Longitudinal Test of ePortfolio Continuous Use: An Empirical Study on the Change of Students' Beliefs

The Electronic Portfolio (ePortfolio) is learner-centered, and its effectiveness depends on the learners' long-term use. Thus, it is proper to conduct the study from the learners' perspectives. Currently, most researches on the use of the ePortfolio are cross-sectional studies, and it is more difficult to find the reasons for the changes of students' beliefs in regard to the long-term use of the ePortfolio. Based on the longitudinal test, this study explained the students' continuous use of ePortfolio and the changes of their beliefs. With 122 samplers in the adoption-continuous stage(T1-T2) and 117 samplers in the continuous stage(T2-T3), this study demonstrates that in continuous use stage (T2-T3), Perceived Ease of Use still influences the users' Perceived Usefulness and attitude toward the ePortfolio. Attribution significantly moderates the users' beliefs from the adoption stage (T1) to the continuous use stage (T2). However, the moderating effect of attribution in the continuous use stage (T2-T3) is insignificant; satisfaction and attribution are the key factors driving the users' continuous intention toward the ePortfolio rather than Perceived Usefulness and attitude. Meanwhile, satisfaction and attribution will change because of the users' expectation disconfirmation, and it will influence the users to continue using ePortfolio.

Keywords: attribution theory; continuance; electronic portfolio; satisfaction

1.Introduction

Portfolio is a familiar term for most people; it can signify supportive data when the students search for jobs. While the global economy is still in a depression, and it is more difficult to search for the jobs, the portfolio becomes more important than before.

Electronic Portfolios (ePortfolios) can be used to trace learning performance/ achievements over time (Kabilan and Khan 2012). In the trend of e-business and with the popularity of the Internet, many schools have started constructing ePortfolio which

can support the students' knowledge and capability transfer from schools to the workplace (Dorninger and Schrack 2008). Chang *et al.* (2012) explored the consistency and difference of teacher-, student self- and peer-assessment in the context of ePortfolio assessment and discovered that self- and teacher-assessment were consistent with the end-of-course examination. Thus, ePortfolio is innovative "Teaching–Learning–Assessment" and it allows the students to become the independent managers in the learning environment (Lopez-Fernandez and Rodriguez- Illera 2009).

ePortfolios can aid in the goal of lifelong learning and introduce the individuals' studies, research, training and work experience (Dorninger and Schrack 2008). The schools can use ePortfolios for various purposes, such as learning evaluation, career planning, records and validation of personal learning and growth (Zhang *et al*. 2007). Therefore, for personal development, the ePortfolio is an extremely valuable tool to assist learning (Lopez-Fernandez and Rodriguez-Illera 2009); it is used as a monitoring tool to recognize the learners' learning and identify their strengths and weaknesses (Kabilan and Khan 2012).

The long-term effectiveness of an information system (IS) relies on the users' continuous use (Bhattacherjee 2001). After examining different experiences, Lin (2011) found that the relationship between satisfaction and continuous intention is stronger for less experienced users than for more experienced users. Since the ePortfolio is based on the students' self-controlled learning, the effectiveness will be demonstrated by the students' long-term operation experience. As to the IS users, Doll and Torkzadeh (1991) suggested that the users' beliefs will influence their attitude and intention to use IS; the users' beliefs are also influenced by causal attributions (Hung *et al.* 2011). Therefore, analysis of the effect of attribution on changes in use beliefs will help to understand and manage the users' use of ePortfolio.

In earlier times, the theoretical models to predict and explain continuous use of IS were the extension of the prediction model at the technology adoption stage, such as the Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), etc. However, Kim and Malhotra (2005) suggested that the studies which predict continuous use stage by prediction models of the technology adoption stage did not fully explain how the beliefs in the adoption stage were effectively expanded to the continuous use stage. Bhattacherjee (2001) modified the "expectation disconfirmation" Theory (EDT) by the Perceived Usefulness (PU) of TAM and proposed the Expectation Confirmation Model (ECM). While he predicted the intention to use at the continuous use stage by Perceived Usefulness and satisfaction, he only probed into the continuous use stage of IS and did not include the acceptance stage to explain how the users' beliefs changed. Based on TAM, Kim and Malhotra (2005) conducted the validation by acceptance-continuous use and demonstrated that the "acceptance- continuous use" model, in comparison to all one-stage model, was more appropriate to explain IS use. In addition, ECM developed by Bhattacherjee (2001) explained intention of IS continuous use by extrinsic motivation (i.e., satisfaction and Perceived Usefulness), but neglected the intrinsic motivation (Hung *et al.* 2007, Hung *et al.* 2011, Malhotra *et al.* 2008).

Since it is required for the expansion of the users' beliefs from the IS adoption stage to continuous use stage, Bhattacherjee and Premkumar (2004) probed into the users' change of perception by a two-stage theoretical model, and suggested that in different users' situations (training of computer-based tutorial and program use of rapid application development), Perceived Usefulness could be expanded from the adoption stage to the continuous use stage. However, regarding attitudes, the research findings were inconsistent. Based on TAM, Kim and Malhotra (2005) demonstrated that Perceived Ease of Use (PEOU) and Perceived Usefulness could be expanded from the

adoption stage to the continuous use stage; however, they did not prove that the correlation of intention to use in two stages was related to the previous and following intention to use. Hsu *et al.*(2006) probed into IS use in different stages by combining TPB and EDT, and demonstrated that some predictors at the adoption stage (c.f., the effect of interpersonal interaction and perceived behavioral control) were not significantly expanded from adoption stage to the continuous use stage. However, they realized that there was significant correlation between use attitudes at the two stages. Since the ePortfolio is learner-centered, the students' independent learning and management are extremely important. Long-term study on the students' change of beliefs to use ePortfolio and management can avoid the effect of the students' change of beliefs on their attitude toward ePortfolio use, enhance their continuous use of ePortfolio and result in the expected effectiveness. Based on the above literatures, it is necessary to probe into the change and management of the users' beliefs in ePortfolio adoption and the continuous use stages by employing a long-term model.

Attribution Theory is used to explain the causes of a special event, state and result (Weiner 2000). In recent years, Attribution Theory has also been adopted to probe into individuals' resistance to information techniques, failure of special IS projects and reaction toward IS (Karsten 2002). As to the academic study and application related to the IS, Attribution Theory is used to find the effects of success and failure of attribution on the users' effectiveness expectation, emotional states, outcome of efforts and the following performance (Rozell and Gardner 2000). Therefore, based on the above researches on the belief change of technology acceptance and continuous use, this study probes into the beliefs and attitudes in ePortfolio acceptance by TAM and explores the factors behind the change of the users' beliefs and attitudes by expectation disconfirmation and Attribution theories. Through a longitudinal approach, this study

tests the changes of the users' beliefs and attitudes from ePortfolio adoption stage to continuous use stage, in order to accomplish the following purposes:

(1) To improve and validate the prediction of the longitudinal (acceptance-continuous use) technology use model.

(2) To determine whether the users' beliefs and attitudes at technology acceptance stage change because of the moderation of the users' attributions.

(3) To verify the consistency of users' attributions between technology acceptance and continuous use stages that influence the students' intention to continuously use the ePortfolio.

(4) To verify the effects of users' beliefs which are expanded from technology acceptance to continuous use stages.

2. Literature Review

2.1 ePortfolio

With the digital development, portfolios evolved into ePortfolios; the terms include: efolio, webfolio, web portfolio and virtual portfolio. They provide virtual space (usually Webs) in order to collect and save Artifacts and Reflections for the teachers, colleagues, experts or community members to validate the students' skills in specific knowledge field (Lopez-Fernandez and Rodriguez-Illera 2009). Barrett (2004) suggested that ePortfolios significantly differ from other evaluation management systems. The students are the priority of the control; the organizations are second. ePortfolios usually fall between traditional portfolios and mature online assessment system (Lopez-Fernandez and Rodriguez-Illera 2009). In regard to the ePortfolio, Chang *et al.* (2012) found that the self- and teacher-assessment were consistent with end-of-course examination scores;

the outcomes of both might reflect student achievements, hence, exhibiting adequate validity.

Chen *et al.*(2001) stated that the ePortfolio may be regarded as a tool to evaluate the learning process; the results show that students can construct an ePortfolio by using an information communication technology to control the learning. Therefore, the ePortfolio is student-centered, with result-oriented evaluation. It is related to the learners' collection, selection and artifacts to validate the related knowledge, techniques and achievements with meanings of works through the process of reflection (Buzzetto-More and Alade 2008). Zhang *et al.* (2007) suggested that the ePortfolio should not simply be an evaluation tool; it can indicate the knowledge obtained in a continuous learning process related to regular data collection, self-reflection and redesign, as well as enhance community interaction and knowledge collaboration. Upon the evaluation of capabilities, ePortfolio can enhance the students' personal development and help them plan continuous education (Lopez-Fernandez and Rodriguez-Illera 2009). Chen *et al.* (2001) demonstrated that the ePortfolio was a reflective communication channel which could enhance the integration of learning results upon evaluation. Therefore, through the ePortfolio, the students will manage their learning and evaluation by positive views and self-efficacy. Since the ePortfolio monitors the students' learning process and abilities, it can be treated as a strategy of instructional methods to validate learning achievement (Lopez-Fernandez and Rodriguez-Illera 2009). Therefore, Buzzetto-More and Alade (2008) proposed the following advantages of the ePortfolio in education：(1) Authentic learning； (2) Experiential learning；(3) Competency-based education；(4) Lifelong learning； (5) Autodidactism；(6) Self-directed learning.

2.2 Continuous models of IS use

Regarding the evaluation and explanation of technology use, Kim and Malhotra (2005) suggested four useful mechanisms: 1) Reason oriented action (ROA): evaluation–behavior relationship; 2) Sequential updating of judgments: evaluation–evaluation relationship; 3) Feedback: behavior–evaluation relationship; 4) Habit: behavior–behavior relationship. This study probes into the above relationship between evaluation and behavior. As to the prediction and explanation of technology use, Hsu and Chiu (2004) indicated that the TPB and TAM are reason-oriented theoretical models. Regarding ROA, it assumes that behavior is driven by motivation, and continuous use is the extension of acceptance. Some motivations or beliefs are used to explain technology adoption and continuous use. Although Kim and Malhotra (2005) agreed that the original acceptance would influence the following continuous use, they suggested that TAM did not specifically indicate how the original judgment and acceptance intention are expanded to influence the following use. According to Bhattacherjee (2001), the explanation of continuous use of IS by the above reason-oriented theories is limited; he suggested that besides the motivations or above beliefs, there are other beliefs different from technology adoption influencing the users' behavior. Based on the EDT of Oliver (1980), the said researcher developed the prediction model of IS continuous use named the ECM. TPB, TAM and ECM will be introduced below.

2.2.1 TPB

TPB is revision of the "Theory of Reasoned Action" (TRA). TRA was developed by Fishbein and Ajzen in 1975. There are two basic assumptions: 1) most behaviors of people are reasonable and controlled by personal will; 2) people's behavior intention (BI) is the key factor influencing the behavior. TRA is mainly used to predict and

explain human behavior. Since most of the studies suggest that human behavior intention is directly related to behavior, TRA is commonly used in the exploration of behavior intention. According to TRA, a person's specific behaviors are determined by behavior intention which is based on his/her subjective norm and attitude (Fishbein, and Ajzen 1975).

TRA is suitable for the behavior controlled by individuals' will. However, in reality, many factors (such as time, money, information and ability) will influence the control by individuals' will. Thus, TRA usually cannot reasonably explain behavior which cannot be totally controlled by individual will. In 1985, Ajzen added "perceived behavioral control (PBC)" in TRA and developed TPB. The theoretical model suggested that people's behavior intention would be influenced by "behavioral attitude", "subjective norm" and "perceived behavioral control". Perceived behavioral control means the beliefs (CBi) in resources and opportunities needed for certain behavior or motivation to influence perceived difficulty regarding behavior intention. It signifies the individuals' perceived difficulty in adopting certain behavior (PFi). Perceived behavioral control reflects the individuals' past experience and expected obstacles. The more resources and opportunities perceived by the indivdiuals, the fewer the expected obstacles and the stronger the perceived behavioral control. The effects of perceived behavioral control on TPB are shown below.

First, perceived behavioral control reveals the motivational implication of behavioral intention: it signifies individuals' perception of personal resources, opportunities or obstacles in adopting certain behavior. For instance, when a person recognizes the lack of resources and opportunities to accomplish certain behavior, his/her attitude toward the behavior and the agreement of the important referent others (such as the seniors) with the behavior will not result in strong behavioral intention.

Thus, perceived behavioral control indirectly influences behavior through behavior intention.

Second, there can be a direct relationship between perceived behavioral control and actual behavior. However, the following conditions should exist: (1) Predicted behavior is not totally controlled by the will. (2) The measurement of the perceived behavioral control must reflect individuals' actual behavioral control.

Based on past research findings, Hsu *et al.* (2006) demonstrated that TPB was effective in explaining individuals' intention to use various kinds of technology. In recent years, TPB has been used in studies on influencing factors from technology acceptance to the continuous use stage. However, beliefs which influence technology adoption and continuous use stages are not completely the same. Lau and Woods (2009) suggested that the users' beliefs in technology will differ according to different use experiences. Taylor and Todd (1995) demonstrated that it was difficult to confirm the stable belief structure related to attitudes by TPB and deemed it necessary to use different belief structures at different technology use stages (Hsu *et al.* 2006).

2.2.2 TAM

TPB is an adpative model of TRA and the development is based on the stability of beliefs. According to Ajzen (1991), it is not easy to indicate the mediating effect of subjective norms on attitude. In addition, in past researches, the effectiveness of perceived behavioral control of TPB was found to be unstable (Taylor and Todd 1995). Therefore, Davis (1989) reviewed the use situations of IS and simplified belief structures of TRA and TPB to develop a behavioral prediction model of TAM, in order to allow the researchers to recognize the internal beliefs, attitudes and intentions which influence use when studying technology use.

TAM and TRA or TPB all suggest that beliefs will influence a person's attitudes and that will affect his/her behavior intention and influence the behavioral performance. From the perspective of technology acceptance, Davis proposed two major factors of attitude: Perceived Ease of Use and Perceived Usefulness (Davis 1989). In comparison to TRA and TPB, TAM's characteristics are presented below:

(1) TAM does not include subjective norms in its research model.

(2) TAM suggests the most critical factors ("Perceived Ease of Use" and "Perceived Usefulness") of individuals' use attitude toward new technology, and replaces behavioral beliefs.

(3) TAM includes perceived behavioral control in Perceived Ease of Use and Perceived Usefulness, and does not discuss and test it separately.

Perceived Ease of Use, Perceived Usefulness and external variables of TAM are described below:

(1) Perceived Ease of Use: Davis(1989) defined Perceived Ease of Use as "the users' perceived ease in learning to operate the system." TAM assumes that when the users perceive that the system is easy to use, it will enhance their efforts to accomplish more jobs and improve job performance. The users' attitude toward the adoption of the system will be more positive. Perceived Ease of Use is also influenced by external variables, including the users' characteristics, system characteristics and organizational factors.

(2) Perceived Usefulness: Davis (1989) defined it as "the subjective expectation of the users to enhance job or learning performance by specific system in the organization." It means that the users perceive the benefit to job performance and the future by using the system.

(3) External variables: the external factors might directly influence potential users' Perceived Ease of Use and Perceived Usefulness. Meanwhile, external variables indirectly influence individuals' use attitudes and beliefs by Perceived Ease of Use and Perceived Usefulness (Venkatesh and Davis 1996).

TAM is widely applied to predict the adoption of new technology. In past researches, TAM and TPB demonstrated inconsistent findings (Lin 2007). In recent years, TAM has been used to explore continuous use of technology (Lin 2011). The comparison between TAM and EDT regarding the explanatory power of continuous use is a point of concern. Premkumar and Bhattacherjee (2008) demonstrated that at the continuous use stage, in comparison to EDT, TAM revealed better explained effect on continuous use intention. However, as for the expansion of beliefs, the existence of Perceived Ease of Use at the continuous use stage was questioned (Bhattacherjee 2001). Therefore, with the two-stage model, Kim and Malhotra (2005) probed into TAM in regard to the technology adoption and continuous use stages and demonstrated that Perceived Ease of Use and Perceived Usefulness of TAM both existed at two stages. However, Bhattacherjee and Premkumar (2004) and Kim (2009) suggested that current studies lack the explanations on how the beliefs at the technology adoption stage are expanded to the continuous use stage.

2.2.3 ECM

Bhattacherjee (2001) was the first researcher who revised EDT (see Figure 1) as ECM (see Figure 2) by Perceived Usefulness, and further explained the perceived beliefs which would influence individuals' continuous use of IS. Regarding ECM, the users first records the original expectation and then starts using the IS. IS users will develop their Perceived Usefulness of IS, then evaluate their original expectation to construct the satisfaction, and finally the satisfaction or dissatisfaction intensity will cause the users

to continue or give up using the IS.

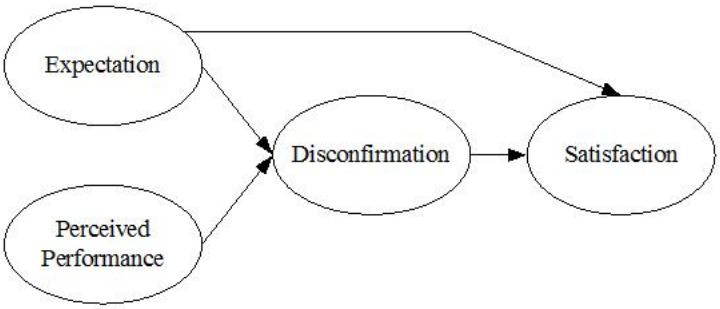

Figure 1 Expectation-Disconfirmation Theory

Source: Oliver(1980)

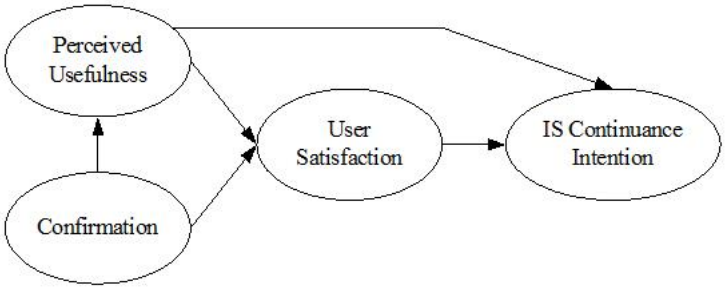

Figure 2 Expectation Confirmation Model of IS Continuance

Source: Bhattacherjee(2001)

Although ECM is the revision of EDT, their difference is listed as follows (Hayashi *et al.* 2004): 1) EDT examines two variables (before and after consumption), whereas, ECM only pays attention to after-variables and treats all before-variables as confirmation and satisfaction; 2) EDT only tests before-expectation instead of after-expectation. However, ECM examines after-expectation; and 3) ECM shows after-expectation by Perceived Usefulness.

Even if EDT suggests that expectation and performance will influence expectation disconfirmation (Oliver 1977, 1980, 1981) and it seems that there is a

relationship between performance and satisfaction, it lacks the objectivity and the dimensions to measure performance, resulting in an ambiguous effectiveness of performance (Oliver and Desarbo 1988). In addition, many scholars agree that expectation will influence the following use and expectation disconfirmation. It means that expectation will differ because of the change of performance (Oliver 1980). Regarding the use of IS, expectation can be measured by Perceived Usefulness (Seddon 1997, Bhattacherjee 2001). Bhattacherjee (2001) replaced expectation by Perceived Usefulness, and validated the effect on satisfaction. Although the ECM of Bhattacherjee is similar to Perceived Usefulness of TAM suggested by Davis (1989), Davis' Perceived Usefulness is future-oriented and used to evaluate the adoption of new IS. Bhattacherjee's Perceived Usefulness originated from expectation confirmation and performance after use.

Liao *et al.* (2009) suggested three theoretical differences between TAM and ECM: 1) although TAM is used to explain technology acceptance and continuous use, TAM tests the variables of technology acceptance, whereas ECM focuses on the long-term effectiveness of technology, such as continuous use and loyalty, instead of the primary adoption; 2) TAM suggests that behavior can be determined by attitude and according to ECM, continuous use depends on satisfaction; attitude and satisfaction are two different concepts; 3) TAM influences attitudes and intention by Perceived Usefulness and Perceived Ease of Use. However, these two beliefs are highly related to the expectation of performance. However, ECM is based on satisfaction/dissatisfaction and is associated with expectation disconfirmation. expectation disconfirmation is the function constructed by the users' expectation and performance. As for the timing of measurement, expectation is employed to measure the use of the system, and performance is evaluated after the use of the system. Premkumar and Bhattacherjee

(2008) indicated that TAM and EDT, the theoretical base of ECM, are different paradigms. TAM is Beliefs–Attitudes–Behavior model, EDT is Expectation–Disconfirmation–Satisfaction model; TAM is a static model, while EDT is a process model.

Based on the above discussion on the continuous use of IS, how variables of TAM are expanded from adoption stage to continuous use stage should be further validated (Liao *et al.* 2009). Prediction on continuous use simply by ECM is limited (lack of intrinsic motivation) (Hung *et al.* 2007, 2011, Malhotra *et al.* 2008). In Oliver's (1980) perception model, the researcher treated satisfaction as the prior variable of attitude; besides, satisfaction and attitude both influence the users' following behavior intention. Therefore, Premkumar and Bhattacherjee (2008) integrated different models to validate the prediction on the continuous use of technology, and demonstrated that the integrated model (TAM+EDT) revealed better explanatory power for the IS continuance.

2.3 Attribution Theory

Attribution Theory is an important theory with which to explore behavioral motivation (Meece *et al.* 2006). It evaluates the behavioral results by "success" or "failure" (such as good or bad purchase behavior) to develop causal inference (Oliver and Desarbo 1988, Meece *et al.* 2006). Since people themselves tend to attribute the behavior or attitude to objects, circumstances or the former combination (Johnson *et al.* 2006), Attribution Theory is used to "prove why a person believes in certain events and offers the decision making or behavioral motivation" (Karsten 2002). Attribution Theory was officially proposed by Heider in 1958. In comparison to Consumer Psychology, Attribution Theory drew the attention of social psychologists, cognitive

psychologists, clinical psychologists and educators (Weiner 2000). Thus, attribution is the issue of perception, and is regarded as the factor of satisfaction (Oliver 1993).

Attribution Theory and expectation disconfirmation do not conflict with each other; instead, they complement each other (Oliver and Desarbo 1988, Hung *et al.* 2011). Attribution Theory explains "why a special event, state or result happens and what the causes are" (Weiner 2000). In recent years, Attribution Theory has been used to explain why a person rejects information technology and then re-accepts it (Karsten 2002). The attribution related to success is considered internal, stable and controllable and differs from that of failure (Russell 1982). For instance, a consumer purchases the product and acquisition leads to the positive or negative state. Thus, the consumer develops the attribution inference of the "good" or "bad" result. It will also influence his/her following consumption (Weiner 2000). As for the interaction between humans and computers, Johnson *et al.* (2006) suggested that the social characteristics of technology would influence a person's attribution. According to Serenko (2007), positive attribution is usually the success factor of human-computer interaction, while negative attribution tends to result in failure.

In regard to the consumers' selection of products, attribution intervenes and influences the following product selection (Weiner 2000). External attribution usually causes an inconsistency between the products and expectation; however, the consumers' misunderstanding tends to be an internal attribution. An uncomfortable environment usually results in attribution of circumstances (Oliver 1993). As for the attribution inferences related to the starting and following results, if a result (positive or negative) is treated as a stable attribution (or the attribution lasts for a period of time), the same result will be expected; if it is regarded as an unstable (temporary) attribution, it means the result might be different from the past. Thus, the uncertain result or expectation will

be different from past periods (Weiner 2000). Tsiros *et al.* (2004) suggested that different kinds of attribution can result in different user satisfaction. After the failure to use the products, attribution of internal situations will result in a negative effect and dissatisfaction (Oliver 1993). In terms of psychology, self-serving bias usually suggests that success is based on personal factors, and that failure is usually attributed to others or environmental factors (Serenko 2007). When encountering bad results, people tend to evade their responsibility (Sebald 2010).

Regarding information technology, Johnson *et al.* (2006) suggested that gender, personality difference, social characteristics of information technology and individuals' perceived social roles of technology and capabilities are closely related to attribution. Therefore, attribution of individuals' use of information technology can be associated with personal factors, technology, individuals' perception of technology and situational factors of technology application. Therefore, for the students who use ePortfolio, the successful outcome of ePortfolios can result in positive attribution as well as their continuous use of the ePortfolios. Their negative attribution can be caused by the negative outcomes; they will thus stop using ePortfolio. The students who use ePortfolios might have stable or unstable attributions which will influence their intention of continuous use.

3. Material and methods

3.1. Research model and hypotheses

This study treats TAM as the analytical model of beliefs and attitudes of ePortfolio use at the acceptance stage and explores the change of the users' beliefs and attitudes from acceptance to continuous use stages by expectation disconfirmation and "attribution". TAM is often used to predict the first adoption of technology, and the prediction is

demonstrated by many researches. At the continuous use stage, Kim and Malhotra (2005) suggested that the studies which predicted continuous use by TAM did not elaborate on how original acceptance was expanded to the continuous use stage. Bhattacherjee and Premkumar (2004) tried to treat expectation disconfirmation as the moderator and probe into how Perceived Usefulness is expanded from acceptance to continuous use stages by longitudinal study. In different experimental situations, their results show that the directions taken from Perceived Usefulness to expectation disconfirmation are inconsistent. Based on the research of Bhattacherjee and Premkumar (2004), Hsu *et al*. (2006) tried to find if interpersonal effect, external effect and personal perceived behavioral control of TPB would be expanded from technology acceptance to the continuous use stage through the mediating effect of expectation disconfirmation. They demonstrated that expectation disconfirmation reveals good mediating effect; this shows that expectation disconfirmation can be the enabler to expand the beliefs in the first acceptance stage to continuous use stage.

Although the researches of Bhattacherjee and Premkumar (2004) or Hsu *et al*. (2006) demonstrated that some beliefs at the technology acceptance stage can be directly expanded to the continuous use stage and they explained part of the questions raised by Kim and Malhotra (2005), the variables they used to measure beliefs differ. Bhattacherjee and Premkumar (2004) adopted Perceived Usefulness in TAM, whereas Hsu *et al*. (2006) used subjective norm and behavioral control of TPB. It was demonstrated that Perceived Usefulness and external effects of subjective norm could be directly expanded from the acceptance stage to the continuous use stage. Nevertheless, perceived behavioral control and the interpersonal effect of subjective norm were not proved in the study of Hsu et al (2006); the expansion should rely on the mediating effect of expectation disconfirmation. The above reason-oriented theoretical

models (TPB and TAM) are based on the view that humans are rational and the researchers assume that human beings systematically use the information acquired as the basis upon which to develop the theories (Igbaria *et al.* 1995). They neglect the fact that humans are not totally rational. Thus, this study suggests that it is necessary to improve the above models to expand the explanatory power and scope of the model.

Further, some opinions of this study are as follows: 1) although Bhattacherjee and Premkumar (2004) treated Perceived Usefulness as the belief at the adoption stage and continuous use stages, they suggested that at the adoption stage, there could be other factors besides Perceived Usefulness (p.234). However, they did not validate this aspect. This study supplements the point by Perceived Ease of Use of TAM; 2) in the research of Kim and Malhotra (2005), the researchers validated the beliefs from the adoption stage to the continuous use stage and acquired positive findings. However, since the correlation between Perceived Usefulness and intention to use at the adoption stage was too low (p.752), it might result in a low connection between intention to use at the adoption stage and the following use (p.752). It lacked an exploration on attitude. The said that the research simply suggested that beliefs at the adoption stage could be directly expanded to continuous use stage, and neglected the enablers. It did not explain how beliefs were expanded (Kim 2009, p.514); in addition, the existence of Perceived Ease of Use at the continuous use stage (the users have the use experience and they can be familiar with the system) was questioned by some scholars (Bhattacherjee 2001); 3) Hsu *et al.* (2006) integrated TPB and EDT in their research. Although the findings demonstrated the existence of the interpersonal effect, external effect and perceived behavioral control at the adoption stage and continuous use stage, only the external effect could be directly expanded from the adoption stage to the continuous use stage. As for interpersonal effect and perceived behavioral control, it lacked proof (p.900) and

they could only be expanded by expectation disconfirmation. According to the literature review in this study, expectation disconfirmation is based on human beings' extrinsic motivation. However, human behavior is usually affected by both intrinsic and extrinsic motivations (Malhotra *et al.* 2008). Although Hsu *et al.* (2006) predicted the users' continuous use intention by beliefs, satisfaction and attitudes, it lacked the intrinsic motivation to change the beliefs from the acceptance stage to the continuous use stage; thus, their research did not fully explain the change of beliefs. As suggested by Kim (2009), current studies do not completely elaborate on the key processes from technology acceptance to continuous use stages (p.515). This study adds the function of attribution to the change of beliefs. It not only matches the perspectives of Malhotra *et al.* (2008) and Kim (2009), but also supplements the above researches. Based on the above, this study develops the research model, as shown in Figure 3. The inference of the hypotheses is discussed below.

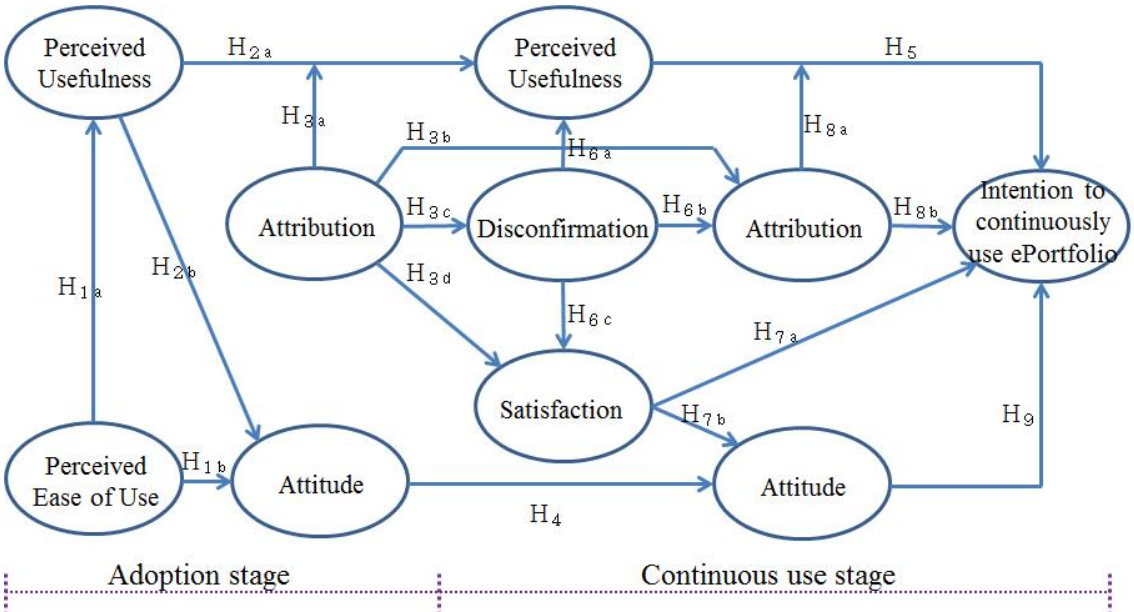

Figure 3 Research model

The prediction of TAM at the technology acceptance stage has been demonstrated by many studies. Besides the indirect function of expectation

disconfirmation, the Perceived Usefulness at the acceptance stage can direct influence the Perceived Usefulness at the continuous use stage is supported by the literatures (Bhattacherjee and Premkumar 2004, Kim and Malhotra 2005). Thus, in ePortfolio situations, the following hypotheses of this study are presented:

H1a: At the adoption stage, the students' Perceived Ease of Use of the ePortfolio will influence their Perceived Usefulness.

H1b: At the adoption stage, the students' Perceived Ease of Use of the ePortfolio will influence their use attitude.

H2a: The students' Perceived Usefulness in regard to adopting the ePortfolio will be directly related to the Perceived Usefulness of the following use.

H2b: At the adoption stage, the students' Perceived Usefulness of the ePortfolio will influence their use attitude.

Attribution is the mediator and moderator to predict human behavior and also directly influences the users' satisfaction and the following use (Fincham and Bradbury 1987, Hung *et al.* 2011,Tsiros *et al.* 2004). Stable attribution can be used to predict the change of expectation and influence Perceived Usefulness (Folkes 1984). Neapolitan (1989) demonstrated that attribution would restrict the Perceived Usefulness of IS. Besides, the users would select, deal with and interpret the information in attribution formation (Ferrin and Dirks 2003). Woodroof and Burg (2003) indicated that the users had specific predispositions toward the IS. The stable or unstable attribution of the predispositions would influence the users' satisfaction with technology use. Thus, this study proposes the following hypotheses:

H3a: The students' Perceived Usefulness of the ePortfolio expanded from the adoption stage to the continuous stage will be moderated by attribution.

H3b: Attribution of the students' adoption of the ePortfolio will be directly related to that of continuous use.

H3c: Attribution of technology adoption stage will influence the students' perceived expectation disconfirmation of the ePortfolio.

H3d: Attribution of technology adoption stage will influence the students' satisfaction with the ePortfolio.

Based on the research of Oliver (1980), Bhattacherjee and Premkumar (2004) suggested that at the technology adoption stage, attitude would directly influence the following use attitude. Hsu *et al.* (2006) also demonstrated the same conclusion in online shopping. Therefore, in the ePortfolio situation, this study assumes the following hypothesis:

H4: The students' attitude toward ePortfolio adoption will directly influence their following use attitude.

It has been demonstrated that Perceived Usefulness of TAM exists at the continuous use stage (Bhattacherjee 2001, Bhattacherjee and Premkumar 2004, Kim and Malhotra 2005) and will influence behavior intention in regard to continuous use (Bhattacherjee 2001, Bhattacherjee and Premkumar 2004). Therefore, in ePortfolio situations, this study posits the following hypothesis:

H5: The students' Perceived Usefulness of ePortfolio will influence their continuous intention.

At the technology continuous use stage, the effect of the users' expectation disconfirmation of technology on Perceived Usefulness and the users' satisfaction is demonstrated by the research of Bhattacherjee (2001) and Hung *et al.*, (2011). Since expectation disconfirmation will influence internal and external attribution (Girodo *et al.*

1981, Hung *et al.* 2011), it will further affect attribution (House 1976). Thus, in ePortfolio situations, this study posits the following hypotheses:

H6a: The students' expectation disconfirmation of ePortfolios will influence the following Perceived Usefulness.

H6b: The students' expectation disconfirmation of ePortfolios will influence the following use attribution.

H6c: The students' expectation disconfirmation of ePortfolios will influence the following use of satisfaction.

The effect of the users' satisfaction on intention of continuous use is demonstrated by many studies (Bhattacherjee 2001, Hsu *et al.* 2006, Hung *et al.* 2007, Hung *et al.* 2011); it also affects the attitude toward continuous use of the technology and the intention (Bhattacherjee and Premkumar 2004, Liao *et al.* 2009, Oliver 1980). Thus, in ePortfolio situations, this study posits the following hypotheses:

H7a: The students' satisfaction with the use of ePortfolios will influence the following intention of continuous use.

H7b: The students' satisfaction with the use of ePortfolios will influence the following use attitude.

Attribution is the moderator to predict human behavior, and directly influences the users' intention of continuous use (Fincham and Bradbury 1987,Hung *et al.* 2011, Tsiros *et al.* 2004). Since attribution helps in probing into the users' expectation, emotional state and performance (Perceived Usefulness) which result in success or failure of IS (Rozel and Gardner 2000), this study offers the hypotheses below:

H8a: The effect of the students' Perceived Usefulness of ePortfolios on intention of continuous use will be moderated by attribution.

H8b: The students' attribution of use of ePortfolios will influence their intention regarding continuous use.

In the researches related to TAM, effect of attitude on behavior intention to use technology is demonstrated. As for continuous use intention of technology, the effect of the users' attitude on intention of continuous use is demonstrated by Oliver (1980), Bhattacherjee and Premkumar (2004) and Liao *et al.* (2009). Thus, in ePortfolio situations, this study proposes the hypothesis below:

H9: The students' attitude to use ePortfolios will influence the following intention of continuous use.

3.2 Measurement

Attribution involves personal profound psychological cognition. Malhotra *et al.* (2008) divided attribution into three kinds of Perceived Locus of Causality (PLOC). They are Internal PLOC, External PLOC, and Introjected PLOC. Internal PLOC is further classified into Identified PLOC and Intrinsic PLOC. Intrinsic PLOC is a person's internal motivation. External PLOC, Introjected PLOC and Identified PLOC are external motivations. In order to effectively match the research requirement, the attribution scale with 22 items of this study is based on the four types of PLOC suggested by Malhotra *et al.* (2008). The scales concerning expectation disconfirmation with 3 items and Perceived Usefulness with 2 items were based on Bhattacherjee and Premkumar (2004). The scale of attitude with 4 items and continuous intention of ePortfolio use with 4 items were modified from Bhattacherjee and Premkumar (2004) and Taylor and Todd(1995), To measure and Perceived Ease of Use, we used an adaptive scale developed by Taylor and Todd(1995) with 4 items. The emotion scale of satisfaction suggested by Oliver (1980) was adopted with 6 items. A Likert 5-point scale is used for the questionnaire design under the assistance of two ePortfolio experts

and two professors (see Appendix A).

According to the date that one university of technology in Taiwan introduced the ePortfolio, the researcher treated the students in the day department using ePortfolio as the subjects. The investigation included three stages. The first was the adoption stage (T1) and the second and third were continuous use stages (T2, T3). The adoption stage (T1) was two weeks after the introduction of the ePortfolio and educational training. The continuous use stage (T2) was three months after the first investigation. The final continuous use stage (T3) was four months after the second investigation. In the first investigation, the researcher inquired about the students' participation intention during the period of educational training. The participants could decide if they would continue using the ePortfolio. The students of the continuous use stage were the data sources of this study.

4. Results

The received data was processed with three approaches. First, we analyzed the demographics for understanding the characters about our samplers. Second, we used Partial Least Squares (PLS) to analyze the data and validate our developed scale by Confirmatory Factor Analysis (CFA) criteria. Finally, we demonstrated the hypothesized associations in our research model by PLS.

4.1 Demographics analysis

This study conducted questionnaire surveys three times. The first survey (adoption stage: T1) was in the second week after the educational training. There were 450 participants. After the educational training, the students decided on whether or not to continue using the ePortfolio. The second survey (continuous use: T2) was conducted three months later. The participants had to have completed the first survey. There were 130

participants, with a total of 122 valid samples. The third survey (continuous use: T3) was conducted four months after the second survey. Thus, the whole longitudinal study lasted for about eight months. The participants of the third survey had to be among the 122 students in the second survey. There were 117 valid returned questionnaires. It shows that from adoption stage (T1) to continuous use stage (T2), the students' continuous use was less stable. About 71% of the students gave up continuously using ePortfolio. At the continuous use stage (T2-T3), the students' continuous use of ePortfolio was stable (96%). An analysis of the samples' basic information is shown in Table 1. It demonstrates that most of the participants used the ePortfolio for the first time.

Table 1
Results of demographics analysis

		Number of samplers				Number of samplers	
Basic information	Category	T_1-T_2	T_2-T_3	Basic information	Category	T_1-T_2	T_2-T_3
Gender	Male	82	77	Experience of ePortfolio	Below 1 year	98	93
	Female	40	40		1~2 years	24	24
Age	Below 21 years old	52	50	Experience of blogs	Below 1 year	70	66
	21~22 years old	36	34		1~2 years	28	27
	23~24 years old	28	27		3~4 years	19	19
	Above 24 years old	6	6		Above 4 years	5	5
Sample Size:122				Sample Size:117			

4.2 Scale Validation

This study used CFA to validate the scale for it is more appropriate than exploratory factor analysis in the areas with strong priori theory. The software named Visual PLS was performed. Scale validation is tested by convergent and discriminant validity (Sethi

and Carraher 1993). Three criteria are suggested for assessment of convergent validity (Fornell and Larcker 1981). First, it is recommended that factor loadings of all standardized items are to be higher than 0.5. Second, the composite reliability (CR) is to be higher than 0.6. Third, the average variance extracted (AVE) needs to be higher than 0.5. Results of testing of convergent validity of the scales are listed in Table 2. Excepting the factor loading (0.326) of one attribution item (ATTR 31) at continuous use stage (T2-T3) is lower than 0.5, factor loading of the rest of the items is above the standard 0.5. Since the items should be consistent in different stages (T1- T2-T3) in the analysis, the said item is retained; the composite reliability of all variables is above the standard 0.7 and AVE value is above the standard 0.5. For discriminant validity, Fornell and Larcker(1981) suggested the AVE value of one dimension should be higher than the square of correlation coefficients between it and any other dimension (Fornell and Larcker 1981). As shown in Table 3 and Table 4, the values of AVE and square of correlation coefficients showed a good discriminant validity of the scale.

Table 2

Results of convergent validity

Time (t_1-t_2)							Time (t_2-t_3)						
Scale Items	Item Loading	Item Mean	Item S.D.	t-Value	CR	AVE	Scale Items	Item Loading	Item Mean	Item S.D.	t-Value	CR	AVE
PEOU11	0.846	4.754	1.215	20.482	0.918	0.738	PEOU21	0.913	4.881	1.176	37.105	0.949	0.825
PEOU12	0.896	4.820	1.060	32.632			PEOU22	0.925	4.915	1.134	59.724		
PEOU13	0.892	4.877	1.095	35.177			PEOU23	0.907	4.838	1.203	37.515		
PEOU14	0.800	4.754	0.982	20.202			PEOU24	0.887	4.709	1.182	44.690		
PU11	0.895	5.000	1.052	36.663	0.886	0.795	PU21	0.923	4.804	1.169	70.707	0.900	0.824
PU12	0.888	4.852	0.959	34.395			PU22	0.892	4.966	0.991	34.972		
ATT11	0.790	4.836	1.031	17.207	0.901	0.696	ATT21	0.906	4.701	1.116	51.791	0.939	0.794
ATT12	0.877	4.746	0.992	39.519			ATT22	0.912	4.632	1.072	37.199		
ATT13	0.862	4.664	1.041	31.671			ATT23	0.915	4.530	1.047	54.895		
ATT14	0.804	4.582	1.059	18.722			ATT24	0.829	4.493	1.030	19.768		
ATTR11	0.718	4.411	0.762	5.768	0.916	0.733	ATTR21	0.769	4.576	0.848	16.964	0.921	0.744
ATTR12	0.900	4.513	0.819	30.448			ATTR22	0.916	4.434	1.013	60.035		
ATTR13	0.894	4.299	0.966	38.804			ATTR23	0.859	4.291	1.097	23.308		
ATTR14	0.897	4.248	0.778	35.436			ATTR24	0.899	4.154	0.946	43.254		
PU21	0.912	4.795	1.149	55.891	0.902	0.822	PU31	0.915	4.624	1.112	61.708	0.888	0.798
PU22	0.900	4.943	0.990	44.976			PU32	0.871	4.786	0.927	27.224		
DCON21	0.877	4.426	0.944	34.045	0.897	0.744	DCON31	0.892	4.504	0.979	52.526	0.905	0.760
DCON22	0.890	4.369	0.955	34.453			DCON32	0.874	4.419	0.985	30.060		
DCON23	0.819	4.557	0.945	27.583			DCON33	0.850	4.586	0.947	22.322		
SAT21	0.843	4.467	1.022	23.169	0.944	0.737	SAT31	0.841	4.462	1.005	30.590	0.931	0.694
SAT22	0.793	4.467	1.030	18.630			SAT32	0.757	4.368	1.072	15.997		
SAT23	0.889	4.574	0.995	35.692			SAT33	0.850	4.607	0.956	27.671		
SAT24	0.878	4.590	0.985	33.314			SAT34	0.856	4.582	0.893	23.561		
SAT25	0.883	4.672	0.940	38.202			SAT35	0.843	4.632	0.934	30.858		
SAT26	0.862	4.484	1.046	32.643			SAT36	0.847	4.543	0.923	29.482		

Table 2

Results of convergent validity (cont.)

Time (t_1-t_2)							Time (t_2-t_3)						
Scale Items	Item Loading	Item Mean	Item S.D.	t-Value	CR	AVE	Scale Items	Item Loading	Item Mean	Item S.D.	t-Value	CR	AVE
ATT21	0.902	4.689	1.100	54.408	0.940	0.795	ATT31	0.822	4.821	0.916	22.496	0.928	0.764
ATT22	0.912	4.623	1.055	44.202			ATT32	0.889	4.761	0.944	38.395		
ATT23	0.916	4.533	1.030	50.424			ATT33	0.906	4.634	1.077	49.392		
ATT24	0.833	4.484	1.022	21.963			ATT34	0.877	4.586	1.067	43.494		
ATTR21	0.734	4.582	0.846	13.710	0.920	0.744	ATTR31	0.326*	4.495	0.760	2.042	0.865	0.640
ATTR22	0.918	4.426	0.995	69.192			ATTR32	0.930	4.316	0.892	61.888		
ATTR23	0.890	4.291	1.082	41.609			ATTR33	0.898	4.231	1.107	36.641		
ATTR24	0.896	4.159	0.934	38.381			ATTR34	0.885	4.161	0.819	24.348		
CBI21	0.908	4.451	1.037	41.211	0.941	0.800	CBI31	0.826	4.564	0.977	13.030	0.924	0.754
CBI22	0.885	4.508	1.014	31.406			CBI32	0.888	4.517	1.133	28.846		
CBI23	0.898	4.443	1.061	41.214			CBI33	0.907	4.457	1.199	55.965		
CBI24	0.887	4.434	1.106	34.289			CBI34	0.850	4.427	1.093	33.853		

Legend: ATT: Attitude; ATTR: Attribution; CBI: Continued behavioral intention; DCON: Disconfirmation; PEOU: Perceived ease of use; PU: Perceived usefulness; SAT: Satisfaction

*For the concern of consistent comparison of model, ATTR31 is remained.

Table 3

Results of discriminant validity(T1-T2)

Adoption-Continuous use stage(T1-T2)										
	PEOU(t_1)	PU(t_1)	ATT(t_1)	ATTR(t_1)	PU(t_2)	DCON(t_2)	SAT(t_2)	ATT(t_2)	ATTR(t_2)	CBI(t_2)
PEOU(t_1)	.738									
PU(t_1)	.430	.795								
ATT(t_1)	.362	.552	.696							
ATTR(t_1)	.229	.278	.397	.733						
PU(t_2)	.049	.092	.105	.050	.822					
DCON(t_2)	.052	.148	.204	.114	.423	.744				
SAT(t_2)	.114	.112	.203	.130	.504	.654	.737			
ATT(t_2)	.145	.197	.250	.127	.503	.650	.692	.795		
ATTR(t_2)	.076	.093	.164	.138	.428	.371	.569	.449	.744	
CBI(t_2)	.148	.150	.246	.152	.419	.487	.707	.573	.632	.800

Table 4

Results of discriminant validity(T2-T3)

Continuous use stage (T2-T3)										
	PEOU(t_2)	PU(t_2)	ATT(t_2)	ATTR(t_2)	PU(t_3)	DCON(t_3)	SAT(t_3)	ATT(t_3)	ATTR(t_3)	CBI(t_3)
PEOU(t_2)	.825									
PU(t_2)	.461	.824								
ATT(t_2)	.472	.508	.794							
ATTR(t_2)	.331	.441	.471	.744						
PU(t_3)	.059	.106	.097	.100	.798					
DCON(t_3)	.042	.066	.089	.114	.518	.760				
SAT(t_3)	.064	.086	.112	.120	.521	.658	.694			
ATT(t_3)	.030	.015	.066	.093	.464	.567	.605	.764		
ATTR(t_3)	.036	.146	.122	.142	.362	.367	.403	.343	.640	
CBI(t_3)	.061	.136	.106	.126	.429	.524	.669	.503	.425	.754

Legend: Diagonal elements represent the value of AVE; Lower triangular elements represent square of correlation coefficients

4.3 Path analysis

As for the path analysis, with more variables and fewer samples, this study conducted a two-stage model analysis by PLS, and the analytical results are shown in Figures 4 and 5. At the adoption-continuous use stage(T1-T2), expecting the hypotheses named H5, H8a, and H9, other hypotheses were significant at $p<0.05$. The Perceived Usefulness(t2), attitude(t2), attribution(t2) and satisfaction (t2) jointly explained 79.3% variance in the continuous intention of ePortfolio use at time t2, with attribution and satisfaction contributing to most of the explanation (ß=0.447 and ß=0.375 individually). About 71.5% of the variance in attitude(t2) was explained by attitude(t1)(ß=0.151), and satisfaction(t2) (ß=0.767), suggesting that satisfaction(t2) is more critical in the formation of continuous attitude toward ePortfolio than prior attitude of adoption; with 48.7% of the variance in attribution(t2) was explained by expectation disconfirmation (t2) (ß=0.613) and prior attribution(t1) (ß=0.719), which the attribution(t2) is influenced by prior attribution(t1) and may be changed by the expectation disconfirmation. Likewise, 66.4% of the variance in satisfaction(t2) was explained by expectation disconfirmation (t2) (ß=0.769) and attribution(t1) (ß=0.109), suggesting the expectation disconfirmation (t2) is the critical enabler of satisfaction(t2). With 51.5% of the variance in expectation disconfirmation (t2) was explained by attribution(t1) (ß=0.188). The slight effect of attribution(t1) on expectation disconfirmation (t2) implies that both of them may be the independent enablers to change the beliefs of continuous use. Also the Perceived Usefulness(t2) was explained by the expectation dsconfirmation (t2) (ß=0.644) and prior Perceived Usefulness(t1) (ß=0.261) at adoption stage, the explained variance of Perceived Usefulness(t2) only has 10% under the moderating effect of attribution(t1). Further, the attitude(t1) was explained by Perceived Usefulness(t1)

(ß=0.560) and Perceived Ease of Use(t1) (ß=0.240) with 55.1 % variance; the Perceived Usefulness(t1) was explained by Perceived Ease of Use(t1) (ß=0.669) with 44.8 % variance that is consistent with prior IT acceptance researches.

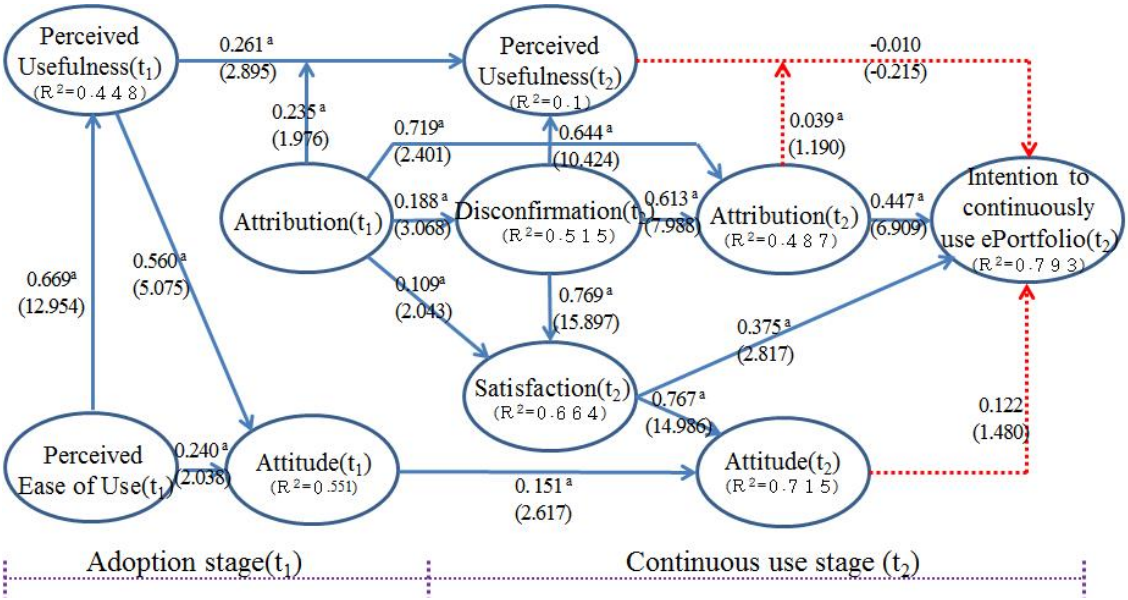

Figure 4 Path analysis of adoption-continuous use stage(T1-T2)

At the continuous use stage(T2-T3), the hypotheses named H1a, H1b, H2a, H2b, H3c, H6a, H6b, H6c, H7a, H7b and H8b were significant at $p<0.05$. The Perceived Usefulness(t3), attitude(t3), attribution(t3) and satisfaction (t3) jointly explained 70.3% variance in the continuous intention of ePortfolio use at time t3, with attribution and satisfaction contributing to most of the explanation (ß=0.208 and ß=0.556 individually). About 61.4% of the variance in attitude(t3) was explained by satisfaction(t3) (ß=0.768), suggesting that satisfaction(t3) is more critical in the formation of continuous attitude toward ePortfolio than prior attitude(t2); with 49.5% of the variance in attribution(t3) was explained by expectation disconfirmation (t3) (ß=0.635), it may be changed by the expectation disconfirmation. Likewise, 66.1% of the variance in satisfaction(t3) was explained by expectation disconfirmation (t3) (ß=0.780), suggesting the expectation

disconfirmation (t3) is the critical enabler of satisfaction(t3). With 50.3% of the variance in expectation disconfirmation (t3) was explained by attribution(t2) (ß=0.137). Also the Perceived Usefulness(t3) was explained by the expectation disconfirmation (t3) (ß=0.655) and prior Perceived Usefulness(t2) (ß=0.255), the explained variance of Perceived Usefulness(t3) only has 6.9%. Further, the attitude(t2) was explained by Perceived Usefulness(t2) (ß=0.517) and Perceived Ease of Use(t2) (ß=0.311) with 60.3 % variance; the Perceived Usefulness(t2) was explained by Perceived Ease of Use(t2) (ß=0.741) with 55.0 % variance.

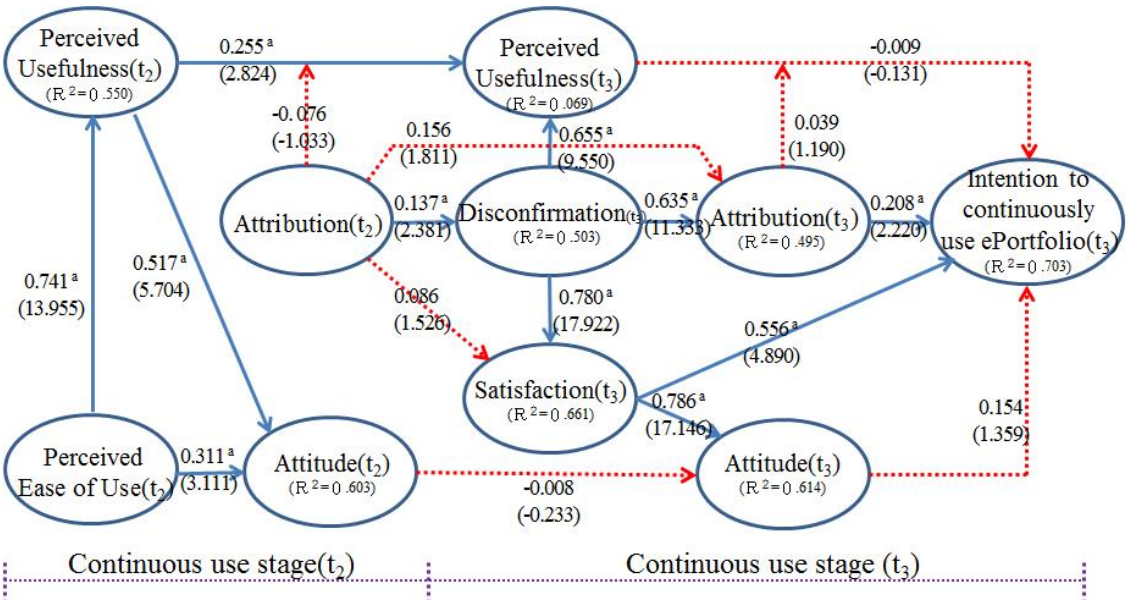

Figure 5 Path analysis of continuous use stage (T2-T3)

5. Discussion

This study conducted path analysis of the two-stage model by PLS, and the analytical results reveal good explanatory power on the users' ePortfolio adoption-continuous use intention. While comparing the path analysis results between the two-stage models, some findings were further discussed. At the time T2 to T3, it shows 79.3% and 70.3% explanatory power on the users' intention of continuous use; 71.5% and 61.4%

explanatory power on attitude; 48.7% and 49.5% explanatory power on attribution; 66.4% and 66.1% explanatory power on satisfaction; 10% and 6.9% explanatory power on Perceived Usefulness and 51.5% and 50.3% explanatory power on expectation disconfirmation. At the time T1 to T2, it shows 55.1% and 60.3% explanatory power on attitude and 44.8% and 55.0% explanatory power on Perceived Usefulness. It demonstrates that the explanatory power of the model on Perceived Usefulness at the adoption stage is much higher than at the continuous use stage. The finding supports the research of Seddon (1997) who suggested that once the users are more experienced with the system, their Perceived Usefulness of the system will not result in their continuous use.

According to Figure 4, attribution is the moderator to change the beliefs from the users' adoption of the ePortfolio (T1) to the continuous use stage (T2). It can moderate the users' change of beliefs related to Perceived Usefulness. At the continuous use stage (T2), the moderating effect of attribution on Perceived Usefulness and continuous use intention of the ePortfolio is insignificant. In addition, according to the analytical results at the continuous use stage (T2), the users' Perceived Usefulness and attitude do not significantly influence the users' intention of continuous use. The users' attribution and satisfaction with ePortfolio use at T2 will significantly influence the students' intention of continuous use.

As shown in Figure 5, at time T2-T3, the users' attribution does not significantly moderate the users' change of beliefs. Besides, the users' attribution is stable and does not significantly affect the users' satisfaction. It will influence the users' change of attribution only through expectation disconfirmation; likewise, at time T2-T3, the students' attitude toward the use of ePortfolio is stable. The change of attitude is insignificant during the continuous use stage. As at time T1-T2, the students' Perceived

Usefulness and attitude do not significantly influence the intention to continuously use ePortfolio. The attribution and satisfaction with ePortfolio use at time T3 will significantly affect the students' continuous use intention. According to Figures 4 and 5, the effect of attribution at the continuous use stage on the students' continuous use intention is higher than Perceived Usefulness and attitude; it influences the students' intention to continuously use the ePortfolio based on user satisfaction.

Based on the above discussion, this study summarized three critical findings:

(1) Attribution significantly moderates the users' change of beliefs in regard to the ePortfolio from the adoption stage (T1) to the continuous use stage (T2);

(2) At the continuous use stage (T2-T3) of the ePortfolio, the effect of the users' attribution on continuous use intention is more significant than Perceived Usefulness and attitude; it influences the users' continuous use intention based on user satisfaction;

(3) The users' Perceived Ease of Use at the continuous use stage (T2) is still the key factor of the users' Perceived Usefulness and attitude.

For the three key points, this study further discusses them below:

(1)Past research findings demonstrated that attribution would make IS users decide on the continuous use according to past use experience (Hung *et al.* 2011, Malhotra *et al.* 2008). This study further shows that attribution not only is stable at the continuous use stage (T2-T3), but also can directly influence the users' intention to continuously use the IS. Besides, from the adoption stage to the continuous use stage (T1-T2), attribution moderates the users' Perceived Usefulness. In other words, the users' Perceived Usefulness at the continuous use stage will be influenced by the users' attribution. Thus, by attribution, the system promoters can guide the users at adoption stage (T1) to successfully approach the continuous use stage (T2) in order to develop the users' continuous use of ePortfolios.

(2)ROA- and ECM-oriented studies all suggest that the users' beliefs and attitudes of Perceived Usefulness will influence the users' continuous use based on user satisfaction. However, at the continuous use stage (T2-T3), the users' beliefs of Perceived Usefulness and attitudes do not significantly influence the users' continuous use intention. While attitude and satisfaction are two different concepts (Liao *et al.*, 2009), this study finds that satisfaction is more suitable than attitude for explaining the ePortfolio continuance in the continuous use stage. As suggested by Seddon (1997), the users are interested in Perceived Usefulness of the new system; however, the original IS cannot attract the users as it did at the adoption stage, unless there is innovation. This study suggests that the users' use experience of IS will further influence their expectation toward the effectiveness of IS. By expectation disconfirmation, they change the attribution of IS and make decisions regarding continuous use.

(3)Past researches suggested that since the users are familiar with the use of IS, Perceived Ease of Use at the continuous use stage will not influence the users' continuous use of the IS (Bhattacherjee 2001, Bhattacherjee and Premkumar 2004). However, the inference lacks the support of social science studies. This study treats Perceived Ease of Use as the key factor at continuous use, and data analysis result shows that the users' Perceived Ease of Use at the continuous use stage (T2-T3) still influences the users' Perceived Usefulness and attitude. Thus, Perceived Ease of Use can trigger Perceived Usefulness of the users' continuous use of ePortfolio and the attitude. At continuous use stage, in order to satisfy new demands, the firms should upgrade the system. However, in system upgrading, the firms should value the users' demand for Perceived Ease of Use.

6. Conclusions

Learner-centered learning models have gradually become the mainstream of learning.

Thus, the learners' portfolio will rely on the learners' self-learning record. The ePortfolio should be developed for long term use in order to completely present the learners' learning process and effectiveness. Thus, in comparison to common IS, the ePortfolio is effective on learners' long-term use.

When dealing with the users' change of beliefs, past information technology adoption-continuous use prediction models had difficulty determining how the users' beliefs were expanded from the information technology adoption stage to the continuous use stage (Kim and Malhotra 2005, Hung et al 2011, Lau and Woods 2009). This study treats attribution and expectation disconfirmation as the key factors of the users' change of beliefs and attitudes in the continuous use of IS. By employing a longitudinal approach, this study aimed to find the users' beliefs and attitude expanded from adoption stage to continuous use stage, in order to analyze the effectiveness of the key enablers. This study demonstrates that although beliefs at the information technology adoption stage can be expanded to the continuous use stage, because of the moderating effect of attribution and expectation disconfirmation, beliefs and attitudes of information technology adoption stage cannot directly influence the students' continuous use. The users' attribution and satisfaction significantly influence the students' continuous. The findings show that the users' satisfaction is critical in the elaboration of continuous use of information technology. However, this finding differs from the past researches which explored the continuous use of IS by the beliefs of information technology adoption (Hsu *et al.* 2006, Kim and Malhotra 2005, Lau and Woods 2009). This study demonstrates that the users' Perceived Usefulness is not significantly effective for explaining the continuous use of information technology. It matches the research of Seddon (1997) who suggested the effectiveness of the users'

Perceived Usefulness in current ISs. Perceived Usefulness in the original system cannot result in the users' continuous use.

In short, according to the analytical results of the two-stage model in this study: Perceived Ease of Use at continuous use stage (T2) will influence the users' Perceived Usefulness and attitude toward the system; attribution from adoption stage (T1) to continuous use stage (T2) significantly moderates the users' beliefs; however, at continuous use stage (T2-T3), the moderating effect is insignificant; it directly affects the users' continuous use intention. For users' continuous use intention, satisfaction and attribution are the key factors; attribution at continuous use stage will change with the users' expectation disconfirmation, and it will further affect the users' intention to continuously use the ePortfolio.

Based on above findings, the theoretical and practical contributions are shown below: 1) theoretical contribution: how beliefs at information technology adoption stage are expanded to continuous use stage and influence the users' continuous use has been the critical issue for the researches on information technology adoption- continuous use model (Bhattacherjee and Premkumar 2004, Hsu *et al.* 2006, Hung *et al.* 2011, Kim and Malhotra 2005, Premkumar and Bhattacherjee 2008, Lau and Woods 2009). This study aimed to use the perspectives of Attribution Theory and expectation disconfirmation. The findings will help the evolution and development of the information technology adoption-continuous use model; 2) practical contribution: key enablers of the users' change of beliefs suggested by this study can assist the system development and allow the promoters to include them in system development and implementation of the activities. The adjustment and management of these key enablers will enhance the system development as well as the planning and implementation of the activities.

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Appendix A. Constructs and Measurement Scales

For PLOC items, each item was preceded by "I will use(t1)/use(t2,t3) the ePortfolio . . ." to capture the self-perceived "reasons" of behavioral intention. For example, item 1 read: "I will use/use the ePortfolio because using the ePortfolio is required by my course description."

Perceived Ease of Use (t1)

(1) Learning to operate the ePortfolio will be easy for me.

(2) 2.I find the ePortfolio will be easy to use.

(3) It will be easy for me to become skillful at using the ePortfolio.

(4) 4.I find it will be easy to use the ePortfolio to do what I want to do.

Perceived Usefulness(t1)

(1) 1.I find the ePortfolio will be useful in my course.

(2) 2.Using the ePortfolio will improve my performance in my course.

Attitude(t1)

(1) Using the ePortfolio will be a good idea for me.

(2) Using the ePortfolio will be a wise idea for me.

(3) 3.I will like the idea of using the ePortfolio.

(4) Using the ePortfolio will be pleasant.

Perceived Ease of Use (t2,t3)

(1) Learning to operate the ePortfolio is easy for me.

(2) 2.I find the ePortfolio is easy to use.

(3) It is easy for me to become skillful at using the ePortfolio.

(4) 4.I find it easy to use the ePortfolio to do what I want to do.

Perceived Usefulness(t2,t3)

(1) 1.I find the ePortfolio would be useful in my course.

(2) 2.Using the ePortfolio would improve my performance in my course.

Attitude(t2,t3)

(1) Using the ePortfolio is a good idea for me.

(2) Using the ePortfolio is a wise idea for me.

(3) 3.I like the idea of using the ePortfolio.

(4) Using the ePortfolio would be pleasant.

Expectation Disconfirmation (t2,t3)

(1) My experience with using ePortfolio was better than what I expected.

(2) The service level provided by ePortfolio was better than what I expected.

(3) Overall, most of my expectations from using ePortfolio were confirmed

Satisfaction(t2,t3)

(1) 1.I am satisfied with my decision to use ePortfolio.

(2) 2.If I had it to do all over again, I would feel differently about the ePortfolio.

(3) 3.My choice to use the ePortfolio was wise one.

(4) 4.I feel good about my decision concerning the ePortfolio.

(5) 5.I think that I did the right thing when I decided to use ePortfolio.

(6) 6.I am happy that I did what I did about the ePortfolio.

Continuous Use Intention(t2,t3)

(1) 1.I intend to continue using the ePortfolio in my course.

(2) 2.I intend to continue using the ePortfolio for collaborating with others in my course.

(3) 3.I intend to continue using the ePortfolio frequently in my course.

(4) 4.I intend to continue using the ePortfolio for communicating with others in my course.

External PLOC(t1-t3)

(1). . . . Because using the ePortfolio is required by my course description.

(2). . . . Because using the ePortfolio is compulsory in my course.

(3). . . . Because my instructor requires me to use the ePortfolio.

(4). . . . Because my instructor would think that I should use the ePortfolio.

(5). . . . Because I'll get in trouble if I don't use the ePortfolio.

(6). . . . Because that is what I'm supposed to do.

(7). . . . So that my instructor wouldn't reprimand me.

Internal PLOC(t1-t3)

Identified PLOC

(1). . . . Because I think it's personally important to myself.

(2). . . . Because I personally like using the ePortfolio.

(3). . . . Because I want to understand how to use the ePortfolio.

(4). . . . Because I want to learn how to use the ePortfolio.

(5). . . . Because I want to find out if I am able to use the ePortfolio.

Intrinsic PLOC

(1). . . . Because I enjoy using the ePortfolio.

(2). . . . Because using the ePortfolio is fun.

Introjected PLOC(t1-t3)

(1). . . . Because it bothers me when I don't use the ePortfolio.

(2). . . . Because I will feel bad about myself if I don't use the ePortfolio.

(3). . . . Because I'll feel ashamed of myself if I don't use the ePortfolio.

(4). . . . Because I want my colleagues to like me.

(5). . . . Because my friends would think that I should use the ePortfolio.

(6). . . . Because my peers would think that I should use the ePortfolio.

(7). . . . So that others won’t get upset with me.

(8). . . . Because I want the instructor to think that I’m a good student.