of tools to develop their own learning systems as platforms integrating learning activities, fostering self-regulated learning, connecting with people and finding expertise. They adopt a variety of tools for varying periods of time. Some tools are adopted and used continuously for a long period of time while some are adopted and soon discontinued. Several factors have been identified to have potential influence on this phenomenon. The aim of this research is to study how the identified factors influence the continued usage of personal learning systems. Target respondents of this questionnaire are people who have used the personal learning environment & network (PLE&N, i.e. Google+ and RSS feeds) created by Prof Eric Tsui. Questions are mainly related to the usage and general feelings about the PLE&N.

Q2 What is your current level of education?

- ❍ Undergraduate (1)
- ❍ Bachelor (2)
- ❍ Master (3)
- ❍ Doctor (4)

Q3 Which of the following option best describes your occupation?

	Administrator (1)	Associate / Analyst (2)	Consultant (3)	Director / General Manager (4)	Engineer (5)	Lecturer / Professor / Teacher (6)	Librarian (7)	Manager / Supervisor (8)	Officer (9)	Operator (10)	Others (11)	Programmer (12)	Project Manager (13)	Researcher (14)	Scientist (15)	Student (16)	Technician (17)
Occupation (1)																	

Q4 What is your gender?

- ❍ Male (1)
- ❍ Female (2)

Q5 What is your year of birth?

- ❍ Selection from a list ranging from 1999(1) to 1950(50)

Q6 Which of the following semester(s) have you taken any subject(s) that involve the use of PLE&N as an assessment criteria?

- ❑ 2010 Semester 1 (12)
- ❑ 2010 Semester 2 (13)
- ❑ 2010 Semester 3 (summer semester) (14)
- ❑ 2011 Semester 1 (1)
- ❑ 2011 Semester 2 (2)
- ❑ 2011 Semester 3 (summer semester) (3)
- ❑ 2012 Semester 1 (4)
- ❑ 2012 Semester 2 (5)
- ❑ 2012 Semester 3 (summer semester) (6)
- ❑ 2013 Semester 1 (7)
- ❑ 2013 Semester 2 (8)
- ❑ 2013 Semester 3 (summer semester) (9)
- ❑ 2014 Semester 1 (10)
- ❑ 2014 Semester 2 (11)

Answer if “Which of the following semester(s) have you taken any subject(s) that involve the use of PLE&N as an assessment criterion?”, “2014 Semester 2” is not selected

Q7 Are you using the PLE&N at the moment?

- ❍ Yes (1)
- ❍ No (2)

Q8 The following 4 sets of questions will require you to provide information on the use of the PLE&N during assessment period (i.e. you receive marks for participation in the PLE&N) and non-assessment period (i.e. you do not receive marks for participation in the PLE&N). How frequent do/did you use the PLE&N? If you do not use the PLE&N during non-assessment period, please do not answer for that column.

	Assessment Period (1)	Non-assessment Period (2)
Less than once per week (1)	❑	❑
Once to twice per week (2)	❑	❑
Three to four times per week (3)	❑	❑
About once per day (4)	❑	❑
More than once per day (5)	❑	❑

Q9 How long do/did you usually use the PLE&N per week? If you do not use the PLE&N during non-assessment period, please do not answer for that column.

	Assessment Period (1)	Non-assessment Period (2)
Less than 15 mins (1)	❑	❑
15 mins to 30 mins (2)	❑	❑
30 mins to 1 hour (3)	❑	❑
1 hour to 2 hours (4)	❑	❑
More than 2 hours (5)	❑	❑

Q10 Please rate the percentage(s) for the location(s) that you use/used the PLE&N (Total = 100). If you do not use the PLE&N during non-assessment period, please rate "No usage" for 100.

Assessment Period:

_____ Campus (1)

_____ Home (2)

_____ Workplace (3)

_____ Travelling (4)

_____ Others (5)

Q11Non-assessment Period:

_____ Campus (1)

_____ Home (2)

_____ Workplace (3)

_____ Travelling (4)

_____ Others (5)

_____ No usage (6)

Q12 Please rate the percentage(s) for the device(s) that you use/used the PLE&N (Total = 100). If you do not use the PLE&N during non-assessment period, please rate "No usage" for 100.

Assessment Period:

_____ Desktop computer (1)

_____ Notebook / Laptop / Netbook (2)

_____ Smart phone (3)

_____ Tablet (4)

_____ Others (5)

Q13 Non-assessment Period:

_____ Desktop computer (1)

_____ Notebook / Laptop / Netbook (2)

_____ Smart phone (3)

_____ Tablet (4)

_____ Others (5)

_____ No usage (6)

Q14 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N would improve my learning performance. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would improve my productivity. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would enhance my effectiveness on learning. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would make it easier to learn. (4)	❍	❍	❍	❍	❍	❍	❍
I would find the PLE&N useful. (5)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would improve the quality of my learning. (6)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would enable me to accomplish tasks more quickly. (7)	❍	❍	❍	❍	❍	❍	❍

Q15 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N is compatible with most aspects of my learning. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N is completely compatible with my current situation. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N fits well with the way I like to learn. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N fits into my learning style. (4)	❍	❍	❍	❍	❍	❍	❍

Q16 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
People who influence my behavior think that I should use the PLE&N. (1)	❍	❍	❍	❍	❍	❍	❍
People who are important to me think that I should use the PLE&N. (2)	❍	❍	❍	❍	❍	❍	❍
I use the PLE&N because of the proportion of peer who use it. (3)	❍	❍	❍	❍	❍	❍	❍
The lecturer has been helpful in the use of the PLE&N. (4)	❍	❍	❍	❍	❍	❍	❍
The lecturer is very supportive of the use of the PLE&N. (5)	❍	❍	❍	❍	❍	❍	❍
In general, the department has supported the use of the PLE&N. (6)	❍	❍	❍	❍	❍	❍	❍

Q17 Instruction to the following 3 sets of adjectives: Each pair of words below describes a feeling dimension. Some of the pairs might seem unusual, but you may generally feel more one way than the other. For each pair of adjectives, please select the position to show how you feel about using the PLE&N in general.

Set 1

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Unhappy (不快樂):Happy (快樂) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Annoyed (惱火):Pleased (高興) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unsatisfied(不滿):Satisfied (滿意) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Melancholic (鬱鬱不樂):Contented (心滿意足) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Despairing (感到絕望):Hopeful (充滿希望) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Bored (厭煩無聊):Relaxed (輕鬆) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q18 Set 2

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Relaxed (輕鬆):Stimulated (刺激) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Calm (平靜):Excited (激動) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sluggish (庸懶):Frenzied (忙亂) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Dull (沉悶無聊):Jittery (焦躁不安) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sleepy (昏昏欲睡):Wide Awake (完全清醒) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unaroused (死氣沉沉):Aroused (生氣勃勃) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q19 Set 3

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Controlled (被控制):Controlling (控制別人) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Influenced (受到影響):Influential (有影響力) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Cared For (照料):In Control (掌握之中) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Awed (敬畏):Important (重要) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Submissive (順從):Dominant (主導) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Guided (受引導):Autonomous (獨立自主) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q20 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
I intend to use the PLE&N in the next 3 months. (1)	❍	❍	❍	❍	❍	❍	❍
I predict I would use the PLE&N in the next 3 months. (2)	❍	❍	❍	❍	❍	❍	❍
I plan to use the PLE&N in the next 3 months. (3)	❍	❍	❍	❍	❍	❍	❍

Please click to submit the questionnaire. Thank you very much for your help.

Appendix 5 – Final Launch Version of Questionnaire

Q1 Introduction: Individual learners adopt a variety of tools to develop their own learning systems as platforms integrating learning activities, fostering self-regulated learning, connecting with people and finding expertise. They adopt a variety of tools for varying periods of time. Some tools are adopted and used continuously for a long period of time while some are adopted and soon discontinued. Several factors have been identified to have potential influence on this phenomenon. The aim of this research is to study how the identified factors influence the continued usage of personal learning systems. Target respondents of this questionnaire are people who have used the personal learning environment & network (PLE&N, i.e. Google+ and RSS feeds) created by Prof Eric Tsui. Questions are mainly related to the usage and general feelings about the PLE&N.

Q2 What is your current level of education?

- ❍ Bachelor (2)
- ❍ Master (3)
- ❍ Doctor (4)

Q3 Which of the following option best describes your occupation?

	Administrator (1)	Associate / Analyst (2)	Consultant (3)	Director / General Manager (4)	Engineer (5)	Lecturer / Professor / Teacher (6)	Librarian (7)	Manager / Supervisor (8)	Officer (9)	Operator (10)	Others (11)	Programmer (12)	Project Manager (13)	Researcher (14)	Scientist (15)	Student (16)	Technician (17)
Occupation (1)																	

Q4 What is your gender?

- ❍ Male (1)
- ❍ Female (2)

Q5 What is your year of birth?

- ❍ Selection from a list ranging from 1999(1) to 1950(50)

Q6 Which of the following semester(s) have you taken subject(s) that involve the use of PLE&N as an assessment criteria?

- ❑ 2010-2011 Semester 1 (1)
- ❑ 2010-2011 Semester 2 (2)
- ❑ 2010-2011 Semester 3 (summer semester) (3)
- ❑ 2011-2012 Semester 1 (4)
- ❑ 2011-2012 Semester 2 (5)
- ❑ 2011-2012 Semester 3 (summer semester) (6)
- ❑ 2012-2013 Semester 1 (7)
- ❑ 2012-2013 Semester 2 (8)
- ❑ 2012-2013 Semester 3 (summer semester) (9)
- ❑ 2013-2014 Semester 1 (10)
- ❑ 2013-2014 Semester 2 (11)
- ❑ 2013-2014 Semester 3 (summer semester) (12)
- ❑ 2014-2015 Semester 1 (13)

Answer if “Which of the following semester(s) have you taken subject(s) that involve the use of PLE&N as an assessment criterion?”, “2014-2015 Semester 1” is not selected

Q7 Are you using the PLE&N at the moment?

- ❍ Yes (1)
- ❍ No (2)

Q8 The following 4 sets of questions will require you to provide information on the use of the PLE&N during assessment period (i.e. you receive marks for participation in the PLE&N) and non-assessment period (i.e. you do not receive marks for participation in the PLE&N). How frequent do/did you use the PLE&N? If you do not use the PLE&N during non-assessment period, please do not answer for that row.

	Less than once per week (1)	Once to twice per week (2)	Three to four times per week (3)	About once per day (4)	More than once per day (5)
Assessment Period (1)	❑	❑	❑	❑	❑
Non-assessment Period (2)	❑	❑	❑	❑	❑

Q9 How long do/did you usually use the PLE&N per week? If you do not use the PLE&N during non-assessment period, please do not answer for that row.

	Less than 15 mins (1)	15 mins to 30 mins (2)	30 mins to 1 hour (3)	1 hour to 2 hours (4)	More than 2 hours (5)
Assessment Period (1)	❑	❑	❑	❑	❑
Non-assessment Period (2)	❑	❑	❑	❑	❑

Q10 Please rate the percentage(s) for the location(s) that you use/used the PLE&N (Total = 100). If you do not use the PLE&N during non-assessment period, please rate "No usage" for 100.

Assessment Period:

_____ Campus (1)

_____ Home (2)

_____ Workplace (3)

_____ Travelling (4)

_____ Others (5)

Q11 Non- assessment Period:

_____ Campus (1)

_____ Home (2)

_____ Workplace (3)

_____ Travelling (4)

_____ Others (5)

_____ No usage (6)

Q12 Please rate the percentage(s) for the device(s) that you use/used the PLE&N (Total = 100). If you do not use the PLE&N during non-assessment period, please rate "No usage" for 100.

Assessment Period:

_____ Desktop computer (1)

_____ Notebook / Laptop / Netbook (2)

_____ Smart phone (3)

_____ Tablet (4)

_____ Others (5)

Q13 Non- assessment Period:

_____ Desktop computer (1)

_____ Notebook / Laptop / Netbook (2)

_____ Smart phone (3)

_____ Tablet (4)

_____ Others (5)

_____ No usage (6)

Q14 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N would improve my learning performance. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would improve my productivity. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would NOT enhance my effectiveness on learning. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would make it easier to learn. (4)	❍	❍	❍	❍	❍	❍	❍
I would find the PLE&N useful. (5)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would NOT improve the quality of my learning. (6)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N would enable me to accomplish tasks more quickly. (7)	❍	❍	❍	❍	❍	❍	❍

Q15 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
Using the PLE&N is compatible with most aspects of my learning. (1)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N is completely compatible with my current situation. (2)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N fits well with the way I like to learn. (3)	❍	❍	❍	❍	❍	❍	❍
Using the PLE&N does NOT fit into my learning style. (4)	❍	❍	❍	❍	❍	❍	❍

Q16 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
People who influence my behavior think that I should use the PLE&N. (1)	❍	❍	❍	❍	❍	❍	❍
People who are important to me think that I should use the PLE&N. (2)	❍	❍	❍	❍	❍	❍	❍
I use the PLE&N because of the proportion of peer who use it. (3)	❍	❍	❍	❍	❍	❍	❍
The lecturer has NOT been helpful in the use of the PLE&N. (4)	❍	❍	❍	❍	❍	❍	❍
The lecturer is very supportive of the use of the PLE&N. (5)	❍	❍	❍	❍	❍	❍	❍
In general, the department has supported the use of the PLE&N. (6)	❍	❍	❍	❍	❍	❍	❍

Q17 Instruction to the following 3 sets of adjectives: Each pair of words below describes a feeling dimension. Some of the pairs might seem unusual, but you may generally feel more one way than the other. For each pair of adjectives, please select the position to show how you feel about using the PLE&N in general.

Set 1

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Unhappy (不快樂):Happy (快樂) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Annoyed (惱火):Pleased (高興) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unsatisfied(不滿):Satisfied (滿意) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Melancholic (鬱鬱不樂):Contented (心滿意足) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Despairing (感到絕望):Hopeful (充滿希望) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Bored (厭煩無聊):Relaxed (輕鬆) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q18 Set 2

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Relaxed (輕鬆):Stimulated (刺激) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Calm (平靜):Excited (激動) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sluggish (庸懶):Frenzied (忙亂) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Dull (沉悶無聊):Jittery (焦躁不安) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Sleepy (昏昏欲睡):Wide Awake (完全清醒) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Unaroused (死氣沉沉):Aroused (生氣勃勃) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q19 Set 3

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
Controlled (被控制):Controlling (控制別人) (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Influenced (受到影響):Influential (有影響力) (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Cared For (照料):In Control (掌握之中) (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Awed (敬畏):Important (重要) (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Submissive (順從):Dominant (主導) (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Guided (受引導):Autonomous (獨立自主) (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

Q20 Please select the option that best describes your agreement.

	Strongly Agree (1)	Moderately Agree (2)	Somewhat Agree (3)	Neither Agree nor Disagree (4)	Somewhat Disagree (5)	Moderately Disagree (6)	Strongly Disagree (7)
I intend to use the PLE&N in the next 3 months. (1)	❍	❍	❍	❍	❍	❍	❍
I predict I would NOT use the PLE&N in the next 3 months. (2)	❍	❍	❍	❍	❍	❍	❍
I plan to use the PLE&N in the next 3 months. (3)	❍	❍	❍	❍	❍	❍	❍

Please click to submit the questionnaire. Thank you very much for your help.

Appendix 6 – Age Distribution of Questionnaire Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21 - 30	4	4.2	4.4	4.4
	22	3	3.2	3.3	7.8
	23	7	7.4	7.8	15.6
	24	1	1.1	1.1	16.7
	25	4	4.2	4.4	21.1
	26	2	2.1	2.2	23.3
	27	5	5.3	5.6	28.9
	28	6	6.3	6.7	35.6
	29	2	2.1	2.2	37.8
	30	3	3.2	3.3	41.1
	31	3	3.2	3.3	44.4
	32	5	5.3	5.6	50.0
	33	6	6.3	6.7	56.7
	34	2	2.1	2.2	58.9
	35	1	1.1	1.1	60.0
	36	5	5.3	5.6	65.6
	37	1	1.1	1.1	66.7
	38	3	3.2	3.3	70.0
	39	3	3.2	3.3	73.3
	40	1	1.1	1.1	74.4
	41	1	1.1	1.1	75.6
	43	2	2.1	2.2	77.8
	45	1	1.1	1.1	78.9
	46	5	5.3	5.6	84.4
	47	2	2.1	2.2	86.7
	48	1	1.1	1.1	87.8
	49	1	1.1	1.1	88.9
	50	2	2.1	2.2	91.1
	52	4	4.2	4.4	95.6
	55	3	3.2	3.3	98.9
	59	1	1.1	1.1	100.0
	Total	90	94.7	100.0	
Missing	System	5	5.3		
Total		95	100.0		

REFERENCES

Agnihotri, R., & Troutt, M. D. (2009). The effective use of technology in personal knowledge management; A framework of skills, tools and user context. *Online Information Review, 33*(2), 329-342.

Ajzen, I. (2002). Residual effects of past on later behavior: Habituation and reasoned action perspectives. *Personality and Social Psychology Review; Pers.Soc.Psychol.Rev., 6*(2), 107-122.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, N.J.: Prentice-Hall.

Avery, S., Brooks, R., Brown, J., Dorsey, P., & O'Conner, M. (2001). Personal knowledge management: Framework for integration and partnerships. *Association of Small Computer Users in Educion (ASCUE) 2001 Conference,* ASCUE.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, N.J: Prentice-Hall.

Barth, S. (2000, The power of one. *Knowledge Management Magazine, December 2000*

Barth, S. (2004). Self-organization: Taking a personal approach to KM. In M. Rao (Ed.), *Knowledge management tools and techniques practitioners and experts*

evaluate KM solutions (pp. 347-361). Amsterdam; Boston: Elsevier Butterworth-Heinemann.

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly*, *25*(3), 351-370.

Blunch, N. J. (2008). *Introduction to structural equation modelling using SPSS and AMOS*. London: Sage Publications.

Bouthillier, F., & Shearer, K. (2002). Understanding knowledge management and information management: The need for an empirical perspective. *Information Research-an International Electronic Journal*, *8*(1)

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*(1), 49-59.

Byrne, B. M. (2001). *Structural equation modeling with AMOS :Basic concepts, applications, and programming*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Caldwell, F. (2002). *Personal knowledge networks emerge with grassroots KM*. USA: Gartner.

Cheong, R. K. F., & Tsui, E. (2010). The roles and values of personal knowledge management: An exploratory study. *VINE: The Journal of Information and Knowledge Management Systems*, *40*(2), 204-227.

Chiu, C., Sun, S., Sun, P., & Ju, T. L. (2007). An empirical analysis of the antecedents of web-based learning continuance. *Computers & Education, 49*(4), 1224-1245. doi:10.1016/j.compedu.2006.01.010

Cho, V., Cheng, T. C. E., & Hung, H. (2009). Continued usage of technology versus situational factors: An empirical analysis. *Journal of Engineering and Technology Management, 26*(4), 264-284.

Choi, H., Kim, Y., & Kim, J. (2011). Driving factors of post adoption behavior in mobile data services. *Journal of Business Research, 64*(11), 1212-1217.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly, 19*(2), 189-211.

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education, 15*(1), 3-8.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge how organizations manage what they know*. Boston, Mass: Harvard Business School Press.

Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information system: Theory and results. (Ph.D., Massachusetts Institute of Technology, Sloan School of Management).

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

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

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace 1. *Journal of Applied Social Psychology, 22*(14), 1111-1132. doi:10.1111/j.1559-1816.1992.tb00945.x

De Vaus, D.,A. (2002). *Surveys in social research* (5th ed.). London: Routledge.

Dishaw, M. T., & Strong, D. M. (1999). Extending the technology acceptance model with task– technology fit constructs. *Information & Management, 36*(1), 9-21.

Doty, D. H., & Glick, W. H. (1998). Common methods bias: Does common methods variance really bias results? *Organizational Research Methods, 1*(4), 374-406.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, Mass.: Addison-Wesley Pub. Co.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. doi:10.2307/3151312

Frand, J., & Hixon, C. (1999). *Personal knowledge management: Who, what, why, when, where, how?* Retrieved Apr 23, 2013, from www.anderson.ucla.edu/faculty/jason.frand/researcher/speeches/PKM.htm

Garner, S. (2010). Supporting the personal knowledge management of students with technology. *Informing Science & IT Education Conference (InSITE) 2010*, Cassino, Italy.

Gefen, D., Rigdon, E., & Straub, D. (2011). An update and extension to SEM guidelines for administrative and social science research. *MIS Quarterly, 35*(2), III.

Hair, J., Sarstedt, M., Ringle, C., & Mena, J. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science, 40*(3), 414-433. doi:10.1007/s11747-011-0261-6

Hair, J. F. (2006). *Multivariate data analysis* (6th ed.). Upper Saddle River, N.J: Pearson/Prentice Hall.

Jarche, H. (2010a). *Personal information management for sense-making.* Retrieved Apr 23, 2013, from http://www.jarche.com/2010/08/personal-information-management-for-sense-making/

Jarche, H. (2010b). *PKM in 2010.* Retrieved Feb 21, 2013, from http://www.jarche.com/2010/01/pkm-in-2010/

Jasperson, J. S., Carter, P. E., & Zmud, R. W. (2005). A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. *MIS Quarterly, 29*(3), 525-557.

Jefferson, T. (2006). Taking it personally: Personal knowledge management. *VINE: The Journal of Information and Knowledge Management Systems*, *36*(1), 35-37.

Jones, W. (2011). No knowledge but through information. In D. Pauleen, & G. E. Gorman (Eds.), *Personal knowledge management individual, organizational and social perspectives* (pp. 143-166). Burlington, Vt.: Gower.

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

Kim, S. S., & Malhotra, N. K. (2005). A longitudinal model of continued IS use: An integrative view of four mechanisms underlying postadoption phenomena. *Management Science, 51*(5), 741-755.

Lee, M. (2010). Explaining and predicting users' continuance intention toward E-learning: An extension of the expectation-confirmation model. *Computers & Education, 54*(2), 506-516. doi:10.1016/j.compedu.2009.09.002

Leone, S. (2012). PLE: A brick in the construction of a lifelong learning society. In Management Association (Ed.), *Organizational learning and knowledge: Concepts, methodologies, tools and applications* (pp. 1835-1854) Hershey, PA.

Leone, S. (2013). *Characterisation of a personal learning environment as a lifelong learning tool*. New York: Springer.

Limayem, M., Hirt, S. G., & Cheung, C. M. K. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly, 31*(4), 705-737.

Lippert, S. K., & Forman, H. (2005). Utilization of information technology: Examining cognitive and experiential factors of post-adoption behavior. *IEEE Transactions on Engineering Management, 52*(3), 363-381.

Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management Science, 52*(12), 1865-1883.

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research, 2*(3), 173-191.

Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge: M.I.T. Press.

Mehrabian, A. (1996). Pleasure- arousal- dominance: A general framework for describing and measuring individual differences in temperament. *Current Psychology, 14*(4), 261-292.

Mehrabian, A., & O'Reilly, E. (1980). Analysis of personality measures in terms of basic dimensions of temperament. *Journal of Personality and Social Psychology, 38*(3), 492-503.

Miller, R. (2005, The evolution of knowledge management. *EContent, 28 (11),* 38-41.

Mohamed, A. C. (2012). Knowledge management: A personal knowledge network perspective. *Journal of Knowledge Management, 16*(5), 829-844.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192-222.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: New York : McGraw-Hill, c1994.

Osgood, C. E., Suci, G. J., & Tannenbaum, R. H. (1957). *The measurement of meaning*. Urbana: University of Illinois Press.

Osgood, C. E. (1952). The nature and measurement of meaning. *Psychological Bulletin, 49*, 197-237.

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin, 124*(1), 54-74.

Pacalin, J., Chui, M., & Miller, A. (2009). *How companies are benefiting from web 2.0: McKinsey global survey results*McKinsey Quarterly.

Parthasarathy, M., & Bhattacherjee, A. (1998). Understanding post-adoption behavior in the context of online services. *Information Systems Research, 9*(4), 362-379.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly, 31*(4), 623-656.

Pollard, D. (2004). *Confessions of a CKO: What I should have done.* Retrieved Apr 23, 2013, from http://howtosavetheworld.ca/2004/05/31/confessions-of-a-cko-what-i-should-have-done/

Roca, J. C., Chiu, C., & Martínez, F. J. (2006). Understanding e- learning continuance intention: An extension of the technology acceptance model. *International Journal of Human - Computer Studies, 64*(8), 683-696. doi:10.1016/j.ijhcs.2006.01.003

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Saunders, M., 1959-, Lewis, P.,1945-, & Thornhill, A. (2007). *Research methods for business students* (4th ed.). Harlow: Financial Times/Prentice Hall.

Shiau, W., & Chau, P. Y. K. (2016). Understanding behavioral intention to use a cloud computing classroom: A multiple model comparison approach. *Information & Management, 53*(3), 355-365. doi:http://dx.doi.org/10.1016/j.im.2015.10.004

Shiau, W., & Chau, P. (2012). Understanding blog continuance: A model comparison approach. *Industrial Management & Data Systems, 112*(4), 663-682.

Shih, C., & Venkatesh, A. (2004). Beyond adoption: Development and application of a user-diffusion model. *Journal of Marketing, 68*(1), 59-72.

Son, M., & Han, K. (2011). Beyond the technology adoption: Technology readiness effects on post- adoption behavior. *Journal of Business Research, 64*(11), 1178-1182.

Spiller, J., Vlasic, A., & Yetton, P. (2007). Post-adoption behavior of users of internet service providers. *Information & Management, 44*(6), 513-523.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). USA: Pearson Education Limited.

Taraghi, B. (2012). Ubiquitous personal learning environment (UPLE). *International Journal of Emerging Technologies in Learning, 7*(Special Issue: FNMA), 7-14.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage - A test of competing models. *Information Systems Research, 6*(2), 144-176.

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: Toward a conceptual model of utilization. *MIS Quarterly, 15*(1), 125-143.

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1994). Influence of experience on personal computer utilization: Testing a conceptual model. *Journal of Management Information Systems, 11*(1), 167-187.

Tsui, E. (2002). *Technologies for personal and peer-to-peer knowledge management*Computer Sciences Corporation, Leading Edge Forum (LEF) Technology Grant report.

Tsui, E., & Sabetzadeh, F. (2014). Lessons learnt from and sustainability of adopting a personal learning environment & network (PLE&N). *International Conference on Educational Technologies,* Taiwan. pp. 51-59.

Tsui, E., Cheong, R. K. F., & Sabetzadeh, F. (2011). Cloud-based personal knowledge management as a service (PKMaaS). Paper presented at the *2011*

International Conference on Computer Science and Service System (CSSS), IEEE, Nanjing, China. pp. 2152-2155.

Venkatesh, V., & Brown, S. A. (2001). A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly, 25*(1), 71-102.

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

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

Wehmeier, S. (1998). *Oxford intermediate learner's english-chinese dictionary*. New York, USA: Oxford University Press.

Wiig, K. M. (1997). Knowledge management: An introduction and perspective. *Journal of Knowledge Management, 1*(1), 6-14.

Wilson, E. V., Mao, E., & Lankton, N. K. (2005). Predicting continuing acceptance of IT in conditions of sporadic use. *AMCIS 2005 Proceedings, , Paper 267.*

Wright, K. (2005). Personal knowledge management: Supporting individual knowledge worker performance. *Knowledge Management Research & Practice, 3*(3), 156-165.