Two Types of Attitudes in ICT Acceptance and Use

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Information and communication technology (ICT) acceptance and use is a prolific research stream in the information systems field. Yet studies on attitude have gone through ups and downs yielding inconsistent and inconclusive findings on attitude's role and impact. This article provides clear definitions of two different types of attitudes and details their relationships to each other and to technology use intention. Empirical data confirm the following: (a) At a theoretical level, attitude toward using ITC as a behavior (ATB) is a better predictor of behavioral intention (BI) than attitude toward ICT as an object (ATO) or ICT; ATO has a positive influence on ATB; and ATO's effect on BI is fully mediated by ATB. (b) Attitudes toward a previous version of the ICT and its use have significant impacts on the current attitudes. (c) At the operational level, considering only one aspect of the attitude constructs will lead to different results of the roles of attitudes on intention.

Information and communication technology (ICT) has become an important part of a majority of organizations and businesses in order for them to maintain a competitive edge. ICT are technologies used by people and organizations for their information processing and communication purposes. Because ICT has to be accepted and used by its intended users to be successful, the research stream on technology acceptance and use has become one of the most prolific, and claimed to be one of the most mature, research areas in the modern information systems (IS) field (Venkatesh, Morris, Davis, & Davis, 2003). The last two decades have seen user acceptance models being proposed, tested, refined, extended, and unified (Sun & Zhang, 2006; Venkatesh et al., 2003). Across the many competing models of technology acceptance, a common influence is the theory of reasoned action (TRA) and theory of planned behavior (TPB; Ajzen, 1991; Ajzen & Fishbein, 1980).

TRA (Fishbein & Ajzen, 1975) posits that behavior is driven by intention, whereas intention is a function of attitude toward performing the behavior and subjective norms surrounding the performance of the behavior. Attitude toward behavior (ATB) is defined as "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein & Ajzen, 1975, p. 216). TPB (Ajzen, 1991)

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extends TRA with the addition of perceived behavioral control as a predictor of behavioral intentions. In combination, attitude toward behavior, subjective norm, and perception of behavioral control lead to the formation of a behavioral intention.

Over the past decades, TRA and TPB have influenced the IS research on technology acceptance and use, from the formation of the famous technology acceptance model (TAM; Davis, 1989), to a number of alternative models, to a recent attempt of a unified theory of technology acceptance (Venkatesh et al., 2003), and several studies on perfecting the models by considering various application contexts and moderating factors (Sun & Zhang, 2006). The convergence of the research focus has been on the roles of an individual's beliefs and various antecedents of beliefs. Several salient behavioral beliefs include perceived usefulness and perceived ease of use.

Despite the importance of attitude toward behavior in TRA and TPB, the concept of attitude has not always been the focal interest in IS research on technology acceptance and use. Empirical studies find inconsistent and inconclusive results for the role of attitude on behavioral intention. Based on a survey of the literature, attitude toward using technology was found to be nonsignificant under different conditions. It is then theorized not to be a direct determinant of intention and thus was excluded from the unified theory of acceptance and use of technology (Venkatesh et al., 2003).

Attitude has been one of the most important concepts in social psychology studies. It is well established that attitude plays important roles in people's judgments, evaluations, and behaviors. ICT acceptance and use is a social phenomenon where attitude should also play an important role. Thus the inconsistent results in the literature are puzzling and beg for further investigation.

This study attempts to provide some explanations of the inconsistent literature. A careful examination of the literature leads us to speculate that there are conceptual and operational misconceptions of attitude in the IS literature. To examine this further, we investigate the theoretical underpinning of different attitude concepts, the structure of attitudes, and the roles of different attitudes in forming technology use intention decisions. In addition, attitude studies suggest that people's attitudes toward similar products or experiences would have influence on the formation of the attitudes related to the new product. We consider the context where users of a target ICT would already have experiences with similar or even the early versions of the target ICT. This has become commonplace now especially for work- or job-related situations where users would rarely start using a completely new ICT. Few existing IS studies, however, have considered such a context, and thus our understanding of the formation of attitudes and use intention decisions in such contexts is scant.

Specifically, we focus on investigating two key points:

1. There are two types of attitudes that have different effects on intention but have been mixed up in a number of studies: attitude toward ICT as an object (ATO), and attitude toward using ICT as a behavior (ATB). We hypothesize that ATB is a strong predictor of intention, whereas ATO's impact on intention is fully mediated by ATB.
2. One's ATO and ATB toward an early version of ICT can impact his or her current ATO and ATB.

An empirical study is conducted to validate our theoretical positions.

The rest of the article is organized as follows. The next section briefly reviews the technology acceptance and use literature where attitude is studied. We then present conceptual development with a research model and corresponding hypotheses, followed by a description of the empirical study and results. We summarize our findings and point out contributions, implications, and future directions in the last section.

1. LITERATURE REVIEW

To provide a literature review in light of the clear distinction between the two types of attitudes, we first adopt the well-established definitions of these attitude concepts in social psychology. ATO is defined as a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly & Chaiken, 1998), or similarly, as a combination of evaluative judgments about an object (Crites, Fabrigar, & Petty, 1994). ATB is defined as an individual's positive or negative feelings (evaluative affect) about performing the target behavior (Fishbein & Ajzen, 1975).

In the IS field, there are a number of competing models for explaining the processes through which individuals make ICT acceptance and use decisions (Sun & Zhang, 2006; Venkatesh et al., 2003). Much of this work is influenced by TRA and TPB (Ajzen, 1991; Ajzen & Fishbein, 1980). Despite the differences among competing models, the convergence is that an individual's beliefs (or cognitive reactions) about using ICT have a significant effect on his or her intention to use and the actual usage behavior of ICT (Agarwal & Karahanna, 2000; Venkatesh et al., 2003). Our observation is that among the many studies using TRA/TPB or TAM as the basic theoretical foundation, only some of them included attitude and its effect on behavioral intention (BI) or behavior in their investigations. In TPB and TRA, beliefs are antecedents of attitudes toward behavior.

We examined the conceptualization of both ATO and ATB in the literature and found that the predictive importance of attitude for BIs varied with the conceptualization of these constructs. For example, for studies on ATO's effect on intention-related variables, Jackson and colleagues studied attitude toward a new information system and found that it did not have a direct effect on BI (Jackson, Chow, & Leitch, 1997). Galletta and colleagues defined attitude as satisfaction with a Web site and found that attitude is a significant predictor of BI (Galletta, Henry, McCoy, & Polak, 2004). Barki and Hartwick (1989, 1994) defined attitude as a psychological state reflecting the affective or evaluative feelings concerning a new system and found it was related to user participation.

For ATB's effect on BI or behavior, Limayem and Hirt (2003) treated attitude as affect yet measured it in similar ways as ATB was measured in some other studies, and found that its effect on BI was nonsignificant. Thompson and colleagues defined attitude as affect toward PC use and found that $ATB \rightarrow BI$ is either nonsignificant (Thompson, Higgins, & Howell, 1991), or $ATB \rightarrow$ behavior is stronger for inexperienced users than experienced users (Thompson & Higgins, 1994). There are, however, a good number of studies that found the significant $ATB \rightarrow BI$

link (Agarwal & Prasad, 1999; Bhattacharjee & Premkumar, 2004; Brown, Fuller, & Vician, 2004; Chau & Hu, 2001; D. A. Harrison, Mykytyn, & Riemenschneider, 1997; Karahanna, Straub, & Chervany, 1999; Malhotra & Galletta, 2005; Mathieson, 1991; Moon & Kim, 2001; Wixom & Todd, 2005).

The measures for attitude are also varied. First, there are disconnections between conceptualization and measurement. For example, some studies conceptualized ATO yet measured it based on Ajzen and Fishbein's (Ajzen & Fishbein, 1980) original recommendations for ATB (Jackson et al., 1997).

Second, attitudes toward behavior were assumed to have different structures. In contemporary social psychology, attitude toward behavior is defined as a complex, multidimensional construct comprising cognitive, affective, and conative components. In a recent study, Ajzen and Fishbein suggested that attitude toward behavior should have both instrumental (mostly cognitive) and experiential (mostly affective) aspects. Yet most attitude measurement techniques resulted in capturing only the "affect" side of the concept. Our literature review confirmed that this practice still exists. IS research has widely accepted the attitude definition by Fishbein and Ajzen (Fishbein & Ajzen, 1975) in that attitude is an individual's positive or negative feelings (evaluative affect) about performing the target behavior (Davis, Bagozzi, & Warshaw, 1989; Moon & Kim, 2001; Venkatesh et al., 2003). That is, attitudes are often considered overall affective evaluations (Ajzen & Fishbein, 1980).

Third, attitude toward behavior was treated at different abstract levels. Some studies measured "global" attitudes (i.e., overall evaluations), whereas others measured the informational base of the attitudes (e.g., underlying reasons for the global attitude). For example, perceived ease of use and perceived usefulness were considered as attitude measures in some studies (A. W. Harrison & Rainer, 1992; Sambamurthy & Chin, 1994). Yet in TAM and other similar models, these two were the cognitive antecedents (i.e., base) of attitude. Some studies measured attitude with a mix of toward object and toward behavior (Thompson & Higgins, 1994).

Fourth, the specificity of the target for the attitudes is different. Some studies assessed attitude toward a type of ICT or general ICT (or ICT use; Brown et al., 2004; Mathieson, 1991), whereas others assess a specific target ICT (Chau & Hu, 2001; Karahanna, Straub, & Chervany, 1999).

The mis-conception of the attitude construct has been noted by other researchers as well. For instance, Wixom and Todd (2005) clearly stated the difference between ATO and ATB, and included ATB in their research model. This, along with our own review of the literature, indicates the following need for investigation and our objectives of this study: (a) the conceptualization of two different types of attitudes, (b) the structure or measurement for each of the two types of attitudes, and (c) the difference between attitudes related to a general type of ICT and attitudes related to a particular target ICT. To address the third point, we investigate slightly different but highly related concepts: attitudes related to an early version of the target ICT (noted as ATO0 and ATB0).

To the best of our knowledge, few studies provide a systematic examination of the two attitude concepts or have considered ATO and ATB together within the same study to distinguish them from each other. We hope that our study can shed light on the inconsistencies and inconclusiveness of the roles of attitude on behavioral intention in technology acceptance and use.

2. CONCEPTUAL DEVELOPMENT

In this section, we review the social psychology and IS literature on theoretical understandings of attitudes, the roles of attitude on behavioral intention, and the structures of attitudes. Along the way, we present our research model and hypotheses to be tested in the empirical study.

2.1. *The Roles of Attitudes*

The attitude-behavior relation has been investigated extensively in social psychology and related fields. Research on attitudes makes a general distinction between attitude toward an object and attitude toward a behavior (Ajzen & Fishbein, 1980, 2005; Eagly & Chaiken, 1998; Forgas, 2000). In a recent effort, Ajzen and Fishbein restated the difference between attitude toward object and toward behavior using both theoretically and empirically established reasoning. They summarized three broad approaches to studying the influences of attitudes on behaviors: (a) the principles of compatibility; (b) the work linking general attitude (i.e., attitude toward object) to specific action, most notably by Fazio's MODE model (Fazio, 1986, 1990); and (c) the reasoned action approach to the prediction of specific behaviors (Ajzen & Fishbein, 2005). The principle of compatibility requires that measures of attitude and behavior involve exactly the same action, target, context, and time elements, whether defined at a very specific or at a more general level (Ajzen, 1988). The MODE (motivation and opportunity as determinants) model assumes that general attitudes can influence or bias perceptions and judgments of information relevant to the attitude object, but for such influence to occur, the general attitudes must first be activated. In turn, general attitude activation is dependent on the person's motivation and information processing capacity (Fazio, 1986, 1990). The reasoned action approach is based on TRA and its successor, TPB, and considers attitude as toward a particular behavior (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

The two attitudes have different functions regarding behavior or behavioral intention. In particular, ATB has been shown to be a much better predictor of behavioral intention and behavior than ATO (Ajzen & Fishbein, 1980, 2005). This finding can be explained by the principle of compatibility (Ajzen, 1988; Eagly & Chaiken, 1998). Generally, for an attitude to be predictive of behavior, the attitude must be assessed at the same level of specificity. So the attitude being assessed must be as broad (or specific) as the behavior in question. It follows then that a behavioral intention toward using something (e.g., ICT) would be best predicted by an attitude measure of behavior regarding that something (again, ICT) rather than an attitude measure of that something, the latter by definition is being assessed at a different level (e.g., attitude toward the ICT itself). This suggests that the effects of ATO and ATB on BI are quite different. Specifically, ATB is a stronger predictor of BI than ATO is. Here we have the first hypothesis.

H1: Attitude toward using an ICT has a positive impact on behavioral intention of using the ICT.

Further, Eagly and Chaiken pointed out that, although the two broad theories of attitudes are generally examined separately (i.e., either attitude toward the object or attitude toward the behavior), it might be useful to examine both together to get a good prediction of behavior. For example, when an attitude toward an object has been activated, there are likely still many options of appropriate behaviors to choose from. If a link is established between an ATO and an ATB (as a possible behavioral choice), then once an ATO has been activated, the ATB should also be activated; this leads to a good prediction of behavior (Eagly & Chaiken, 1998). This suggests that ATO and ATB are related: Activating ATO is likely to activate ATB as well.

In the IS literature, some empirical studies support the claim that attitude toward object predicts attitude toward behavior. For example, Wixom and Todd (2005) found ATO (called satisfaction in their study) to be an antecedent to ATB but not an antecedent to BI. Thus, to summarize, ATO predicts ATB, which in turn predicts BI. From this, we postulate the following hypothesis.

H2: Attitude toward an ICT has a positive impact on attitude toward using the ICT.

The direct effect of ATO on behavioral intention can be conditional, according to the motivation and opportunity as determinants (MODE) model (Fazio, 1986, 1990). The MODE model posits that high motivation and information process capacity will lead to attitude-consistent behavior; low motivation and information process capability may lead to either attitude-consistent behavior or behavior unrelated to attitude depending on the strength of the chronically accessible attitude (Fazio, 1990). Our examination of the IS literature showed that few studies controlled these conditional situations when they examined the influence of attitude toward object on intention. This may account for the inconsistent findings on the role of ATO on intention and behavior.

Studies using MODE mostly considered ATO without the presence of ATB. We believe that with the presence of ATB, ATO's influence on intention should be fully mediated by ATB. The MODE model itself can be used to justify this proposition. According to the MODE model, attitude can be activated in one of the two ways: in a controlled or deliberative fashion (when motivation and information-processing capacity is high) and in an automatic or spontaneous fashion (when motivation and information processing capacity is low). Once the attitude is activated, it influences definition of the situation or event, possibly directing attention to positive or negative consequences of performing the behavior in line with the positive or negative evaluation of the object. The process of activating an attitude is then expected to influence the person's attitude toward the behavior and thus guide behavior in accordance with the valence of the general attitude (Ajzen & Fishbein, 2005). This argument leads to the hypothesis that ATO influences intention via ATB.

In the IS literature, among the few studies considering both ATO and ATB within the same study, Wixom and Todd (2005), as mentioned earlier, found attitude toward object (called satisfaction in their study) to be an antecedent to ATB, but not an antecedent to BI. They did not examine whether the ATO's effect on

intention is fully mediated by ATB but we speculate that it should be, and this is consistent with what we hypothesize.

H3: The effect of attitude toward an ICT on behavioral intention is fully mediated by attitude toward using the ICT.

2.2. The Impact of Attitudes Related to a Similar ICT

Because participants taking part in a study examining ICT use are likely to have previous experience with similar ICT, it is important to take these prior attitudes into account. Specifically, we explore the role of one's attitudes toward an early version of the current ICT and toward using the early version (ATO0 and ATB0, for short) on one's attitudes related to the current ICT. Research specifically regarding these types of relationships is scant; however, basic theories within social psychology and attitude research and research in the applied realms of marketing, advertising, and ICT allow us to make some general predictions (Aaker & Keller, 1990; Festinger, 1957; Ouellette & Wood, 1998; Zajonc, 1968). First, the principle of mere exposure demonstrates that people prefer (e.g., rate more positively) things that they are familiar with (Zajonc, 1968). Thus, if people are familiar with the previous version of the ICT and if the current version is similar, familiarity should lead people to feel positively towards the current version. Further, the principle of consistency suggests that people seek to maintain consistency, for example, amongst their beliefs, attitudes, and behaviors (Festinger, 1957). It then follows that, if people have a positive attitude toward using the previous version, to maintain consistency, they would also feel positively toward using the new, similar version. Research by Ouellette and Wood (1998) demonstrated that past behaviors, along with attitudes toward the behavior and subjective norms, predict behavioral intentions even when those past behaviors are not well-learned. Further, research examining these relationships has found that attitudes toward a similar object and attitudes toward behavior with a similar object impact one's attitudes related to the current object. For instance, attitude research demonstrates that once a stimulus is categorized, its evaluation may be consistent with the category evaluation (Wegener, Petty, & Smith, 1995); therefore, if a target ICT product is perceived to be in the same category as a product previously used, the target ICT is likely to be evaluated in light of the existing category evaluation. This is confirmed by our preliminary results in the e-commerce context: A user can form a positive reaction toward a new Web site after a 0.5-sec exposure if the Web site resembles typical e-commerce Web site designs (Zhang & Li, 2007). Similarly, research in the domain of marketing and advertising demonstrates that attitudes that a consumer holds toward a parent brand impact attitudes toward new products released by that parent brand (Aaker & Keller, 1990); this effect is particularly strong when the new product is similar to existing products (Boush & Loken, 1991; Park, Milberg, & Lawson, 1991). The research discussed thus far would suggest positive relationships between ATO0/ATB0 and ATO/ATB; however, an alternative theoretical perspective should also be considered. The theory of psychological reactance is based on the idea that people do not like having

FIGURE 1 The research model. *Note.* ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward a system; ATB = attitude toward using a system; BI = behavioral intention to use the system.

their choices made for them/taken away from them (Brehm, 1966; Brehm & Brehm, 1981). If people have positive attitudes toward the previous version and feel like it is being taken from them, this might lead them to have negative attitudes toward the current version.

Because relevant theories and research could lead us to predict both positive and negative relationships, we explore the relationships between ATO0, ATB0, and current attitudes rather than make specific predictions on the directions of these effects. Thus, we have the following four hypotheses.

- H4: Attitude toward a similar ICT has an effect on attitude toward the ICT.
- H5: Attitude toward a similar ICT has an effect on attitude toward using the ICT.
- H6: Attitude toward using a similar ICT has an effect on attitude toward the ICT.
- H7: Attitude toward using a similar ICT has an effect on attitude toward using the ICT.

Finally, based on early discussions for supporting H2, we add a link between ATO0 to ATB0 to form Hypothesis 8.

- H8: Attitude toward a similar ICT has a positive impact on attitude toward using that similar ICT.

Figure 1 summarizes the hypotheses into the research model.

3. METHOD

3.1. Study Setting

This study tests the research model in a mandatory ICT use context. There has been some perceptions that there is little variance in behavioral intention and actual use in mandatory settings, making it difficult to predict empirically

(Hartwick & Barki, 1994). This may seem true especially if simple “yes/no” nominal categories are used to measure behavioral intention. However, existing research shows that behavioral intention is a variable even in mandatory use environment (Hartwick & Barki, 1994). In mandatory settings, people can use a system at different levels and to different extents. They can have various intentions regarding how much and to what extent they use the system in the future. In short, even if people perceive their use of the system as mandatory, behavioral intentions still vary because some users do not want to obey the mandates (Venkatesh & Davis, 2000). The relevance of studying behavioral intention in a mandatory context is evidenced by a good number of technology acceptance research studies (Sun & Zhang, 2006).

The data for this study were collected as part of a larger field study with a survey method to understand student evaluations of a course management system, WebCT, at a major northeast university in the United States. A new version, WebCT 6.0, was implemented in the fall 2006 semester. It is significantly different from its previous version (WebCT 4.0) with new looks, new terminologies, and new functions. Thus it requires users to develop new mental models and understandings.

3.2. Data Collection

The data were collected during the 3rd and 4th weeks of the fall 2006 semester when students were getting settled in their courses. An announcement for the survey was posted in the WebCT 6.0 home pages of those courses that require WebCT 6.0 to be used as part of the courses. Students were told that complete survey entries would be included in a drawing for winning one of two \$100 cash prizes. A link directed participants to an online survey Web site hosted at SurveyMonkey.com.

Responses from 348 graduate and undergraduate students were included in this study. All of these participants had used the previous version WebCT 4.0 for at least 1 month. They had an average age of 26 years ($SD = 8.8$), experience of 13 years ($SD = 5.2$) of using computers, and 9 years ($SD = 2.7$) of using the World Wide Web. Of the participants, 67% were female, 62% Caucasian/White, 15% Asian/Pacific Rim, 10% African American, and 6% Hispanic. Among the participants, 53% were undergraduate students, 36% masters' students, and 10% doctoral students. The majority of them just started using WebCT 6.0 since the beginning of the semester; a few participated in the piloting of WebCT 6.0 in the summer. They had used the previous version WebCT 4.0 for an average of 15 months ($SD = 11$).

3.3. Measurement

The most recent theoretical understanding of the structure of attitude posits that ATB contains instrumental (e.g., desirable/undesirable, valuable/worthless) as well as experiential (e.g., pleasant/unpleasant, interesting/boring) aspects; thus attitude measures should contain items representing these two subcomponents

(Ajzen & Fishbein, 2005). For ATB, we constructed the measures based on the guideline by Ajzen & Fishbein (2005, p. 199).

In terms of attitude toward object, it has been well established that global attitude should be measured by general evaluative terms such as positive/negative, good/bad, desirable/undesirable, and like/dislike and that global attitudes toward objects are also composed of an affective (feeling) and cognitive (belief) component (Crites et al., 1994).

The measures for behavioral intention were adopted from Wixom and Todd (2005). The appendix lists the instrument. All constructs were measured using multiple items on 5-point Likert scales, ranging 1 (*strongly disagree*), 2 (*somewhat disagree*), 3 (*neither agree nor disagree*), 4 (*somewhat agree*), and 5 (*strongly agree*). Table 1 shows the descriptive statistics of the measuring items.

3.4. Data Analyses

Data analyses consisted of two phases. The first phase was confirmatory factory analysis to assess the measurement model to test convergent and discriminant validities. All constructs were modeled as reflective and by multiple indicators as shown in the appendix. The second phase tested the research model using structural equation modeling technique. Partial Least Square (PLS) was used for both phases. PLS is a second-generation multivariate technique that facilitates testing of the psychometric properties of the scales for measuring a construct and the estimation of the parameters of a structural model. As a component-based structural equation modeling technique, PLS is in essence exploratory and emphasizes explaining variance (Gefen, 2002; Gefen, Straub, & Boudreau, 2000). In this sense,

Table 1: Descriptive Statistics for the Measurement Items

	<i>Mean</i>	<i>SD</i>
ATO01	3.79	1.02
ATO02	3.61	1.04
ATO03	3.75	1.04
ATO04	3.77	1.03
ATB01	3.75	0.96
ATB02	3.61	0.98
ATB03	3.53	1.01
ATB04	3.44	1.03
ATO1	3.46	1.09
ATO2	3.44	1.15
ATO3	3.55	1.12
ATO4	3.58	1.11
ATB1	3.31	1.08
ATB2	3.71	1.01
ATB3	3.35	1.09
ATB4	3.30	1.08
BI1	3.29	1.11
BI2	3.41	1.06

PLS is appropriate for this research, as we have many new relationships and are interested in the explanatory power of this model.

The measurement model was examined in Phase 1 for convergent and discriminant validities. Convergent validity was assessed by reliability of items, composite reliability of constructs, and average variance extracted (AVE). Discriminant validity was assessed by examining cross-loadings and the relationship between correlations among constructs and the square root of AVEs. Reliability of items was assessed by examining each item's loading on its corresponding construct. A common rule of thumb suggests that the item loading should exceed .70 (Barclay, Higgins, & Thompson, 1995; Chin, 1998). Confirmatory factor analysis results showed that all items exhibited loadings of more than .70 to their corresponding constructs, indicating adequate reliability of items. Table 2 shows composite reliability. AVE measures the amount of variance that a construct captures from its indicators relative to the amount due to measurement error (Chin, 1998). It is recommended to exceed 0.5. As shown in Table 2, all of the constructs met this guideline.

AVE is also suggested to serve as a means of evaluating discriminant validity (Fornell & Larcker, 1981). The square root of the AVEs should be greater than the correlations among the constructs, which indicates that more variance is shared between the construct and its indicators than with other constructs. In Table 2, the numbers on the leading diagonals are the square root of the AVEs. Off-diagonal elements are the correlations among constructs. All diagonal numbers are greater than the off-diagonal ones, indicating satisfactory discriminant validity of all the constructs. Another criterion for assessing discriminant validity is that no measurement item should load more highly on any construct other than the construct it intends to measure (Chin, 1998). An examination of cross-factor loadings (Table 3) shows that all items satisfied this guideline. This indicates that ATO and ATB in general (including ATO0 and ATB0) are different constructs confirmed by empirical evidence.

We do notice that there are some high cross-loadings in Table 3. The nature of the constructs in the research model may be one reason (Gefen, 2002). As we can see, the constructs in the research model are conceptually closely related. Therefore,

Table 2: Composite Reliability and Correlations of Constructs

	No. of Items	Composite Reliability	AVE	ATO0 ^a	ATB0 ^a	ATO ^a	ATB ^a	BI ^a
ATO0	4	.97	.88	.94				
ATB0	4	.95	.82	.85	.91			
ATO	4	.97	.88	.03	.11	.94		
ATB	4	.92	.74	.07	.21	.77	.86	
BI	2	.91	.84	.17	.29	.61	.75	.92

Note. AVE = average variance extracted; ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward information and communication technology as an object; ATB = attitude toward using information and communication technology as a behavior; BI = behavioral intention.

^aThe first number in the column is the square root of the AVEs. Off-diagonal elements are the correlations among constructs.

Table 3: Cross-Factor Loadings for Measurement Items and Constructs

<i>Items/Constructs</i>	<i>ATO0</i>	<i>ATB0</i>	<i>ATO</i>	<i>ATB</i>	<i>BI</i>
ATO01	0.89	0.68	0.08	0.00	0.09
ATO02	0.82	0.69	0.06	-0.03	0.10
ATO03	0.90	0.72	0.08	0.00	0.11
ATO04	0.85	0.70	-0.01	-0.05	0.08
ATB01	0.64	0.87	0.09	0.02	0.09
ATB02	0.75	0.94	0.08	0.05	0.15
ATB03	0.75	0.93	0.06	0.00	0.17
ATB04	0.69	0.89	0.12	0.07	0.20
ATO1	0.23	0.08	0.91	0.44	0.42
ATO2	0.29	0.06	0.94	0.45	0.37
ATO3	0.25	0.05	0.95	0.43	0.36
ATO4	0.27	0.06	0.96	0.43	0.36
ATB1	0.24	0.10	0.66	0.86	0.43
ATB2	0.15	0.20	0.58	0.84	0.57
ATB3	0.16	0.15	0.63	0.89	0.68
ATB4	0.25	0.16	0.58	0.86	0.46
BI1	0.35	0.18	0.45	0.53	0.91
BI2	0.32	0.21	0.52	0.71	0.93

Note. All loadings are significant at the .001 level. ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward information and communication technology as an object; ATB = attitude toward using information and communication technology as a behavior; BI = behavioral intention.

the relatively high cross-loadings are not surprising. Furthermore, Table 2 shows that our measures exhibit good discriminant validities, as previously mentioned. Combined, we believe that the high cross-loadings do not have significant threats to the validity of our research model.

3.5. Results

Results from Phase 2, the structural model, are shown in Figure 2. PLS does not use model fit indices; however, the explanatory power of a structural model could be assessed by the R^2 values (variance accounted for) in the dependent latent variables. Figure 2 shows that the model can explain 57% of the variance in BI, 63% in ATB, 2% in ATO, and 73% in ATB0.

The empirical results support all hypotheses. Specifically, attitude toward the early version of the system, ATO0, has negative effects on both types of current attitudes. Attitude toward using the early version, ATB0, has positive effects on both types of current attitudes. Attitude toward the system, ATO, significantly affects attitude toward using the system, ATB. And ATO does not have a direct effect on BI, meaning its effect on BI is fully mediated by ATB.

To test the full mediating effect of ATB, we conducted a three-step analysis as suggested by Baron and Kenny (1986). When ATB is not considered, ATO has a significant direct effect on BI with a coefficient of 0.61 ($p < .001$). In the full model as shown in Figure 2, the link between ATO and BI is nonsignificant and the

FIGURE 2 The empirical model. *Note.* ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward a system; ATB = attitude toward using a system; BI = behavioral intention to use the system.

coefficient for $ATB \rightarrow BI$ is 0.70 ($p < .001$), meaning ATB fully mediates the effect ATO has on BI. Thus H3 is supported.

It is noteworthy that a low amount of variance in ATO is explained by the research model (.02), even though the effects from ATO0 and ATB0 to ATO are significant. Because our model included only two factors (attitudes related to previous version of the ICT, ATO0, and ATB0) as antecedents of ATO, the finding suggests that attitudes related to previous version of the ICT do not explain a lot of variance in the attitude toward the new version of the ICT and that there are likely other antecedents of ATO that we did not include in the study. To test whether ATO0 and ATB0 could explain a large amount of variance in ATB, we did a supplementary analysis by considering ATO0 and ATB0 as the only direct antecedents of ATB. About 9% of the variance in ATB can be explained by ATO0 and ATB0. Again, this indicates that there are other factors that influence ATB.

To gain a better understanding of the relationships and the impacts of measurements, we conducted a number of supplementary analyses. First, we tested if ATO0 and ATB0 would have any direct effects on BI. Again following the three-step procedure, we found that ATO0 and ATB0 have direct effects on BI (with coefficient of $-.30$, $p < .01$ and $.55$, $p < .001$, respectively) when ATO and ATB are not considered. But once ATO and ATB are in the model, the two links $ATO0 \rightarrow BI$ and $ATB0 \rightarrow BI$ become nonsignificant. This means that previous attitudes on a similar or early version of the system do not directly influence current behavioral intention; their effects are fully mediated by two types of attitudes related to the current system. Second, we tested what would happen if only one aspect of the construct (either instrumental or experiential) is considered as a measurement for either ATO/ATO0 or ATB/ATB0. According to Ajzen and Fishbein (2005), the instrumental aspect of ATB should be measured by “desirable” and “valuable,” whereas the experiential aspect of ATB should be measured by “pleasant” and “interesting.” Correspondingly, the instrumental aspect of ATO should be measured by “desirable” and “good,” whereas the experiential aspect of ATO should be measured by “like” and “positive.” The instrumental and experiential measures lead to the following empirical models in Figures 3a and 3b, respectively.

FIGURE 3 The empirical model for (a) the Instrumental Measurement of ATO/ATO0 and ATB/ATB0 and (b) the Experiential Measurement of ATO/ATO0 and ATB/ATB0. Note. ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward a system; ATB = attitude toward using a system; BI = behavioral intention to use the system.

Although these two results are consistent with each other in terms of significance of linkages, they are different from that in Figure 2 where both the instrumental and the experiential aspects are considered together for ATO and ATB. In particular, ATO0 does not have a direct effect on ATO; ATB does not fully mediate ATO's effect on BI; and ATO has a direct effect on BI. Thus considering different aspects of the constructs at the operational level will lead to different conclusions of the effects of the constructs.

3.6. Common Method Bias Testing

Because all constructs were measured at the same time, there is a potential for common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), which could threaten the validity of the findings. Although it is not a new method at all, common method bias has been rarely assessed in information systems research, with notable exceptions (e.g., Liang, Saraf, Hu, & Xue, 2007). We followed the procedure invented by Liang and colleagues using PLS.

Specifically, a three-step procedure was followed. First, indicators of all constructs in the original model were converted to one-indicator latent constructs.

Second, a new variable called “method” was created with all indicators in the original model as its indicators. The method construct was then linked to all single-indicator constructors. Third, we ran the new model including the new method construct and assessed the results.

Two criteria were applied to assess the common method bias: factor loadings and a comparison between variances of single-indicator constructs explained by principle constructs and those explained by the method factor. According to Williams and colleagues (Williams, Edwards, & Vandenberg, 2003), single-indicator constructs should load more heavily on their principle constructs (original latent variables to which they belong) than on the method factor. Second, variances explained by principle constructs indicated by the squared values of the path coefficients should be significantly larger than variances explained by the method factor.

As we can see in Table 4, all factors are loaded more heavily on their own substantive constructs (R1) than on method (R2). All substantive factor loadings are significant at the .01 level, whereas no method factor loadings are significant at the .05 level. Moreover, variances explained by principle constructs (R12) are significantly larger than variance explained by the method factor (R22). Therefore, we can conclude that common method bias should not be a concern in this study.

Table 4: Common Method Bias Analysis

Construct	Indicator	Substantive Factor Loading (R1)	Variance Explained by the Principle Construct (R12)	Method Factor Loading (R2)	Variance Explained by the Method Factor (R22)
ATO0	ATO01	0.953**	0.908	−0.018	0.000
	ATO02	0.952**	0.906	−0.028	0.001
	ATO03	0.920**	0.846	0.034	0.001
	ATO04	0.924**	0.854	0.014	0.000
ATB0	ATB01	0.885**	0.783	−0.017	0.000
	ATB02	0.928**	0.861	0.019	0.000
	ATB03	0.925**	0.856	0.001	0.000
	ATB04	0.897**	0.805	0.000	0.000
ATO	ATO1	0.867**	0.752	0.051	0.003
	ATO2	0.949**	0.901	−0.013	0.000
	ATO3	0.959**	0.920	−0.017	0.000
	ATO4	0.973**	0.947	−0.020	0.000
ATB	ATB1	0.931**	0.867	−0.095	0.009
	ATB2	0.756**	0.572	0.108	0.012
	ATB3	0.910**	0.828	−0.031	0.001
	ATB4	0.850**	0.723	0.014	0.000
BI	BI1	0.946**	0.895	−0.038	0.001
	BI2	0.895**	0.801	0.039	0.002

Note. ATO0 = attitude toward a previous system/version; ATB0 = attitude toward using a previous system/version; ATO = attitude toward information and communication technology as an object; ATB = attitude toward using information and communication technology ICT as a behavior; BI = behavioral intention.

** $p < .01$.

4. DISCUSSIONS AND CONCLUSION

There are several limitations in this study that should be addressed before we provide discussions and conclusion. First, the target ICT is a learning management system that is mandatory to college students (our participants). Although the population and target ICT fit each other and the findings have merit, the findings may not be applicable directly to other contexts with different populations and ICT. Further research is needed to validate the findings. Second, we focus only on attitudes and intention and their relationship. The literature shows that there are many other important factors that can influence intention in addition to attitudes (Sun & Zhang, 2006). This may account for the low variance of ATO explained by this research. Third, we took a snapshot approach and collected data at the initial use time to understand the relationships among attitudes and intention, and among attitudes related to different versions of ICT. A longitudinal approach may reveal more insight on how these factors related to each other, especially the differences between initial use and continued use of current version of the ICT. Fourth, we did not control for experience, especially experience with the previous version of the ICT. Given that experience may moderate the relationships proposed in the research model, as suggested by existing empirical studies (e.g., Sun & Zhang, 2006; Taylor & Todd, 1995), controlling for the potential effects of experience may be worthwhile and yield some interesting findings.

The main purpose of this study was to examine the effects of two different types of attitudes on ICT acceptance and use decisions. To do this, we focused on only the most commonly used factor in the literature that threatened the role of attitude: behavioral intention. Although this might be considered a limitation of the study, as previously mentioned, our approach allows us to be more focused on the objectives of this study.

This study demonstrates both conceptually and empirically that attitude toward a system and attitude toward using the system are two different concepts that have very different effects in forming technology acceptance and use intentions. We show that attitudes related to a similar, previously used ICT can influence intention through current attitudes. We also demonstrate that an attitude structure that incorporates both experiential and instrumental aspects shows good psychometric properties.

The findings can shed light on the current literature of technology acceptance and use. The different conceptualizations and operationalizations of attitude in the literature may have contributed to the inconsistent and inconclusive role of attitude on behavioral intention, making it difficult to compare across studies and resulting in attitude being excluded as a direct antecedent of behavioral intention. For example, if a study intended to investigate the effect of ATB on BI, but operationalized ATB as ATO or toward a similar ICT (as ATO0), then it is likely to find a nonsignificant or weaker effect (as in our case with coefficient of $-.30$ for $ATO0 \rightarrow BI$, 0.61 for $ATO \rightarrow BI$ vs. 0.70 for $ATB \rightarrow BI$) of attitude on behavioral intention. Also, if ATB or ATO were measured with only one of the two subcomponents (Ajzen & Fishbein, 2005), it may also lead to different effects, as our supplementary analysis results in Figures 3a and 3b demonstrate. In light of the fact that many IS studies

emphasized on the experiential aspect of ATO/ATB (influenced by Fishbein & Ajzen, 1975, and often measured by “liking” or “prefer”), it is likely that their findings tend to be weaker than what it should be. This is demonstrated by our findings: the coefficient of $ATB \rightarrow BI$ and the R^2 of BI in Figure 3b (experiential measure) is smaller than those in Figure 3a (instrumental measure) and in Figure 2 (the combined measure).

It is interesting to note that the attitude toward previous version of the software has a negative impact on the current attitudes. There are two possibilities here: (a) the more one is positive about the previous version, the more negative one's attitude toward the current version and attitude toward using the current version would be; and (b) the more negative one is toward the previous version, the more positive one's attitudes are regarding the current version. One potential explanation for the first possibility could be the idea of psychological reactance (Brehm, 1966; Brehm & Brehm, 1981). People do not like their choices being taken away from them or their choices being made for them, and they often react in ways that reflect this. So, for example, if someone had a positive attitude toward the previous version of the software (our data showed that many participants had positive attitude toward WebCT 4.0), they may not want to have to use a new version (many participants expressed that their use of WebCT 6.0 was forced), and therefore react by having negative attitudes toward the new version and toward using the new version. An explanation for the second possibility (negative $ATO0 \rightarrow$ positive ATO) is that, when someone is negative about the previous version, the new version (especially when it is quite different, as in the case of WebCT 6) may seem to be more attractive because it may seem to have addressed those negative aspects of the previous version. It is possible that participants' attitudes toward the new version could change as they gain experience and become more comfortable with the new version. Examining fluctuations in these attitudes over time, with increased usage and in the presence of other antecedents to attitudes, is a fruitful avenue for further research.

Although $ATO0$ has negative effects on current attitudes, $ATB0$ has positive effects on the current attitudes. This finding further demonstrates that ATO and ATB in general are two different concepts. $ATB0$ is toward using WebCT 4 (the early version), and using an ICT has to do with the reason of using it (in this case, to help learning). Both WebCT4 and WebCT 6 have the same purpose: to help learning. Thus people would have the same reason of using them. The principle of consistency (Festinger, 1957) thus can predict and explain that people's attitude toward using an early version of ICT would be carried over, or be consistent, with their attitude toward using the current ICT. $ATB0$'s positive effects on current attitudes mean that the more one is positive about using the early version of ICT, the more positive she or he is about using the current version, and the more negative one is about using the early version, the more negative she or he is about using the current version.

One research implication of the current findings has to do with the treatment of attitudes in future empirical studies. Future studies should pay attention to the holistic nature of attitudes that includes both instrumental and experiential aspects. Another research implication is to pay attention to the antecedents of

ATB because of its important impact on BI. TRA, TPB, and TAM clearly state the importance of instrumental determinants (various beliefs). Recent movement in the IS, psychology, and other fields has started to examine the experiential (largely affective) antecedents of ATB. This makes sense as the structure of attitudes includes both components. The third research implication is that previous empirical studies should be re-examined in light of the ATO/ATB distinction to draw conclusion on the role of attitudes on behavioral intentions.

There are also practical implications of our study. Attitude toward behavior fully mediates the role of attitude toward object on behavioral intention. Knowing this, ICT designers, managers, trainers, marketers and other stakeholders should understand that a positive attitude toward a particular ICT will not lead potential users to decide to accept or use the ICT. To increase the chance of potential users adopting and continuously using an ICT, efforts should be put into identifying antecedents of attitudes toward behavior in addition to attitude toward the ICT. Another implication has to do with the negative impact of attitude toward a previous version of the ICT on current attitudes. This finding suggests that in the case of mandatory ICT use, if people hold a positive attitude toward an early version of the product, they are more likely to have negative attitudes for the current version. Knowing this, ICT designers, managers, trainers, marketers, and other stakeholders may want to take note of what aspects led to the positive previous attitude to (a) make sure those positive features are retained in the new product and (b) make sure it is clear to users that the features they found appealing before are still present and/or the features they found distasteful are no longer present. Future research should determine what information people use in forming their attitudes toward ICT and include this information when modeling the relationships between attitudes towards objects, attitudes toward behaviors, and behavioral intentions. Finally, it should be noted that the current research focused on mandatory ICT use. Future research should explore the relationships between prior attitudes, current attitudes, and behavioral intentions in regards to voluntary use of ICT.

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APPENDIX

Instrument

Attitude toward object of the previous version (ATO0)

- ATO01 The previous version of WebCT 6 was desirable
- ATO02 I like the previous version of WebCT 6
- ATO03 I am positive about the previous version of WebCT 6
- ATO04 The previous version of WebCT 6 was good

Attitude toward behavior of the previous version (ATB0)

- ATB01 Using the previous version of WebCT 6 was pleasant
- ATB02 Using the previous version of WebCT 6 was valuable
- ATB03 Using the previous version of WebCT 6 was desirable
- ATB04 Using the previous version of WebCT 6 was interesting

Attitude toward object (ATO)

- ATO1 I think WebCT 6 is desirable
- ATO2 I like WebCT 6
- ATO3 In general, I am positive about WebCT 6
- ATO4 In general, WebCT 6 is good

Attitude toward behavior (ATB)

- ATB1 Using WebCT 6 is pleasant
- ATB2 Using WebCT 6 is valuable
- ATB3 Using WebCT 6 is desirable
- ATB4 Using WebCT 6 is interesting

Behavioral intention (BI)

- BI1 I intend to use WebCT 6 at every opportunity in the future
- BI2 I plan to increase my use of WebCT 6 in the future