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Exploring academic teachers' continuance toward the web-based learning system: The role of causal attributions

Ming-Chien Hung [a], I.-Chiu Chang [b], Hsin-Ginn Hwang [c,*]

[a] Department of Information Management, Nanhua University, No. 55, Sec. 1 Nanhau Rd., Dalin Township, Chiayi County 62248, Taiwan, ROC
[b] Department of Information Management, National Chung Cheng University, 168, University Rd., Min-Hsiung Chia-Yi, Taiwan, ROC
[c] Institute of Information Management, National Chiao Tung University, 1001 University Road, Hsinchu, Taiwan, ROC

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ABSTRACT

The Expectation Confirmation Model (ECM) is a popular model used to explain the continuance of information system usage. However, past studies have found that the ECM, based on extrinsic motivations (e.g. perceived usefulness, user satisfaction), has limitations insofar as people often have both intrinsic and extrinsic motivations simultaneously. This study used the belief of causal attributions to extend the ECM and verify it in a web-based learning system (WLS) context. Nine hypotheses were derived from the modified ECM. Empirical data were collected by a mail survey from faculty with experience of WLS in Taiwanese universities. The final sample used for further analysis comprised of 144 respondents. The results revealed that the modified ECM has greater power to explain the continued intention of WLS usage even if the effects of user satisfaction and perceived usefulness on continued intention are reduced.

1. Introduction

Despite the widespread recognition of value of electronic learning (e-learning) over the past decade, many users discontinue e-learning after initial acceptance of its usage (Lee, 2010). Thus, the expected benefits of e-learning, which complement or even substitute traditional face-to-face learning, are not adequately reflected in the online learning market (Wu, Tsai, Chen, & Wu, 2006). As the long-term success of information systems (IS) depends on continued usage rather than mere acceptance (Bhattacherjee, 2001), understanding the factors that affect users' intention to continue using e-learning system can not only help system developers, but also teachers and vendors design the best strategies to increase its usage (Lee, 2010).

Bhattacherjee (2001) was the first researcher to modify the Expectation Confirmation Theory (ECT) of consumer behavior into the Expectation Confirmation Model (ECM) to explore the continued intention to use IS. Both ECT and ECM assume that satisfaction has a central role in explaining the repurchasing behavior or continuance of IS usage. However, research findings on the relationship between user satisfaction and system usage have been mixed and inconclusive (Bokhari, 2005). For example, in several cases that high user satisfaction scores coincide with a declining market share (Eggert & Ulaga, 2002). Moreover, it has been found that if there is only one choice available to the consumer, and it is a necessary product, user satisfaction scores may remain higher even after a series of unsatisfying experiences (Weiner, 2000). While the ECM tries to explain "why some users discontinue usage of IS after they have pre-accepted it" (Bhattacherjee, 2001), it remains weak in explaining why users discontinue usage despite being satisfied with their post-usage experience (Hung, Hwang, & Hsieh, 2007). The ECM is based on extrinsic motivations (e.g. perceived usefulness, user satisfaction), ignoring the intrinsic motivation of users and, therefore, requires augmentation in terms of theoretical extension to account for IS continuance (Hayashi, Chen, Ryan, & Wu, 2004; Sorebo, Halvari, Gulli, & Kristiansen, 2009; Wu et al., 2006).

* Corresponding author. Tel.: +886 5 5712121x57428.
E-mail addresses: chemyhmc@gmail.com (M.-C. Hung), misicc@mis.ccu.edu.tw (I.-C. Chang), hghmis@iim.nctu.edu.tw (H.-G. Hwang).

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Causal attributions are often used to explain the reasons underlying observed behaviors, events and outcomes (Rozell & Gardner, 2000) and have been used to explain the use or nonuse of an IS (Karsten, 2002). Rozell and Gardner (2000) state that "attribution theory could potentially contribute to IS research and practice by providing intrinsic insight into the effects that attributions for computer-related success and failure exert on users' efficacy expectations, affective states, effort, and subsequent performance".

As the complete description of a personal behavior must include both intrinsic and extrinsic motivations, four justifications are presented below as to why this study incorporates causal attributions in the ECM. First, despite the ECM being based on the central role of satisfaction, the interrelationship between satisfaction and actual usage is weak (Eggert & Ulaga, 2002). Second, attribution theory suggests the complementary response styles, the elements that Oliver & Desarbo derived from the attribution theory to provide a wider range of determinants for the satisfaction, besides the expectancy disconfirmation paradigm (Oliver & DeSarbo, 1988). Third, the attribution theory provides a useful framework for explaining consumers' reactions to a product as either a success or a failure following the initial decision-making (Folkes, Koletsky, & Graham, 1987; Oliver & DeSarbo, 1988; Weiner, 2000). Fourth, the impact of different attributions on satisfaction and behavioral intention varies (Tsiros, Mittal, & Ross, 2004). The attribution theory can potentially contribute to IS disciplines through the study of continuance or discontinuance of IS usage (Rozell & Gardner, 2000). Finally, the perceived locus of causality was found to significantly influence the initial adoption and experienced usage of IS (Malhotra, Galletta, & Kirsch, 2008).

Shee & Wang (2008) found e-learning, as different from general IS, to be a highly user-oriented system that focuses on the content and how it is presented. The nature of e-learning is such that it offers instructors and learners "possibilities", rather than a "ready to use" resource (Sorebo et al., 2009). While general IS elicits performance from individual users, e-learning is based on the cooperation between instructors and learners. Furthermore, the outcome of using an e-learning system may need a longer time period and, therefore, the e-learning system is deemed more suitable for continuing studies. In this regard, the key objectives of this study include: 1) extending the theoretical development of the ECM by incorporating causal attributions; and 2) understanding the determinants of continuing usage of the web-based learning system (WLS).

2. Literature review

2.1. Web-based learning

For web-based learning, the Internet is used as the delivery medium for class discussions and activities (Coppola, Hiltz, & Rotter, 2002). With the Internet, learners have greater flexibility and convenience when accessing required information (Buckley, 2003). Rosenberg (2001) described the benefits of e-learning as: 1) lower costs, 2) more dependable access to new information, 3) a "just-in-time" learning approach, 4) building communities, and 5) providing increasingly valuable learner services. Buckley (2003) found no differences in student outcomes in examination scores and course grades between traditional classroom-based and web-supported courses. This finding implies that web-based learning can provide equal results, with the added flexibility and convenience of delivering tuition and resources online.

Generally, the term "e-learning" covers a variety of electronic delivery media. Three fundamental criteria for e-learning are that: 1) it is networked, which makes it capable of instant updating, storage/retrieval, distribution, and sharing of instructions or information; 2) it is delivered to the end user via a computer using standard Internet technology; and 3) it focuses on the broadest view of learning that goes beyond the traditional paradigms of training (Rosenberg, 2001). In an e-learning setting, it is often assumed that learners can self-judge their own needs in terms of material, time, or pace of learning. This implies the WLS is designed to be flexible to meet learners' needs. However, various e-learning systems have been developed, and not all of these miscellaneous tools are necessary to optimize the grasp of new information (Clarebout & Elen, 2006). There are many factors that cause dissatisfaction to both teachers and students, such as the lack of cues, lack of face-to-face contact, nonverbal communication, isolation, and problems with hardware/software or network connectivity (Buckley, 2003). Additionally, the teachers' roles (i.e. cognitive, affective, and managerial), which may influence students' learning outcome, may change when teachers change their teaching models (Coppola et al., 2002). Since the contents of WLS have to be provided by the teachers, understanding determinants of teachers' continuance behavior provides insights into learning effects and appropriateness of various tools (Clarebout & Elen, 2006).

Castro Sánchez and Elena (2011) find that teachers' perception about the change of teaching strategy and workload impacts their use of e-learning, since teachers are required to put in extra effort to create digital teaching materials. Thus, teachers' self-efficacy may influence their workload perceptions. Other than self-efficacy, Sun, Tsai, Finger, Chen, and Yeh (2008) summarized factors of user characteristics that affect e-learning usage as age, gender, experience, users' temperaments (guardian, idealist, artisan, and rational), scholastic aptitude, epistemic beliefs, teaching styles and cognitive modes, etc.

2.2. Expectation confirmation model

The expectation confirmation is commonly used to address the question of how consumers summarize their experiences which then influences their subjective evaluation of satisfaction (Oliver, 1993). Oliver (1980) concludes that satisfaction judgments can be identified in ECT. That means expectations provide a baseline to gauge the level of satisfaction, as consumers form expectations about the specific product or service prior to purchase; perceived performance may either confirm or disconfirm pre-purchase expectations; and satisfaction is positively affected by expectations and positive disconfirmation. Additionally, Oliver (1980) further suggests that ECT can be expanded by including the factor of repurchase intention.

Although ECT has been widely used to study consumer satisfaction, post-purchase behavior, and service marketing (Bhattacherjee, 2001; Oliver, 1980; 1993), Bhattacherjee (2001) highlighted three major issues of ECT. First, consumers' consumption experience may change their expectations, and these changes may impact their subsequent cognitive processes. Second, ECT studies involved varying and conflicting

conceptualizations of satisfaction constructs, which could reduce the predictive ability of ECT. Third, differing conceptualizations of expectation have emerged across ECT studies. Some researchers explain expectations as pre-consumption beliefs about overall performance and operationalize it as anticipated performance. However, others define expectations as the beliefs about the level of production or service attributions, and operationalize it as either individual beliefs or the summation of such beliefs. Therefore, Bhattacherjee saw it as necessary to modify ECT to evaluate IS continuance.

To adapt ECT for IS contexts, Bhattacherjee (2001) used the perceived usefulness variable of the Technology Acceptance Model (TAM) (Davis, 1989) to modify ECT into an ECM of IS usage (see Fig. 2), in an effort to examine cognitive beliefs that influence an individual's intention to continue usage of an IS. In TAM (Davis, 1989), behavioral intention is a function of attitude and perceived usefulness. Attitude mediates the link between behavioral intention and beliefs about perceived ease of use and perceived usefulness. Perceived ease of use is a direct determinant of perceived usefulness. Bhattacherjee (2001) suggested that a user's decision to continue usage of IS applications is similar to a consumer's decision to continue purchasing a product or service because both decisions follow an initial (acceptance or purchase) decision, both are influenced by the initial use experience, and both can potentially lead to an ex-post reversal of the initial decision.

In the ECM, users record an initial expectation based on prior IS usage, which then leads them to use the IS again. Subsequently, users are able to develop their perceptions about usefulness of the IS. Next, the users can assess their original expectations to establish their level of satisfaction with the IS. Finally, the emotional intensity and quality of satisfaction or dissatisfaction experienced by users drives them to either continue or discontinue their usage of the IS in question.

Thus, the ECM differs from ECT in three ways (Hayashi et al., 2004). First, while ECT examines both pre-consumption and post-consumption variables, the ECM focuses only on post-acceptance variables. ECM regards effects of any pre-acceptance variables as already captured in both (dis)confirmation and satisfaction constructs. Second, ECT only examines the effect of pre-consumption expectations rather than post-consumption expectations, while ECM amends the ECT to include ex-post expectation. Third, the ex-post expectation is represented by perceived usefulness in the ECM.

Based on the perspective of the organismic integration theory, Malhotra et al. (2008) classified users' motivation associated with IT acceptance and continued usage in intrinsic perceived locus of causalities (PLOC) and extrinsic (i.e. external, introjected and identified PLOC). External PLOC represents an important intermediate step through which social influences are internalized and integrated; introjected PLOC is the conflict between perceived external behavioral influences and personal norms and values. Identified PLOC represents users' actions based on personal values and meaningful goals and outcomes. Intrinsic PLOC is based on what comes instinctively and spontaneously and is typically characterized by self-perceived reasons for behavior performed simply for its inherent enjoyment or fun. Oliver (1980) claimed that satisfaction is based on perception of values derived from evaluation of meaningful outcomes. Therefore, satisfaction can be seen as one kind of identified PLOC that belongs to extrinsic motivations. Additionally, for achieving the value outcome, Malhotra et al. (2008) regarded both performance and perceived usefulness as extrinsic motivations.

Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance". Seddon (1997) suggests that in post-usage the words "would enhance" in Davis's definition need to be replaced with "has enhanced". Perceived usefulness in Bhattacherjee's ECM is derived from the (dis)confirmation of expectations and on the performance enabled by past consumption. This contrasts with Seddon's (1997) argument that "no matter how good a system has been in the past, past benefit is not a sufficient condition for future use; future use must be based on expectations of future benefit," Kim and Malhotra (2005) asserted that it is plausible that initial acceptance affects later continuance. In addition, both satisfaction and perceived usefulness are extrinsic motivations, and people have both intrinsic and extrinsic motivations associated with their IT acceptance and continued usage (Malhotra et al., 2008). Sorebo et al. (2009) found that intrinsic motivation can be useful for explaining e-learning continuance intention. In consideration of the above arguments, the factor of intrinsic motivation must be considered and further testing that incorporates perceptions of perceived usefulness in relation to IS continuance is necessary.

2.3. Attribution theory

This study incorporated causal attributions into the ECM to supplement its explanation of IS continuance. The concept of causal attributions was derived from the attribution theory introduced in 1958. It is of interest to social psychologists, cognitive psychologists, clinical psychologists, personality psychologists and educational psychologists, but is relatively absent in consumer psychology (Weiner, 2000). Attribution theory views the purchase outcome as a product of evaluations of success or failure (e.g. good and bad purchases), which then elicit the causal inferences (Oliver & DeSarbo, 1988). The attribution theory is used to demonstrate why a person believes an event occurred and provides the motivation for decisions and actions (Karsten, 2002). The attribution theory is regarded as a cognitive theme proposed as a satisfaction determinant (Oliver, 1993). It is not in conflict with expectation (dis)confirmation but is complementary to expectancy (dis) confirmation paradigm (Oliver & DeSarbo, 1988).

The attribution theory focuses on explaining "why a particular event, state, or outcome has come about and the consequences of phenomenal causality" (Weiner, 2000) and has provided insight into individuals' rejection of IT, failed IS projects, and reactions to an IS (Karsten, 2002). Russell (1982) perceived the causal attributions for success to be internal, stable and controllable. However, among Weiner's four most important factors affecting attributions ability, effort, task difficulty, and luck, the latter two are neither stable nor controllable. Weiner (2000) found that whether the consequence is positive or negative, the consumer would reach an attributive conclusion regarding the purchase outcome and this conclusion surely influences subsequent consumer behavior.

Causal attributions have a role in post-initial outcome decision-making (Weiner, 2000). Consequently, causal attributions intervene and exert their influence after a product-related outcome occurs, prior to the next purchase decision (Weiner, 2000). Attribution theory offers insights into both self and social perception to explain individual behavior. Social perception focuses on causes of the observed behavior of others. For example, IS professionals may infer that a successful outcome will result from good system design, while users may regard a successful outcome as resulting from their expertise or effort (Karsten, 2002).

The original dimensions of causal attributions were suggested by Weiner et al. (1971). They specified two primary causal dimensions: locus of control (now termed causal locus), and stability. In 1974, Weiner added a third dimension, labeled "intentionality", which was later reconceptualized as "control causality" (Weiner, 1979). In general, Weiner's three-dimensional taxonomy of causal locus (internal/dispositional or external/task situation), controllability, and stability (variability) is well supported, and the Causal Dimension Scale (CDS) developed by Russell (1982) is a popular method for measuring general causalities (Oliver & DeSarbo, 1988; Russell, 1982; Weiner, 2000). However, the CDS had obliqueness between locus and control measurements in a field setting, and that the reliability for the control scale was low (Watkins & Cheng, 1995), resulting in the causal locus getting much research attention. While the CDS is commonly used to measure general causal attributions, causes of success or failure are many and varied such as ability, individual mood, task difficulty, luck, environmental constrains, and organizational factors (Johnston & Kim, 1994). CDS and its followers have offered limited explanination of causes of an event; it is still not fully tailored for web-based learning settings.

3. Research methodology

3.1. Model and hypotheses

The attribution theory assumes that persons have an innate need to understand the causes of events around them. Changing the attributions of causes affect intrinsic motivation and expectation change (Johnston & Kim, 1994). As aforementioned that ECM ignore the intrinsic motivation, this study incorporates causal attributions into the ECM (see Fig. 1) to strengthen the explanation of phenomenal causality within the actual continuance behavior for the following reasons:

1) Performance, perceived usefulness, and satisfaction are some types of extrinsic motivations. However, people simultaneously have both intrinsic and extrinsic motivations associated with behavioral outcomes (Malhotra et al., 2008).
2) The effect of satisfaction on actual behavior is questioned (Eggert & Ulaga, 2002; Weiner, 2000), and yet this effect impacts the ability of ECM to explain consumers' subsequent behavior.
3) Although perceived usefulness has a strong, persistent effect on user intention, it follows a temporal pattern in the causal association predicted from the TAM. However, the temporal changes of TAM constructs do not explain why or how these constructs change over time or the emergent factors driving such change (Bhattacherjee & Premkumar, 2004).
4) Since IS satisfaction may have salient predictors in addition to those identified by ECT (Bhattacherjee, 2001), it may partly determined by personal characteristics or positions, such as managerial, professional, and operating positions (Doll, Deng, Raghunathan, Torkzadeh, & Weidong, 2004) which confirms Oliver and DeSarbo's (1988) complementary response styles for expectation (dis)confirmation as determinants of satisfaction.
5) Attribution theory has provided a useful framework for explaining consumers' reactions to product success or failure (Folkes et al., 1987; Oliver & DeSarbo, 1988). It could potentially contribute to IS research and practice by providing insights into users' post behavior (Rozell & Gardner, 2000).
6) The ECM is used to explain post-usage, and similarly, attributions are appropriate for studying post-initial outcome decision-making (Weiner, 2000).
7) Attributions are found not only to have a direct effect, but also an indirect effect, on the intention to repurchase a product (Folkes et al., 1987). The interrelationships between various attributions and their effects on satisfaction and behavioral intention have been found to differ (Tsiros et al., 2004).

The refined model comprises five constructs named (dis)confirmation, perceived usefulness, user satisfaction, causal attributions, and behavioral intention of WLS continued usage (see Fig. 1). As (dis)confirmation affects the overall internal/external attribution styles (Girodo, Dotzenroth, & Stein, 1981), expectation (dis)confirmation may influence attributions' choices. Further, Ferrin and Dirks (2003) suggested that users select the process and interpret information as part of the causal attribution process that creates different perceptions of usefulness. Various causal attribution types influence satisfaction judgments differently (Tsiros et al., 2004), such as the factors aforementioned in the section 2.1 and situational factors (Doll et al., 2004). Additionally, different causal attribution types have been found to exert different influences on behavioral intentions (Malhotra et al., 2008; Tsiros et al., 2004). Malhotra and Galletta (2005) identified that a user's commitment to use IS, emanating from internal and/or external motivation, may influence the initial adoption and extended usage.

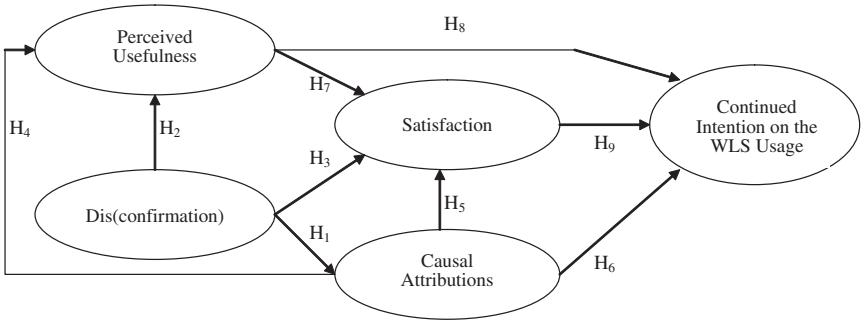

Fig. 1. Proposed research model for e-learning continuance.

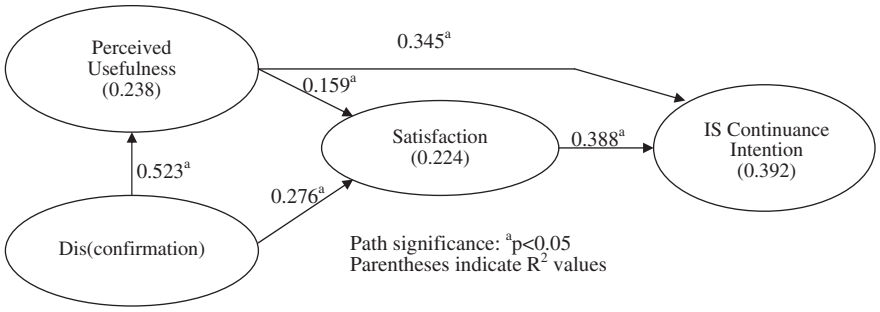

Fig. 2. Path analysis of initial ECM.

In the initial ECM model, relationships among constructs of (dis)confirmation, perceived usefulness, user satisfaction, and behavioral intention were generally verified. Since the e-learning setting is different to general IS usage as mentioned in Section 1, this study verified the initial ECM in the e-learning setting again. The following hypotheses were then used to test the refined research model and to clarify the determinants of behavioral intention of WLS continued usage.

H_1: The (dis)confirmation of academic teachers' expectations has a significant effect on causal attributions of the success of WLS.
H_2: The (dis)confirmation of academic teachers' expectations has a significant effect on their perceptions of usefulness of WLS.
H_3: The (dis)confirmation of academic teachers' expectations has a significant effect on their satisfaction with WLS.
H_4: Academic teachers' causal attributions have significant effects on their perception of usefulness of WLS.
H_5: Academic teachers' causal attributions have significant effects on their judgments of satisfaction with WLS.
H_6: Academic teachers' causal attributions have significant effects on their intention to continue to use WLS.
H_7: Academic teachers' perception of the usefulness of WLS has a significant effect on their satisfaction with WLS.
H_8: Academic teachers' perception of the usefulness of WLS has a significant effect on their intention to continue to use WLS.
H_9: Academic teachers' satisfaction has a significant effect on their intention to continue to use WLS.

3.2. Measurement scales

The scales concerning (dis)confirmation and continued intention of WLS usage were based on Bhattacherjee's (2001) with 3 items. To measure perceived usefulness, we used an adaptive scale developed by Saadé and Bahli (2005) for an e-learning context with 3 items. As the scales of satisfaction may be cognitive, affective, or both, Eggert and Ulaga (2002) declared that the feeling of satisfaction essentially represents an affective state of mind. Meanwhile, Babin and Griffin (1998) had suggested that satisfaction itself is purely emotional. Therefore, satisfaction would be viewed only as affective in this study; the emotion scale of satisfaction suggested by Oliver (1980) was adopted with 5 items. Three items were used to measure the continuance of using the WLS.

To identify detailed causalities of successful WLS, a scale of causal attributions was developed according to procedures proposed by Johnston and Kim (1994). First, 20 teachers were interviewed using an open-ended questionnaire to elicit their thoughts concerning attributes that led to success in their usage of WLS during the previous semester. Those teachers' answers then were coded into 30 causes and were reviewed by 10 teachers who had more than five-year experience in using the WLS to confirm those 30 coded causes under the schema of "Teaching and Learning Environment" (i.e. content, format, pedagogy, and infrastructure) (Pahl, 2003). The experienced interviewees also suggested six new causes (in addition to the 30 coded causes; see Appendix A). The 36 coded causes were then content analyzed by two PhD students majored in Management Information System (MIS) independently. The differences in classifications of coded causes were resolved through discussion among for the researchers.

The reliability of content analysis of the causal instrument was checked with the inter-rater agreement method and AC_1 statistic test (Gwet, 2002). The inter-rater agreement on classifying 36 causes was 0.942 and the AC_1 statistic was 0.913 for the success of WLS usage. Both content analysis showed the interviewees' responses to be reliable in that they exceeded the usual standard of 0.70 (De Wever, Schellens, Valcke, & Van Keer, 2006). After the initial questionnaire was developed, pretest and pilot test were conducted to improve reliability and validity of the instrument. Five PhD students, one associate professor, and one professor participated the retest, and all of them were experts in WLS and applied WM in MIS, business or computer science courses. A discussion was raised after the pretest to collect feedback on the length of the scales, the format of the scales, clarity on the wording of questions, and the adequacy of the item sequence of the scales. For the pilot test, a convenient sample of 58 teachers from a local university, experienced in use of WM was obtained with 45 responses returned. After the pilot test, the number of items was trimmed from the original 36 causes to 21 with a Cronbach's alpha value of 0.866.

The final questionnaire contains two parts. The first part has 10 questions aimed at identifying the WLS experience and the basic information concerning the responders and the second part consists of 35 items aimed at probing the variables of each of the constructs of the research model. The questions of second part were designed with seven-point Likert scale in which "one" represents strongly disagree and "seven" represents strongly agree.

3.3. Data collection procedure and sample

This study used Wisdom Master (WM) as researched tool. In Taiwan, WM has market share of over 70% is claimed by the company and has been checked by this study based on 163 school portals before the study. More than 30,000 students have gained their recognized

credits through WM. Primary functions of WM are similar to that for most of the WLS. However, WM was the first e-learning system to meet the standard of Run-Time Environment Conformance of the Sharable Content Object Reference Model (SCORM) 1.2 locally. That is why it is popular and has high market shares of the e-learning platform in Taiwan.

The name list of schools that purchased the WM was offered by the company. An invitation letter was then sent to ask each school to participate our study. Seventy two implemented schools agreed to participate but only 49 schools released the name list of their teachers who registered in WM. A guest account of WM was given by those schools to observe the course activities for one month to identify whether those registered teachers had in fact used WM in their teaching or not. The email addresses of those active teachers were got from their teaching website and a questionnaire was sent to them by email. The respondents returned the email survey voluntarily. A statement clearly stated that participants could stop the session at their choice without any obligation on the cover letter of the questionnaire.

825 questionnaires were delivered to those teachers who had used WM for course activities in 48 of the schools (excluding one school for which the pilot test was conducted). There were 144 complete questionnaires and were used for further analysis, with a respondent rate of 17.45%. As aforementioned, WM is the most popular WLS in Taiwan and has users distributed through out the entire island. The Taiwan island is divided into three major areas, i.e. northern, central and southern Taiwan. The responses for each of the three areas were about the same: northern Taiwan 34.02%, central Taiwan 29.17%, and southern Taiwan 36.80%. Therefore, we believe the sample is reasonably representative.

4. Data analysis and results

Statistical tools SPSS 11.0 and LISREL 8.30 were used for data analysis. First, demographic data were summarized by descriptive statistics. Second, exploratory factor analysis (EFA) was used to refine the initial instrumentation followed by ANOVA analysis to test homogeneity of various teaching models. Finally, this study used confirmatory factor analysis (CFA) to approve the scales and structural equation modeling (SEM) to test the proposed hypotheses.

4.1. Demographic analysis

Among the 144 respondent WLS users, majority was male (68.06%), aged between 31 and 50 (89.58%), with a PhD (62.5%) degree, and ranked as junior faculty (lecturer or assistant professor, 64.59%). Continued users of WLS accounted for 77.08% of the 144 respondents 63.89% were applying WLS to 1–2 courses, 82.64% reported successful usage, and 87.5% were with less than three years of experience of WLS. About one fifth (22.22%) of the respondents used multiple teaching models (MTMC) with WLS simultaneously in different courses and only 4.17% had experience of using e-learning systems other than WM (Table 1).

22.92% of respondent had not applied WLS for the semester when this study was conducted. The profile of users who had discontinued usage of WLS was younger than 50, with PhD degree, and rank above lecturer (see Table 2). There was no gender difference in users who had discontinued WLS. The possible reasons are that the interface of WM is friendly enough, so aged teachers continue to apply WLS in their teaching. While those ranked above lecturer had other obligations in research and administration and, therefore, they tended to discontinue WLS in their teaching. Interestingly, 68% (17/25) of those who experienced failure in applying WLS would continue using the WLS. A further analysis was conducted to reveal the profile of this group of teachers.

4.2. ANOVA analysis

This study used ANOVA analysis to examine the homogeneity of measured variables under different teaching models (i.e. distance learning, blended learning, supportive teaching, and MTMC). The results of the ANOVA analysis are presented in Table 3, which shows no significant differences across the different teaching models. Therefore, all the 144 respondents were used for further statistical analysis of CFA and SEM.

Table 1
Demographic analysis.

Item	%	Item	%	Item	%
Gender		Position		How long have you used WLS?	
Male	68.06	Assistant instructor	2.08	Less than one year 53	36.81
Female	31.94	Lecturer	34.03	1–3 years 73	50.69
Age		Assistant professor	30.56	4–6 years 16	11.11
Below 31 years	2.08	Associate professor	26.39	Above 6 years 2	1.39
31–40 years	47.22	Professor	6.94	No. of courses on WLS	
41–50 years	42.36	Teaching models of WLS		1–2 courses	63.89
Above 50 years	8.34	Distance learning	29.17	3–4 courses	29.86
Highest level of education		Blended learning	15.28	5–6 courses	4.17
College/university	0.69	Supportive teaching	33.33	Above 6 courses	2.08
Master's degree	36.81	MTMC	22.22		
PhD	62.50				
Apply WLS for this semester		Experience with WLS		Number of WLSs used?	
Yes	77.08	Success	82.64	One kind	95.83
No	22.92	Failure	17.36	Two kinds	4.17
Sampling size: 144					

Table 2
Demographic comparisons between continuance and discontinuance.

	No.	Failure	Success	Mean of CI	Age			Gender		Educational degree			Position				
					Below 41years	41–50	51–60	Male	Female	College/ university	Master's degree	PhD	Assistant instructor	Lecturer	Assistant professor	Associate professor	Professor
Discontinuance	22.92%	32%	21.01%	5.33	23.94%	26.23%	0%	23%	21.74%	100%	18.87%	24%	33.33%	18.37%	25%	21.05%	40%
Continuance	77.08%	68%	78.99%	5.8	76.06%	73.77%	100%	77%	78.26%	0%	81.13%	76%	66.67%	81.63%	75%	78.95%	60%
Ratio					1:3.2	1:2.8		1:3.3	1:3.6		1:4.3	1:3.1	1:2	1:4.4	1:3	1:3.8	1:1.5
No.	144	25	119		71	61	12	98	46	1	53	90	3	49	44	38	9

4.3. Item analysis and reliability estimates

While unrepresentative items lead to factor analysis producing extra dimensions without a common core, this study uses the item-to-total correlation to purify the scales before undertaking the required factor analysis. It is suggested that the item-to-total correlation below 0.3 be eliminated (Kumar, Scheer, & Steenkamp, 1995). Four items were eliminated by the item-to-total correlation in this study.

Among many techniques of estimating reliability, the Cronbach's alpha coefficient makes the least restrictive assumptions and thus is considered the best way of ensuring internal consistency reliability (Bollen, 1989). Cronbach's alpha value of 0.7 or greater indicates high reliability while a value from 0.35 to 0.7 is moderate reliability, and lower reliability if less than 0.35 (Guieford, 1965). The Cronbach's alpha value of this study is over 0.5 which is acceptable for an exploratory study (see Appendix B).

4.4. Validity estimates

Two types of validity are proposed for this study (Bollen, 1989): 1) content validity, which indicates whether the items appear to measure what they are intended to measure; and 2) construct validity, which measures whether the item scores intercorrelate with other measures as expected. The content validity was done by the pretest that mentioned in Section 3.2. Both Exploratory Factor Analysis (CFA) and Confirmatory Factor Analysis (CFA) are commonly used for factor analysis. The EFA is an ex-post concept used to define the underlying constructs. Conversely, CFA is an ex-ante concept used to validate scales measuring specific constructs (Hair, Anderson, Tatham, & Black, 1998). This study tests the scales through EFA, followed by CFA to verify the construct validity.

Construct validity is usually measured by convergent and discriminant validity (Sethi & Carraher, 1993) with the factor loadings gained from EFA. Two accepted rules are suggested by Hair et al. (1998): firstly, to delete items whose factor loadings are less than 0.5. And the second is to delete items with factor loadings of greater than 0.5 on two or more factors. The lower the number of items, the higher will be the discriminant validity. As shown in Appendix B, factor loading values of all items was greater than 0.5. Meanwhile, no items with a factor loading of greater than 0.5 appeared twice, across multiple factors, demonstrating that the scales had good construct validity. Additionally, causal attributions consisted of six items after EFA, which were classified into two dimensions labeled "teacher literacy" and "assisted ability of WLS". The sample of 144 was not large enough to test the full measurement model given the needed ratio of variable numbers relative to the sample size (1:10). For such a small ratio, Sethi and Carraher (1993) have suggested that the approach of limited information can be used. Therefore, this study conducted a second-order CFA to ensure that causal attributions could be directly measured by means of "teacher literacy" and "assisted ability of WLS", with RMSEA, with 90% confidence intervals, the value of 0.05 is suggested to be a good fit. Hu and Bentler (1999) recommended a higher standard of accepting models with CFI equal to or greater than 0.96, and RMSEA equal to or less than 0.06. The model fits of second-order CFA are $\chi^2 = 9.495$ (df = 7, $p = 0.219$); $\chi^2/df = 1.356 < 3$; GFI = 0.978; AGFI = 0.934; NFI = 0.939; NNFI = 0.962; CFI = 0.982; IFI = 0.983; RMSEA = 0.052, indicating a good model fit. CFA was then used to test the construct validity of the measurement model, as described below.

1) Convergent validity: three criteria are suggested for assessment of convergent validity (Fornell & 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 (Jőreskog & Sőrbom, 1993). 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 4 below, and show a good convergent validity.

Table 3
ANOVA analysis of teaching models.

Variables	Mean				*F*-value	Sig.	Homo-geneity	Sig.
	Distance learning ($N = 42$)	Blended learning ($N = 22$)	Supportive teaching ($N = 48$)	MTMC ($N = 32$)				
CF	4.818	4.849	4.285	4.656	2.060	0.108	1.461	0.228
TL	5.730	5.500	5.743	5.552	0.491	0.689	1.166	0.325
AA	5.516	5.167	5.528	5.458	0.854	0.467	2.084	0.105
CA	5.623	5.333	5.635	5.505	0.777	0.509	0.910	0.438
PU	5.179	5.409	4.948	5.109	0.725	0.538	0.583	0.627
SA	5.167	5.546	5.063	5.813	5.138	0.002	1.583	0.196
CI	5.143	5.318	5.028	5.281	0.548	0.650	2.363	0.074

$P < 0.01$.
CF: Confirmation; TL: Teacher literacy; AA: Assisted ability of WLS; PU: Perceived usefulness; SA: Satisfaction; CI: Continued intention; CA = (TL + AA)/2.

Table 4
Results of convergent validity.

Dimensions	Items	Standardized loading	Standard error	t-value[c] (for λ)	AVE[a]	CR[b]
CF	CF1	0.853	0.094	11.694	0.632	0.837
	CF2	0.740	0.109	9.663		
	CF3	0.788	0.099	10.500		
CA	TL	0.567	0.092	6.141	0.588	0.730
	AA	0.924	0.098	8.783		
PU	PU1	0.773	0.127	9.445	0.596	0.7472
	PU2	0.771	0.101	9.427		
SA	SA1	0.615	0.109	7.420	0.532	0.770
	SA2	0.847	0.090	10.944		
	SA3	0.706	0.081	8.779		
CI	CI1	0.665	0.129	7.973	0.547	0.705
	CI2	0.807	0.094	9.688		

λ = factor loadings relate to the observed variables to the latent variables.
[a] AVE (Average variance extracted): $\rho_v = (\Sigma\lambda^2)/((\Sigma\lambda^2) + \Sigma(\theta))$.
[b] CR (Composite reliability): $\rho_c = (\Sigma\lambda)^2/((\Sigma\lambda)^2 + \Sigma(\theta))$.
[c] $p < 0.01$.

2) Discriminant validity: there are three methods of measuring discriminant validity. Jőreskog and Sőrbom (1989) suggested to test the confidence interval of correlation. When establishing the correlation coefficients among the dimensions by adding or subtracting two standard deviations, the construct is said to have good discriminant validity if its confidence interval does not include '1' (Hair et al., 1998). Table 5 shows that no correlation coefficients, after adding or subtracting two standard deviations, include '1'. This demonstrates good discriminant validity. Secondly, the correlation coefficients among all dimensions must be less than 0.85. Table 5 shows that all correlation coefficients among the dimensions used in this study were less than 0.85, which represents good discriminant validity. Thirdly, the AVE value of one dimension should be higher than the square of correlation coefficients between it and any other dimension (Fornell & Larcker, 1981). Table 5 shows that all values of AVE fitted this condition, implying good discriminant validity. For example, in Table 5, the lowest AVE value is 0.532, and the maximum value of correlation coefficients is 0.535 (the square is 0.286).

4.5. Hypothesis testing

For a full latent model, Bollen (1989) proposed a two-stage analysis. The first, stage uses CFA to estimate parameters of the measurement model. Second, path analysis is used to test the structural model. Each indicator of this study was modeled reflectively (as in CFA), and the five constructs were linked through the nine hypotheses, H_1 to H_9 (see Fig. 1). The model's estimation was performed using the maximum likelihood approach.

Although coefficients, standard errors, and calculated t-values are commonly used in examining structural model (Hair et al., 1998), evaluations of model fit can be taken from various criteria of model fit. The common suggested criteria for estimating overall model fit of the ECM and modified ECM are listed in Table 6, such as χ^2, χ^2/df, the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), normed fit index (NFI), nonnormed fit index (NNFI), incremental fit index (IFI), root mean square residual (RMR), and root mean square error of approximation (RMSEA).

Among these indicators, χ^2 is commonly used to test the model fit, as it is sensitive to sample size. Thus, as sample size increases, rejection probability also increases. Given that χ^2 is unstable and dependent on the number of samples (Jőreskog & Sőrbom, 1989), it is recommended that χ^2/df is less than 3 for a good fit. Although the overall coefficient of determination (R^2) is calculated to measure the entire structural equation, no statistical significance test can be performed for it. Therefore, the relative measurement of fit is suggested for each structural equation (Hair et al., 1998). Some approaches are suggested for evaluating different models. The overall model fit in absolute terms is measured. RMR can be used to compare different models based on the same data set (Jőreskog & Sőrbom, 1989). As an RMR value of close to zero shows a good model fit, values of GFI and AGFI from 0.80 to 0.89 are regarded as reasonable and it is a good model fit if their value is greater than 0.9 (Jőreskog & Sőrbom, 1993). Other indicators, such as NFI, NNFI, CFI and IFI, are used to compare the goodness-of-fit between the theoretical model and the independent model. Among them, values of INI and NNFI may be close to or greater than '1' (Bollen, 1989). Therefore, this study concluded that all goodness-of-fit indices of both initial and modified ECM exceeded recommended levels. All metrics provided evidence that both models demonstrated a good fit to the observed data (see Table 6). Thus, the suggested hypotheses for both models were verified (see Figs. 2 and 3).

Table 5
Correlation among latent variables.

	CI	SA	PU	CF
SA	0.500*			
PU	0.535*	0.371*		
CF	0.447*	0.437*	0.488*	
CA	0.413*	0.225*	0.386*	0.244*

AVE: CI = 0.547, SA = 0.532, PU = 0.596, CA = 0.588, CF = 0.632.
*$P < 0.01$.

Table 6
Comparison of model fit between initial ECM and modified ECM.

Indicators	Suggested value	ECM		Modified ECM	
		Values of indicator	Good fit?	Values of indicator	Good fit?
χ^2	Insignificant	$\chi^2 = 3.223$ (df = 1, $P = 0.0726$)	Yes	$\chi^2 = 2.413$ (df = 1, $P = 0.120$)	Yes
χ^2/df	<3	3.223	No	2.413	Yes
GFI	>0.9	0.989	Yes	0.993	Yes
AGFI	>0.9	0.890	No	0.900	Yes
NFI	>0.9	0.978	Yes	0.988	Yes
NNFI	>0.9	0.907	Yes	0.923	Yes
IFI	>0.9	0.985	Yes	0.993	Yes
RMR	<0.05	0.038	Yes	0.027	Yes
RMSEA	<0.05	0.124	No	0.099	No

As shown in Figs. 2 and 3, the path significances and R^2 value of each dependent variable was examined. For the initial ECM, the path was significant at $p < 0.05$. Intention to continue WLS usage was directly influenced by satisfaction ($\beta = 0.388$) and perceived usefulness ($\beta = 0.345$). Similarly, (dis)confirmation also showed an indirect effect on WLS continuance intention ($\beta = 0.107$) by the satisfaction construct ($\beta = 0.180$) and the perceived usefulness construct. Direct influence on satisfaction was found by both (dis) confirmation ($\beta = 0.276$) and perceived usefulness ($\beta = 0.159$), while perceived usefulness was directly influenced by (dis)confirmation ($\beta = 0.523$). In addition, the explained R^2 of WLS continuance intention, satisfaction and perceived usefulness were 39.2%, 22.4%, and 23.8% respectively.

For the modified ECM, excluding hypothesis five, all hypotheses were significant at $p < 0.05$. Intention to continue WLS usage was seen to be directly influenced by satisfaction ($\beta = 0.350$), perceived usefulness ($\beta = 0.268$), and causal attributions ($\beta = 0.303$). In addition, causal attributions also had an indirect effect on WLS continuance intention ($\beta = 0.042$) via the satisfaction construct, the perceived usefulness construct ($\beta = 0.122$), and path of perceived usefulness–satisfaction constructs ($\beta = 0.021$). Similarly, (dis)confirmation also showed an indirect influence on WLS continuance intention ($\beta = 0.092$) via the satisfaction construct, via the perceived usefulness construct ($\beta = 0.112$), via the causal attributions construct ($\beta = 0.069$), through the path of the causal attributions-satisfaction constructs ($\beta = 0.100$), through the path of the perceived usefulness-satisfaction constructs ($\beta = 0.190$), and through the path of the causal attributions-perceived usefulness-satisfaction constructs ($\beta = 0.019$). Satisfaction was directly influenced by (dis)confirmation ($\beta = 0.264$) and perceived usefulness ($\beta = 0.129$), and was indirectly influenced by causal attributions ($\beta = 0.059$) and (dis)confirmation ($\beta = 0.054$) via perceived usefulness. Perceived usefulness was directly influenced by (dis)confirmation ($\beta = 0.419$) and causal attributions ($\beta = 0.455$). The causal attributions were influenced by (dis)confirmation ($\beta = 0.227$). In addition, the explained R^2 of WLS continuance intention, satisfaction, perceived usefulness, and causal attributions were 43.8%, 23.3%, 32.3%, and 9.9% respectively.

5. Discussion

Results of the path analysis indicated that the modified ECM provides somewhat better predictive power relative to the initial ECM, i.e. $R^2_{PU} = 0.238$, $R^2_{SA} = 0.224$, and $R^2_{CI} = 0.392$, compared with $R^2_{PU} = 0.323$, $R^2_{SA} = 0.233$, and $R^2_{CI} = 0.438$ for the modified ECM. In a setting where both models exhibit a reasonable fit to the data and explain continued intention to a similar extent, other criteria are suggested to determine the 'best' model (Taylor & Todd, 1995). Commonly, given equivalent fit statistics and explanatory power, the most parsimonious model, preferred as the 'best', is that which relies on the smallest number of predictors for a good prediction (Bagozzi, 1992). However, Taylor and Todd (1995) are of the view that determination of the 'best' model depends on the purpose for which the model is used. Thus, both parsimony and its contribution to understanding a phenomenon should be examined when evaluating models.

In this study, the difference of parsimony between the 4-variable initial ECM and the 5-variable modified ECM may not be significant. Furthermore, the modified ECM provides understanding of both intrinsic and extrinsic motivations associated with continued intention to

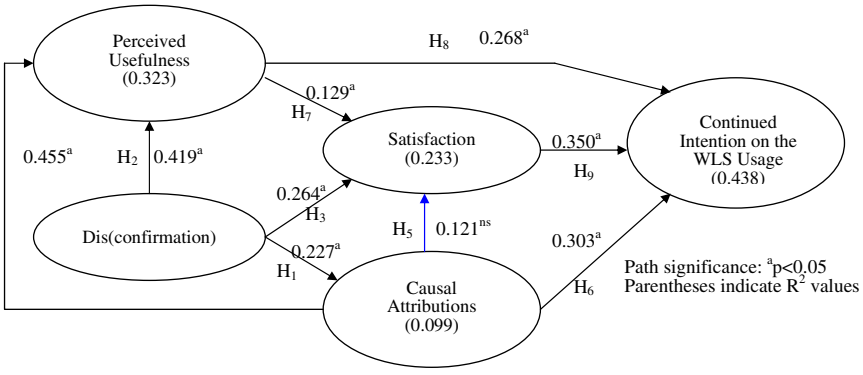

Fig. 3. Path analysis of modified ECM.

use WLS which increase the explanatory power under lower effects of satisfaction and perceived usefulness on continued intention of IS usage. It identifies specific beliefs of causal attributions that can be targeted by system designers or managers in seeking to encourage users' continuance of WLS. Thus, in our view, the modified ECM is preferable to the initial ECM.

5.1. Findings regarding demographics analysis

The respondents with a PhD were more than those with a master's degree. The possible reason is that most universities in Taiwan, especially colleges, motivate their faculties to pursue higher degree in order to fulfill the requirement of accreditation. In Taiwan, lecturers with a master's degree often have a teaching orientation while those with a PhD degree are more likely to have research and administration obligations Thus, promotion of WLS should not focus on teachers who possess a PhD only.

Besides, a significant proportion of respondents (33.96% of lecturers, and 33.33% of professors) use supportive teaching models in e-learning courses that underuse the WLS. Based on the first open interviews of 20 teachers for causal attributions about e-learning success, some attributions are the suggested reasons for this. First, teachers are still most used to traditional teaching activities in classroom, and are not familiar with e-learning. Second, e-learning courses take more time and effort than traditional courses in terms of preparation of teaching materials. To overcome this problem, more support and resources need to be provided to teachers willing to use more functions of e-leaning, such as online materials or online instruction. Third, e-learning alters the nature of the interaction between teachers and students, who are not yet familiar with this new style of interaction. The majority of respondents (63.89%) had taken fewer than two courses with WLS. This finding of low adoption levels of e-learning suggests that the e-learning in Taiwan is still at it's infancy stage. Moreover, the e-learning model may not be appropriate for all courses.

As many faculties discontinue usage of e-learning after initial adoption of WLS, it is important to study the causes of continued WLS usage. Excluding assistant instructors and professors (given their low numbers), teachers who have had a successful experience are tending towards continuance and yet those who experienced failure are also tending to continue their usage. This finding is inconsistent with Dixon, Spiro, and Jamil (2001). If people had causal attributions of failure, it would lead to subsequent failure, and thus, they would tend to discontinue their usage of an IS. In this study, 82.6% (119/144) of respondents had successful experience of WLS. Among them, 79% (94/119) were tending towards continuance and 21.01% (25/119) had discontinued the use of WLS. Those who discontinued were mostly ranked above lecturer (76%), had less than 3-year experience of WLS (88%), and had applied WLS to only 1–2 courses (84%). Yet, 68% (17/25) of those who experienced failure (17.4%, 25/144), were tending to continue WLS usage. Among them 59% (10/17) ranked above lecturer, 88% (15/17) had less than 3-years experience of WLS, and 59% (10/17) were applying WLS to 1–2 courses. In other words, those who ranked above lecturer and were applying WLS to fewer courses would discontinue more among the successful users of WLS and would continue less among the failure users of WLS. Those who had less experience of WLS would tend to continue, irrespective of whether they experienced success or failure in using WLS. The possible reasons are that lecturers are teaching oriented, and are more willing to apply WLS in their teaching. On the other hand, those who rank above lecturer have other obligations, such as research and administration, and are less willing to apply WLS in their teaching. Those who had less than 3-years experience of using WLS were found unstable, which means this much time to provide incentive to promote use of WLS may be more effective.

5.2. Findings regarding causal attributions with IS continuance

TAM-based studies have frequently viewed continuance behavior as an extension of acceptance. However, how and why initial acceptance evolves into continuance remains unclear (Bhattacherjee & Premkumar, 2004; Kim & Malhotra, 2005). Bhattacherjee (2001) defined perceived usefulness as expectation regarding post-usage, and sought to explain evolution of the expectation of continuance (Bhattacherjee & Premkumar, 2004). However, results of Bhattacherjee's two experiments found inconsistent relationships between perceived usefulness and (dis)confirmation, and between perceived usefulness and satisfaction. Thus, the fact that ECM uses usefulness to measure expectation may ignore the changes in intrinsic motivation during post-usage.

The fact that causal attributions may influence changes in expectation (Johnston & Kim, 1994) explains how expectations change in post-usage. This study demonstrates that causal attributions significantly influence perceived usefulness and continued intention to use IS. The modified ECM can avoid limitations of the initial ECM, and provide an explanation of why and how expectations regarding IS usage may change. Causal attributions may thus contribute to IS research (Rozell & Gardner, 2000) and become a new construct in future studies of IS continuance. Additionally, this study has found that causal attributions do not significantly affect satisfaction but do significantly influence intention to continue to use IS, revealing that causal attributions can improve the explanation of IS continuance. Consequently, causal attributions can improve the ability of satisfaction to explain behavioral aspects of IS usage.

While the initial ECM based on perceived usefulness and satisfaction is limited in explaining IS continuance (Hung et al., 2007), causal attributions can boost its explanatory power. For example, effects of perceived usefulness and satisfaction on continued IS usage intention are clearly reduced from $\beta = 0.345$ to 0.268 and $\beta = 0.388$ to 0.350, respectively. However, R^2 of continued intention of IS usage is improved from 39.2% to 43.8%. According to effects of causal attributions (see Fig. 3), the verified results indicate that incorporating causal attributions into the modified ECM, in order to explain IS continuance, outperforms the initial ECM. The causal attributions can reduce limitations of satisfaction and perceived usefulness in explaining IS continuance by way of its direct effects on continued intention of WLS usage. Based on the above discussion, operating and managing causal attributions are useful for increasing continued usage of e-learning systems.

This study found that the reasons for teachers continuing WLS usage can be classified into two primary subcategories: the ability of WLS to assist teacher. Unlike traditional literacy (ability to read and write), "teacher literacy" in this context is the ability to design and construct on-line teaching materials using the e-learning system, involvement, and time needed to design. The "assisted

ability WLS" includes the customized ability of e-learning systems to support customization of teaching materials and activities and forming a professional knowledge community for teachers to share and discuss course materials. In other words, both teacher ability and the e-learning system account for teachers' causal attributions to further influence their satisfaction and intention to reuse the WLS.

5.3. Theoretical implications

On the basis of the verification and discussion in this study, the modified ECM can be seen to contribute to the body of research on IS continuance. First, based on the perspective of Cook and Campbell (1979), if a study captures effects across diverse subjects in different organizational settings, its external validity increases. This study surveyed the majority of schools in Taiwan which have implemented WM (WLS). Thus, the scale of causal attributions developed in this study can help researchers interested in e-learning better understand teachers' motivations and behaviors toward WLS. Second, the modified ECM provides a basis for theoretical study of WLS continuance, and is useful for research on other forms of IS. Finally, while satisfaction is limited in explaining IS continuance, this study significantly extends existing theories of IS continuance by introducing the role of causal attributions.

5.4. Practical implications

This study has some important practical implications. First, when planning to promote WLS, organizations can predict and explain IS continuance using the modified ECM. University Presidents and WLS designers can benefit significantly from understanding attributional patterns of their users and the forces driving these attributions. Since personal attributions are found to be correlated with WLS outcomes (Hayashi et al., 2004), it is critical for University Presidents and WLS designers to collect and understand attributions of users. University Presidents can develop suitable incentive mechanisms to promote teachers' intrinsic motivations to use e-learning. With understanding of personal attributions of teachers, WLS designers can improve their WLS systems for teachers who have specific attributions. Based on the attributions found in this study, it is suggested that system designers improve the interface of WLS to reduce the time and effort required for teachers to operate the system. Similarly, involvement and sharing of teaching materials can enrich the quality and experience of teaching. University Presidents need to establish a culture that promotes exchange of teaching materials via WLS. Consequently, suggestions to University Presidents are to provide incentive mechanisms, such as monetary compensation to reward teachers' sharing materials, and intrinsic motivations, such as inspiring individual involvement or improving digital materials design and quality to encourage teachers' usage of WLS. Finally, different e-learning systems have different functions, and users do not always select the most appropriate learning programs (Clarebout & Elen, 2006). Therefore, online help is an area that system designers need to concentrate.

5.5. Limitations and future research

This research does suffer from certain limitations. First, this study conducted the survey via email. Although email is a useful tool for expanding the reach of a survey, many teachers chose not to reply because of privacy concerns. Sample bias may result as responding teachers may tend to have a more favorable attitude towards WLS than their peers. In contrast, concerns of teachers regarding privacy may be ignored. Second, individual schools have introduced WLS at different times, possibly as a result of different stages of maturation. However, this study could not accurately identify such differences among the sampled schools. Third, for WM is only one kind of WLS, applying the research results to other WLS platforms should be done cautiously.

A number of future research avenues could be followed, based on the present study. First, in order to generalize the research results, future studies could apply various systems of WLS and explore other factors within causal attributions and additional personal characteristics to obtain a better fitting model. Furthermore, future studies may also include the causes of personal characteristics in the adapted ECM model to further contribute to continuance of WLS usage. Second, this study conducted a cross-sectional survey. However, the causes of teacher behavior need to be viewed via a longitudinal survey. Consequently, future studies might employ a longitudinal survey. Third, the causes of IS success and failure vary, whereas this study focused only on causes of successful IS usage. Future research could, therefore, perhaps focus on causes of failed IS usage as well. Finally, the scale of causal attribution of academic teachers toward e-learning was first developed by this study, so this requires verification by future researchers.

6. Conclusions

Although benefits of e-learning are widely recognized (Saadé & Bahli, 2005), results of this survey revealed that considerable number of teachers discontinue their usage after initial adoption (22.92%). This finding supports our motivation for studying WLS continuance.

The ECM is a popular model for explaining continuance or discontinuance of IS usage beyond the reason-oriented theories (e.g. Theory of Reasoned Action, Theory of Planned Behavior, and TAM) (Hung et al., 2007). This study improved the explanatory power of the initial ECM for explaining e-learning continuance. In detail, this study identified determinants of continued intention to use e-learning system in terms of WLS. Furthermore, the study sought to explain why some users who had initially accepted WLS and were satisfied with their post-usage experience later discontinued because of causal attributions.

The results of the data analysis presented acceptable support for eight of the nine proposed hypotheses. Additionally, the findings revealed that a user's perceived satisfaction with WLS is an important predictor of the intention to continue using WLS. Partial results confirm the findings of Bhattacherjee (2001). However, the causal attributions used in this study can improve the explanatory abilities of

WLS continuance that ECM can't. Besides, Hayashi et al. (2004) suggested that continued usage of e-learning depends on the gap between expectations and post-usage experience. This study also found that perceived usefulness, regarded as post-usage expectations and causal attributions, has a significant effect on continued intention of WLS usage. Concurring with Johnston and Kim (1994), this study identified that causal attributions are change drivers of post-usage experience. Furthermore, both (dis)confirmation and causal attributions were found to significantly affect perceived usefulness. This finding was consistent with some previous studies (Ferrin & Dirks, 2003; Folkes, 1984; Hung et al., 2007). Prior researchers have usually articulated that among users who perceived their past experiences of WLS as successful, were often more willing to use WLS in the future, while those who perceived failure in their past experience tend to discontinue usage. However, results of the survey revealed that whether WLS usage was perceived as success of failure, some users remained interested in continuing WLS usage. Based on these findings, the modified ECM is helpful for future research on the post-usage behavior in the e-learning context.

Furthermore, the modified ECM includes both intrinsic and extrinsic motivations of WLS users, whereas the initial ECM accounted only for extrinsic motivations. Since causal attributions can change post-usage experience, incorporating causal attributions into ECM is beneficial for explaining why some users discontinue their usage of IS even if they had initially accepted it and were satisfied with their usage experience. Thus, this study offers new insights into IS continuance and provides a more complete understanding of continuance behavior for researchers and practitioners alike.

Appendix A

Concerned attributions for success on WLS usage.

No.	Items of causal attributions
1	Accumulating the teaching materials to enrich teaching
2	The convenience of operating WLS (e.g. creating courses, uploading study assignments, print, communicating messages, and downloading materials)
3	User-friendly interface
4	Teachers' teaching habits (e.g. the habit of computerized teaching)
5	Improving the controllability of teaching program
6	Teachers' autonomy of creating courses through the WLS
7	Teachers' ability to design their digital teaching materials well
8	The learning record of (e.g. avoiding the dispute about leaning scores and assignments)
9	The stability of WLS
10	The kinds of courses on WLS
11	The sharing ability of course materials provided by WLS
12	The ability of WLS to ensure the safety of teaching materials (e.g. backup and restore the teaching materials)
13	Teachers' ability to operate WLS
14	Learning effort of students
15	The completeness degree of WLS functions
16	Teachers' customized ability to teach materials supported by WLS
17	Adequate education and training of WLS
18	Teachers' consideration of the time needed to design the teaching materials[a]
19	Teaching models (e.g. distance, blended, or supportive teaching)
20	The change of interaction style between the teacher and students
21	Teachers' environmental consciousness (e.g. reducing paper wastage)
22	Teachers' equipment of the computerized teaching theory[a]
23	Sufficient bandwidth of the network
24	The privacy protection for the teachers and students
25	The executive's determination to push the WLS
26	Students' intention in selecting a course
27	Administrative workload within the school
28	Group power (ex: the majority of group members are WLS users)
29	The environment of teaching discussion and the interchange culture of the school[a]
30	The sharing processes for teaching materials in the school[a]
31	Taking the counseling for students
32	The integration between the WLS and administrative systems of the school
33	The rewards and punishments of the school
34	The introduced model of WLS (e.g. down to up or up to down)
35	Teachers' involvement in WLS[a]
36	Well organized teaching materials design[a]

Note: Among the 30 interviewees, three managers were suggested by the executive of the SUNNET company. Furthermore, they suggested other interviewees who were experienced with WM. The interview process was divided into two phases. The first phase involved an open question. Twenty interviewees were asked to briefly state the main cause(s) of their most recent decision regarding the successful usage of WM. These 20 interviewees consisted of two professors, three associate professors, four assistant professors, eight lecturers, and three managers of WM. Each interview took between 30 and 90 min. Following this first interview, the researcher independently coded 30 causes for the next interview. For the second interview phase, the 30 causes obtained from the first interview were incorporated into closed questions. Based on the scheme of the "Teaching and Learning Environment" suggested by Pahl (2003), 10 interviewees were asked to confirm the causes of WM success among the 30 causes. Meanwhile, they also could add other causes they believed were important. Six new causes were suggested in the second phase of the interviews. The 10 interviewees in this second phase consisted of one professor, one associate professor, three assistant professors, and five lecturers, and each interview lasted between 20 and 40 min.

[a] The new items added at the second phase of interviews.

Appendix B

Results of EFA.

Dimensions		Measured items	Factor loading	Eigen-values	% of Var	% of Var. (Cum.%)	Cronbach's α value
Causalattributions	Teacher literacy	TL1: My consideration of the timeneeded to design the teaching materials	0.893	2.193	56.978	56.978	0.658
		TL2: My involvement in WLS	0.683				
		TL3: My ability to design my own digital teaching materials well	0.668				
	Assisted ability of WLS	AA1: My customized ability to teach materials supported by the WLS	0.783	2.767	43.176	43.176	0.659
		AA2: The controllability of my teaching program	0.743				
		AA3: The sharing ability of course materials provided by WLS	0.662				
Confirmation		CF1: My experience with using WLS was better than what I expected.	0.882	3.952	76.967	76.967	0.851
		CF2: The service level provided by WLS was better than what I expected.	0.879				
		CF3: Overall, most of my expectations from using WLS were confirmed.	0.871				
Perceived usefulness		PU1: Using the WLS in the course has made it easier for me to give tests and exams.	0.947	3.110	80.352	80.352	0.760
		PU2: Using the WLS in the course would make it easier for me to assign my assignment(s).	0.843				
Satisfaction		SA1: I am satisfied with my decision to use WLS.	.850	2.437	68.888	68.888	.779
		SA2: I think that I did the right thing when I decided to use WLS.	.834				
		SA3: My choice to use a WLS was a wise one.	.804				
Continued intention		CI1: If I could, I would like to discontinue my usage of WLS. (Reverse coded)	.982	3.493	51.627	51.627	.590
		CI2: I intend to continue using WLS rather than discontinue my usage.	.751	2.211	35.352	86.980	
		CI3: My intentions are to continue using WLS rather than use any alternative means (e.g. traditional teaching activities in classroom).	.988				

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