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THE INFLUENCE OF PERSUASION, TRAINING, AND EXPERIENCE ON USER PERCEPTIONS AND ACCEPTANCE OF IT INNOVATION

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Abstract

Information technology (IT) cannot produce any positive outcome unless it is adopted and used. Theories and empirical research suggest that IT adoption and usage are determined by user beliefs and attitudes toward IT. However, little is known about what factors affect the formation and change over time of user beliefs and attitudes. It is critical to understand such factors so that effective managerial interventions can be created and implemented to positively influence user acceptance and use of IT innovations.

Based on theories of innovation diffusion, information technology adoption, and persuasion, this study investigates the effect of persuasion, training, and direct-use experience on the formation and change over time of user perceptions and adoption decisions of IT innovation. The results of a longitudinal experimental study show that persuasion significantly affects the formation of users’ initial perceptions, attitude toward, and intention to adopt IT. Training provided in the introduction stage of IT innovation helps the user form a more realistic expectation. As users’ direct-use experience with IT innovation increases over time, their perceptions and adoption intentions change substantially. The results suggest that persuasion, training, and direct-use experience are important variables that need to be considered in IT innovation and adoption research and practice.

1. INTRODUCTION

Past IS research has shown that user adoption and usage of IT innovation is ultimately determined by her beliefs and attitudes toward the IT innovation (Davis 1989; Davis et al. 1989; Mathieson 1991; Taylor and Todd 1995; Venkatesh and Davis 2000). The innovation literature suggests that it is the user’s perceptions of the characteristics of an innovation, rather than the characteristics as defined by experts or change agents, that affect adoption (Rogers 1995). User beliefs and attitudes are subjective and idiosyncratic; they may be formed and changed over time. A far more essential research and managerial issue is thus to identify organizational mechanisms that may positively influence user beliefs and attitudes so as to increase the likelihood of user adoption and use.

Although IS researchers have made significant progress in understanding user adoption behavior, most studies have focused on using perceptions and attitudes to predict intentions and behaviors. Little is known about what factors influence the formation and change over time of user perceptions of and attitudes towards IT innovation. The temporal dimension of the adoption process has been ignored in most empirical IT adoption research (Karahanna et al. 1999; Melone 1990). Drawing upon theories of innovation diffusion, the intention-based theories of IT adoption, and the persuasion literature, this paper attempts to extend existing knowledge about individual adoption of IT innovation by examining the effects of three key factors, viz., persuasion, training, and user direct-use experience, on the formation and change over time of user perceptions and acceptance of IT innovation.
We argue that an individual’s perceptions of IT innovation do not remain static and should be examined from a dynamic or longitudinal perspective. Individuals construct their own unique understanding and expectation of the IT innovation as they are exposed to certain persuasive arguments and training, and this understanding can change and be redefined with increased direct-use experience with the IT innovation. In other words, initial persuasion and training are important ways of conveying to the users the social norm as well as the knowledge and skills needed to form initial beliefs and attitudes, whereas direct-use experience provides the users with the necessary means to reinvent and more realistically define their expectation about the use and consequences of the IT innovation. Using a longitudinal experimental design, this study examines the effects of persuasion, training, and user direct-use experience on the formation and change over time of user perceptions of a computer-aided software engineering (CASE) tool.

2. THEORETICAL BACKGROUND

2.1 Innovation Adoption and Diffusion

Innovation adoption and diffusion is often viewed as a stage-based process (Kwon and Zmud 1987; Rogers 1983; Thompson 1969). In this process, an individual passes from initial awareness and knowledge of the innovation, to forming a favorable or unfavorable attitude toward it, to a decision to adopt or reject it, to putting the innovation to use, and to finally confirm or reverse the initial adoption decision (Rogers 1995). In any stage, an individual may decide to stop the adoption process or to discontinue using the innovation. Innovation adoption is thus not a one-time decision, but rather an iterative decision process (Leonard-Barton 1988).

Various factors have been proposed to affect individuals’ attitudes toward and adoption decisions of innovations. Rogers (1995) suggests five sets of variables that influence innovation adoption and diffusion: (1) perceived characteristics of innovations, (2) types of innovation-decision, (3) communication channel, (4) nature of the social system, and (5) extent of change agents’ promotion effort. The last three categories are clearly related to persuasive communications and social influence, which we will address later.

Innovation characteristics as perceived by the adopters are important factors that affect technology adoption (Moore and Benbasat 1991). The most widely cited innovation characteristics are relative advantage, compatibility, complexity, trialability, and observability (Rogers 1983). These five characteristics explained from 49% to 87% of the variance in innovation adoption rate (Rogers 1995). Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes. Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. Trialability is the degree to which an innovation may be experimented with on a limited basis. Finally, observability is the degree to which the results of an innovation are visible to others.

In developing an instrument for measuring the perceptions of adopting an IT innovation, Moore and Benbasat split observability into two distinct constructs: result demonstrability and visibility. Result demonstrability is the degree to which the results of using an innovation are tangible, whereas visibility is the degree to which an innovation is visible. In the current study, we use six major innovation characteristics: relative advantage, ease of use (complexity), visibility, result demonstrability, compatibility, and trialability. These six attributes are chosen because they have been consistently shown by previous research as the primary characteristics that affect user adoption of innovation.

2.3 Intention-Based Theories of IT Adoption

Great research progress has been made in the last decade in understanding user adoption and usage of IT innovations. Particularly, a research stream has emerged that uses intention-based theories such as theory of reasoned action (TRA) (Fishbein and Ajzen 1975), theory of planned behavior (TPB) (Ajzen 1991), and technology acceptance model (TAM) (Davis 1989; Davis et al. 1989) to predict user acceptance of IT (e.g., Hartwick and Barki 1994; Igbaria et al. 1995; Mathieson 1991; Taylor and Todd 1995). According to these theories, user adoption and usage behaviors are determined by intention to use IT, which in turn is influenced by beliefs and attitude about IT.

Since attitude and beliefs about IT innovation are antecedents of user intention and usage, it is critical to understand the external variables that influence the formation and change of attitudes and beliefs (Davis et al. 1989). Recent research has examined the influence of user characteristics, system quality and organizational support on perceived ease of use and perceived usefulness (Igbaria et al. 1995); the impact of computer self-efficacy, objective usability, and direct experience on perceived ease of use.
(Venkatesh and Davis 1996); the effect of user intrinsic motivation in training on creating favorable user perceptions (Venkatesh 1999). Venkatesh and Davis (2000) extended TAM by incorporating social influence and cognitive instrumental processes as external variables.

However, with a few exceptions (e.g., Agarwal and Prasad 1997; Karahanna et al. 1999; Venkatesh and Davis 2000), most empirical studies have ignored the temporal dimension of IT adoption. This limitation raises some serious issues. Individuals in different stages of the adoption process may hold different beliefs, and may be influenced by different antecedent variables. Agarwal and Prasad reported that the same IT innovation characteristics impact differently on current usage and future intentions. Karahanna et al. found significant differences in beliefs and attitudes between users in the pre-adopter stage and those in the post-adoption stage. Venkatesh and Davis (2000) found that the same external variable had a different impact on users’ perceptions of IT in different stages of the adoption process. Without identifying the specific stage, the empirical results might have been confounded by the temporal dimension of the adoption process. Agarwal and Prasad suggested that a unitary model may not work for explaining or predicting user adoption outcomes in different stages. Karahanna et al. called for longitudinal research that tracks the same individual over time through the adoption process.

Based on relevant theories and using a longitudinal experimental design, this study extends the existing intention-based theories of IT adoption by examining the effects of three important external variables, persuasion, training, and direct-use experience, on the formation and change over time of user beliefs and adoption decisions of IT innovation.

### 2.3 Persuasion Theory

Persuasion refers to “an active attempt to influence people’s action or belief by an overt appeal to reason or emotion” (Wright and Warner 1962, p. 7), or “communication intended to influence choice” (Brembeck and Howell 1976, p. 19). Since beliefs are the ultimate determinants of behavior, in order to influence an intention or the corresponding behavior, it is necessary to change the underlying beliefs. Persuasion has been shown to be one of the most important strategies for influencing beliefs and behavior (Fishbein et al. 1980).

Persuasion can be viewed as a social influence mechanism to form, transmit, and change social norm (Cialdini and Trost 1998). Kelman (1961) suggests that social influence operates through three processes: internalization, identification, and compliance. Internalization results from accepting information from expert sources as evidence of reality, and integrating it into one’s own cognitive system. Identification results from feeling some bond with a likable source and persists for as long as the likable source is still salient. Compliance results from a powerful source that has control over the message recipient. In an early stage of innovation adoption, since the potential adopter lacks knowledge of the innovation and its social context, persuasion not only conveys to an individual information about the behavioral object (informational influence) but also signals to her what important others believe in and expect her to do with respect to the behavior (identification and compliance influence).

Petty and Cacioppo (1981) categorized two basic routes to persuasion: central and peripheral. Central route is based on the arguments central to the issue under consideration. It emphasizes the content quality of the persuasive arguments. The peripheral route emphasizes various cues associated with the arguments. Peripheral cues include the length of the argument, source credibility and attractiveness. Petty et al. (1981) suggested that personal relevance of an issue is a key factor that determines which persuasion route should be followed. Under high relevance, attitudes are influenced primarily by the quality of the arguments in the message, whereas under low relevance, attitudes are influenced primarily by peripheral cues.

In this study, we choose to examine the effect of the central route or argument quality of persuasion on the formation and changes of individual beliefs and adoption decisions. Our choice of argument quality is based on the following rationales. First, the quality of persuasive arguments is one of the most studied variables (Petty and Wegener 1998). Second, changes induced via the central route tended to be enduring and predictive of subsequent behavior, whereas changes induced via the peripheral route tended to be more ephemeral and less predictive of subsequent behavior (Cialdini et al. 1981). Third, Fishbein and Ajzen (1981, p. 359) argued that “the general neglect of the information contained in a message…is probably the most serious problem in communication and persuasion research….the persuasiveness of a communication can be increased much more easily and dramatically by paying careful attention to its content…than by manipulation of credibility, attractiveness…or any of the other myriad factors.”

Argument quality is comprised of two dimensions: argument strength and argument valence (Areni and Lutz 1988). Argument strength is defined as the audience’s subjective probability that the attitude object is associated with some outcome or consequence, whereas argument valence is the audience’s evaluation of that consequence (Areni and Lutz 1988). In order to enhance argument quality, either argument strength or argument valence, or both, should increase. One way to enhance argument quality is to provide a causal explanation because it can change beliefs by altering the balance of explanations available in support.
of alternative beliefs (Slusher and Anderson 1996). Another way to elevate argument quality is by providing concrete evidence (e.g., statistics, data, etc.) in support of the argument (Petty and Cacioppo 1979).

3. **HYPOTHESIS**

Innovation diffusion is essentially a process of persuasive communication and influence whereby potential users become informed about the availability of new technology, are persuaded to adopt, and gain understanding about the innovation through learning by using (Rogers 1983). Accordingly, adoption may be viewed as primarily the outcome of a learning or communications process (Brown 1981). Attewell (1992) distinguishes two types of information and communications: signaling and learning. Signaling refers to persuasive communication about the existence and potential gains of an innovation. Learning refers to the process whereby users obtain the technical know-how knowledge to develop an understanding of the strengths and weaknesses of the innovation and to effectively use the innovation in a specific context. In the learning process, end-users go through not only learning by training where the conceptual and operational knowledge and skills are learned but also learning by using where they apply the technological knowledge and skills in their work and develop a unique understanding of the innovation (Rosenberg 1982). In the IT innovation adoption literature, training and direct-use experiences have also been found to have significant impact on user beliefs and attitudes about IT (e.g., Davis and Bostrom 1993; Igbaria et al. 1995; Venkatesh 1999; Venkatesh and Davis 1996, 2000).

We conceptualize that, in the innovation adoption process, potential users go through three stages of information processing and learning: persuasion, training, and direct-use experience. The persuasion process conveys to potential adopters the capability of the innovation, the benefits of using it, and significant others’ evaluations and opinions about the innovation. Training in the initial stage provides users with the conceptual and operational knowledge and skills that are necessary to understand and form pre-adoption beliefs and attitude about the IT innovation. Direct-use experience results from reinvention (Clark 1987; Rice and Rogers 1980) where the users develop their own idiosyncratic understanding and use of the technology. Based on this conceptualization of the stages of user information processing and learning, we examine the effects of argument quality, training, and direct-use experience on the formation and changes over time of individual beliefs and adoption decision of IT innovation.

3.1 **Effects of Argument Quality**

Theories and empirical findings in social psychology and innovation research have shown persuasion to be one of the most significant factors influencing the formation and change of users’ beliefs and attitudes. As previously reviewed, the quality of persuasive arguments has been shown to be the most important determinant of persuasion outcome. More specifically, high quality arguments are expected to yield favorable cognitive and affective reactions to the message, while low quality arguments should lead to negative responses to the message (Petty and Cacioppo 1984; Petty et al. 1980, 1981).

In IT innovation adoption literature, Galletta et al. (1995) found that word of mouth from peers significantly affected user attitudes and behavioral intentions related to a software package. King and Kugler (1993) found that rhetorical strategies in the form of emotional and rational arguments had significant influence on technology adoption decisions. Other studies have reported significant effects of managerial support, social norm, and influence on user perceptions and adoption (Grover 1993; Hartwick and Barki 1994; Igbaria et al. 1995, 1997; Venkatesh and Davis 2000). Therefore, we propose

\[ \text{Hypothesis 1:} \quad \text{The quality of persuasive arguments will have a significant effect on user perceptions, attitudes, and intentions about an IT innovation.} \]

3.2 **Effects of Training**

IT training provides users with conceptual and procedural knowledge about the target system (Venkatesh 1999) and thus plays an important role in influencing the formation of user perceptions and attitudes toward the new technology. Empirical IS research suggests that training significantly increases procedural knowledge, which, in turn, affects perceived ease of use (Venkatesh 1998; Venkatesh and Davis 1996), attitudes (Raymond 1990), and usage (DeLone 1988; Fuerst and Cheney 1982; Igbaria et al. 1989; Kraemer et al. 1993; Lee 1986; Raymond 1988; Schewe 1976). Therefore, we propose

\[ \text{Hypothesis 2:} \quad \text{Training will have a significant effect on user perceptions, attitudes, and intentions about an IT innovation.} \]
3.3 Effects of Direct-Use Experience

The social psychology literature suggests that experience gained through direct use is one of the most important sources of information about the target object (Fazio and Zanna 1981) and one’s self-efficacy (Bandura 1986). In addition, one’s attitude toward an object frequently develops through behavioral experience (Wood et al. 1995). Thus, behavioral experience enhances one’s ability to process informational and social influence perceptions and behavior through change in efficacy expectancy and outcome expectancy (Bandura 1977, 1982).

Increased direct-use experience has been found to influence user beliefs about IT (Rivard and Huff 1988) and enhance the user’s confidence in her ability to understand and use IT in performing her task (DeLone 1988; Kraemer et al. 1993). The user’s perceptions and behavioral intentions formed through initial persuasion and training may change as her direct-use experience increases (Venkatesh and Davis 2000). Rice and Case (1983) found that manager judgments of an e-mail system’s overall appropriateness were associated with the duration of usage. King and Xia (1997) found that an individual’s perceptions and evaluations of new technologies changed significantly over time as her use experience increased. It has been argued that the temporal effects of use experience in the post-adoption stages needs to be examined in order to develop better theories of user attitude and behavioral changes (King and Xia 1997; Walther and Burgoon 1992). Therefore, we propose

Hypothesis 3: User perceptions, attitudes, and intentions about an IT innovation will change significantly as the user’s direct-use experience increases over time.

4. METHODS

4.1 System

A commercial CASE software package was selected for the study. The software package has comprehensive CASE functionalities based on reusable object repositories that support systems and software development. Functionalities used in this study included creating and maintaining procedural design diagrams (e.g., data flow and entity relationship diagrams) and object-oriented design diagrams (e.g., use case, class, and state transition diagrams).

4.2 Subjects

Ninety-two undergraduate students at a large U.S. university participated in the study. All participants were currently enrolled in an information systems analysis and design course. To ensure there were no confounding effects caused by differences in subjects’ prior knowledge and skills, no instruction on the software was given and the software was not made available to the subjects prior to the experiment. Results of a pre-experiment questionnaire showed that none of the subjects had any experience with the software used in this experiment or with other CASE tools. On average, the subjects had 9.11 years of computer experience, 3.85 hours of daily computer use, two years of work experience, and had completed two IS development projects.

4.3 Procedure

The manipulations of this longitudinal experiment include argument quality (low or high) and training (with or without). Subjects were randomly assigned to one of four groups with 23 subjects in each group. Data were collected at three points in time. A pre-experiment questionnaire (T0) was used to collect subject background information and general computer beliefs. Two additional questionnaires measuring the focal variables were administered at the training session (T1) and four weeks later (T2), respectively. Subjects in Group 1 and Group 2 read persuasive messages and then completed the T1 questionnaire. In contrast, subjects in Group 3 and Group 4 went through training first, read persuasive messages, and then completed the T1 questionnaire at the end. Each subject was appropriately given one of the two versions (high or low argument quality) of persuasive messages based on our experimental design.

4.4 Independent Variables

4.4.1 Argument Quality

Following the norm in social psychology research, argument quality was manipulated by differing levels of causal explanation and concreteness of evidence. As discussed before, the effect of persuasion route depends on issue relevance. Under high personal relevance, individual beliefs and attitudes are primarily influenced by central route or argument quality; whereas under low
personal relevance, peripheral routes become more important. In this study, since software use was part of the subjects’ project work, high personal relevance was expected. Two measures were used to check subjects’ perceived relevance of using the CASE tool. The result confirmed our expectation. To control for any confounding effects caused by peripheral cues, all messages were of about the same length (about 57 words). Each pair of high versus low argument messages was given the same source.

The content of the arguments was adapted from various sources including commercial magazines, academic papers, and advertising brochures. Each argument was related to one of the six innovation characteristics. In the high quality version, arguments were presented with concrete evidence (i.e., statistics, data) and causal explanation in support of the use of the CASE software. The low quality version of arguments was from a more neutral stance without concrete evidence or causal explanation.

4.4.2 Training

The lab training session consisted of two parts: a 30-minute lecture followed by a 45-minute hands-on practice. One of the authors first lectured on the general concepts and functionalities of the system and then performed a demonstration creating two data flow diagrams. Subjects then completed individually two data flow diagrams that were similar to those demonstrated by the lecturer. The subjects were able to complete the diagrams within 45 minutes.

4.4.3 Direct-Use Experience

In the four weeks following the training, all subjects used the CASE software in completing their system analysis and design projects. The CASE software was available 24 hours a day to the students at a dedicated computer lab, hence could be used at any time. The T2 questionnaire was administered at the end of the fourth week.

4.5 Dependent Variables

Dependent variables measured in this study included perceived innovation characteristics (relative advantage, ease of use, visibility, result demonstrability, compatibility, and trialability), attitudes toward and intention to use the CASE software.

Measures for the dependent variables were generated from two sources: two pilot studies and two existing instruments by Moore and Benbasat (1991) and by Davis (1989). A method similar to that used by Davis et al. (1989) was used to solicit salient beliefs. Twenty-five undergraduates participated in the pilot studies. In the previous year, all participants had taken the same course, which used the same software tool. Their backgrounds were also very similar to those of the participants of the experiment. Seven-point Likert scales were used for all items measuring the dependent variables, ranging from “strongly disagree” to “strongly agree.”

5. RESULTS

5.1 Manipulation Checks

Three measures were used to check the manipulation of argument quality. Subjects in the high quality treatments rated significantly higher on argument strength \((M = 6.42)\) and content desirability \((M = 6.02)\) than those in the low quality treatments \((M = 2.57, M = 2.37; F = 186.96, p = .0001; F = 387.68, p = .0001\), respectively). Ratings based on seven-point Likert scale questions indicated that the arguments were easy to understand and that there was no difference in understandability between the two versions.

To check the effectiveness of training, three measures related to software functionality, knowledge, and lab training effectiveness were used. Using a seven-point Likert scale, subjects rated all three measures high \((M = 5.85, M = 6.75, M = 6.13, \text{respectively})\), indicating effective training with the software. In addition, there was no significant difference in perceived training effectiveness between the low and the high quality argument treatment groups. We conclude, therefore, that our manipulation of argument quality and training was successful.

Subjects did not differ across treatment groups in their general computer experience \((F = 0.34, p = .7991)\), daily computer use \((F = 0.23, p = .8742)\), work experience \((F = 1.25, p = .2981)\), and the number of IS projects completed \((F = 0.40, p = .7505)\). Thus, the results of the experiment should not be affected by the subjects’ prior computer and work experiences.
5.2 Reliability and Validity of Measurement

As shown in Table 1, the reliability coefficients, as determined by Cronbach’s alpha, exceeded 0.70 for all scales except visibility (0.63), compatibility (0.56), and trialability (0.51). The measurement was considered to satisfy content validity because of the care we took in generating the scales. Convergent and discriminant validity was assessed using factor analysis. The factor analysis result indicated that all scales were unidimensional. Results of factor analysis suggested that relative advantage, ease of use, and visibility showed clear discriminant validity. Result demonstrability, trialability, and compatibility, however, tended to converge with other scales. Overall, although reliability and discriminant validity were not very satisfactory, since most items were adapted from existing validated instruments (Agarwal and Prasad 1997; Davis et al. 1989; Moore and Benbasat 1991), the validity and reliability of the measurement were considered adequate for the purpose of this study.

<table>
<thead>
<tr>
<th>Scale item</th>
<th>Factor loading</th>
<th>Scale reliability (Cronbach’s α)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative advantage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Makes job easier</td>
<td>.90</td>
<td>.91</td>
</tr>
<tr>
<td>Completes task more quickly</td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>Increases productivity</td>
<td>.85</td>
<td></td>
</tr>
<tr>
<td>Useful for study and work</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td>Improves effectiveness of projects</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td>Enhances quality of projects</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>Useful for projects</td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>Helps learn my work</td>
<td>.61</td>
<td></td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to learn</td>
<td>.93</td>
<td>.90</td>
</tr>
<tr>
<td>Easy to become skillful</td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>Understandable</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>Time-consuming</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have seen others use</td>
<td>.73</td>
<td>.63</td>
</tr>
<tr>
<td>The software is visible</td>
<td>.73</td>
<td></td>
</tr>
<tr>
<td><strong>Result demonstrability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits are communicable</td>
<td>.88</td>
<td>.70</td>
</tr>
<tr>
<td>Easy to tell about results</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fits with my work style</td>
<td>.83</td>
<td>.56</td>
</tr>
<tr>
<td>Compatible with other software</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td><strong>Trialability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunity to try out</td>
<td>.82</td>
<td>.51</td>
</tr>
<tr>
<td>Trial version is available</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td><strong>Attitude</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Like using it</td>
<td>.93</td>
<td>.84</td>
</tr>
<tr>
<td>Enjoyable</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td><strong>Intention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would use in future work</td>
<td>.88</td>
<td>.70</td>
</tr>
<tr>
<td>Would use it rather than other software</td>
<td>.88</td>
<td></td>
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</tbody>
</table>
5.3 Effects of Persuasion, Training, and Experience

Table 2 presents the ANOVA results on user perceptions of the six innovation characteristics, attitude, and intention to use at T1. The results yielded a significant positive main effect of argument quality across all variables, thus supporting Hypothesis 1. Training had a significant positive main effect on ease of use, visibility, and attitude, but not on other measures, thus partially supporting Hypothesis 2. Overall, the results did not reveal any significant interaction effects.

The results of cross-cell responses at T1 are shown in Table 3. Scale scores were computed by averaging the scores of the items measuring the corresponding scale. In general, there was a clear pattern in the mean response scores across all variables: Group 4 (high quality, training) had the most positive responses, followed by Group 2 (high quality, no training) and Group 3 (low quality, training). Group 1 (low quality, no training) had the lowest response scores. To further detect the differences between groups, a post hoc contrast analysis was performed. All pair-wise mean response differences were significant on all variables except for those between Group 1 and Group 3 (significant only on ease of use, visibility, and compatibility) and those between Group 2 and Group 4 (significant only on ease of use, visibility, and trialability).

To test whether the effects of persuasion and training on user perceptions sustain over time, we examined cross-cell mean responses at T2 (Table 4). The ANOVA results (Table 5) suggested that argument quality at T1 had significant positive main

<table>
<thead>
<tr>
<th>Table 2. Cross-Cell ANOVA Test Results at T1</th>
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<tbody>
<tr>
<td>Variable</td>
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<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Relative advantage</td>
</tr>
<tr>
<td>Argument quality</td>
</tr>
<tr>
<td>Training</td>
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<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Ease of use</td>
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<tr>
<td>Argument quality</td>
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<tr>
<td>Training</td>
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<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Visibility</td>
</tr>
<tr>
<td>Argument quality</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Result demonstrability</td>
</tr>
<tr>
<td>Argument quality</td>
</tr>
<tr>
<td>Training</td>
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<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Compatibility</td>
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<tr>
<td>Argument quality</td>
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<td>Training</td>
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<tr>
<td>Argument quality × Training</td>
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<tr>
<td>Trialability</td>
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<td>Argument quality</td>
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<tr>
<td>Training</td>
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<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Attitude</td>
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<tr>
<td>Argument quality</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Argument quality × Training</td>
</tr>
<tr>
<td>Intention</td>
</tr>
<tr>
<td>Argument quality</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Argument quality × Training</td>
</tr>
</tbody>
</table>
Table 3. Cross-Cell Responses at T1

<table>
<thead>
<tr>
<th>Scale</th>
<th>Group 1 (low quality, no training)</th>
<th>Group 2 (high quality, no training)</th>
<th>Group 3 (low quality, training)</th>
<th>Group 4 (high quality, training)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>4.30 (.66)</td>
<td>5.50 (.69)</td>
<td>4.37 (.90)</td>
<td>5.82 (.77)</td>
</tr>
<tr>
<td>Ease of use</td>
<td>3.29 (.67)</td>
<td>5.11 (.57)</td>
<td>4.39 (1.05)</td>
<td>5.84 (.74)</td>
</tr>
<tr>
<td>Visibility</td>
<td>1.46 (.54)</td>
<td>2.24 (1.14)</td>
<td>2.19 (1.29)</td>
<td>3.35 (1.68)</td>
</tr>
<tr>
<td>Result demonstrability</td>
<td>4.24 (1.01)</td>
<td>5.50 (.75)</td>
<td>4.33 (.90)</td>
<td>5.72 (1.10)</td>
</tr>
<tr>
<td>Compatibility</td>
<td>3.48 (.63)</td>
<td>5.52 (.67)</td>
<td>3.91 (.72)</td>
<td>5.63 (.84)</td>
</tr>
<tr>
<td>Trialability</td>
<td>4.24 (1.23)</td>
<td>6.28 (.65)</td>
<td>3.80 (1.49)</td>
<td>5.72 (.96)</td>
</tr>
<tr>
<td>Attitude</td>
<td>3.61 (1.00)</td>
<td>4.93 (.82)</td>
<td>4.00 (.90)</td>
<td>5.46 (1.18)</td>
</tr>
<tr>
<td>Intention</td>
<td>3.63 (.88)</td>
<td>4.89 (.90)</td>
<td>3.65 (1.15)</td>
<td>4.76 (.85)</td>
</tr>
</tbody>
</table>

*Numbers in table are means (standard deviations).

Table 4. Cross-Cell Responses at T2

<table>
<thead>
<tr>
<th>Scale</th>
<th>Group 1 (low quality, no training)</th>
<th>Group 2 (high quality, no training)</th>
<th>Group 3 (low quality, training)</th>
<th>Group 4 (high quality, training)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>3.74 (1.32)</td>
<td>4.38 (1.12)</td>
<td>4.51 (.88)</td>
<td>5.23 (1.19)</td>
</tr>
<tr>
<td>Ease of use</td>
<td>3.09 (1.41)</td>
<td>4.43 (1.02)</td>
<td>4.49 (.80)</td>
<td>5.23 (.86)</td>
</tr>
<tr>
<td>Visibility</td>
<td>3.43 (1.70)</td>
<td>3.91 (1.59)</td>
<td>3.74 (1.38)</td>
<td>4.17 (1.22)</td>
</tr>
<tr>
<td>Result demonstrability</td>
<td>3.56 (1.46)</td>
<td>4.39 (1.09)</td>
<td>4.15 (.95)</td>
<td>4.78 (1.29)</td>
</tr>
<tr>
<td>Compatibility</td>
<td>2.67 (1.23)</td>
<td>3.91 (1.25)</td>
<td>3.70 (.93)</td>
<td>4.78 (1.30)</td>
</tr>
<tr>
<td>Trialability</td>
<td>4.67 (1.60)</td>
<td>5.33 (1.55)</td>
<td>4.72 (1.19)</td>
<td>5.80 (1.08)</td>
</tr>
<tr>
<td>Attitude</td>
<td>2.49 (1.54)</td>
<td>3.71 (1.14)</td>
<td>3.37 (1.25)</td>
<td>4.70 (1.58)</td>
</tr>
<tr>
<td>Intention</td>
<td>2.83 (1.56)</td>
<td>3.87 (1.14)</td>
<td>3.28 (1.24)</td>
<td>4.54 (.71)</td>
</tr>
</tbody>
</table>

* Numbers in table are means (standard deviations).
effects on user perceptions at T2 across all variables except for visibility. Training at T1 had significant positive main effects on user perceptions at T2 except for visibility, result demonstrability, and trialability. The results of cross-cell mean responses at T2 (Table 4) showed a pattern similar to that suggested in Table 3: Group 4 had the most positive responses, followed by Group 2, Group 3 and Group 1. Overall, the results suggest that the impact of initial persuasion and training on user perceptions sustained even after four weeks.

Table 6 presents the results of within subject mean response differences between T2 and T1. As shown in the last column, as users’ direct-use experience increases, their perceptions, attitudes, and intention changed significantly, supporting Hypothesis 3. In this study, there was a clear deterioration over time on all variables except for visibility and trialability. The reason why visibility increased might be that the CASE software was not used in the university except in this course and that the subjects saw more use as more students worked on their projects. Trialability might have increased as the subjects had the opportunity to try out different functions. The results suggest that users’ more realistic assessment based on direct-use experience was more negative than that based on initial persuasion and training. More specifically, subjects with no initial training showed greater change than those in groups with training. Clearly the initial training helped the subjects to form relatively more realistic assessments.

6. DISCUSSION AND CONCLUSION

The present study reveals a rich set of patterns and results. Due to space limitation, we will only highlight the most important findings without discussing other specific results. In general, the results suggest that persuasion quality is a significant factor that affects the formation and change over time of user perceptions, attitudes, and intention related to IT innovations. Training significantly influences the formation of user perceptions on ease of use, compatibility, visibility, and trialability but not on the other variables. A plausible explanation is that ease of use, compatibility, visibility, and trialability are forms of efficacy expectancy rather than forms of outcome expectancy (Bandura 1977 1982). This is consistent with empirical studies of TAM that found that training had a strong influence on perceived ease of use, but not on perceived usefulness (Venkatesh 1999; Venkatesh and Davis 1996). In addition, the influences of initial persuasion and training on users’ perceptions were sustained over time, further indicating their importance.

User perceptions, attitudes, and intention changed significantly over time as the user’s direct-use experience increased. These results support previous empirical findings that user perceptions and evaluations are a function of their knowledge and direct-use experience (e.g., Nelson 1990; Rivard and Huff 1988; Schmitz and Fulk 1991; Venkatesh and Davis 2000) and that user perceptions and evaluations are dynamic, hence change over time (Agarwal and Prasad 1997; Hartwick and Barki 1994; Karahanna and Straub 1999; King and Xia 1997). The initial persuasion and training mold the informational and social influence foundation for the formation of user perceptions. These perceptions are based on limited knowledge and experience, and thus are vague and tentative in nature. Users develop a better understanding of the strengths and weaknesses of the IT innovation through direct-use experience in their unique task environment. Such idiosyncratic know-how knowledge enables the users to change their initial expectations to more realistic assessments.

This study has important theoretical and practical implications. It contributes to the IT innovation and the intention-based theories by providing empirical evidence that persuasion, training, and experience are important external variables that influence the formation and change over time of user evaluation and adoption of IT innovation. The power of the intention-based theories of IT innovation adoption may be enhanced significantly by taking into consideration the impact of persuasion, training, and experience as well as the dynamic nature of user evaluations and the temporal dimension of adoption process.

The ultimate purpose of understanding user adoption behavior is to develop programs to influence the likelihood of its occurrence. This study suggests that persuasion is a powerful but under-utilized mechanism for enhancing user adoption and use of IT innovation. In the early stage of IT diffusion, managers may create effective persuasive strategies to help users’ information processing so that positive evaluations will be formed. Training programs should be used to enable users to gain conceptual and procedural knowledge that is necessary for the users to overcome the knowledge barriers and to realistically process the persuasive information provided. It is also important that users’ perceptions and attitudes are monitored and managed over time so that appropriate measures can be taken with any changes resulting from increased direct-use experience. In addition, managers can change users’ perceptions and behavior by mediating their experience with the IT innovation.

The use of student subjects may potentially constrain the generalizability of the results. However, we believe this is not a significant problem for the following reasons. The students were themselves users of the software that was relevant and instrumental for their projects. The process involved was very similar to real-world IT adoption situations. In addition, most theories of persuasion and IT innovation adoption were developed and validated using student subjects. Future research is needed to replicate the study in different organizational settings. Relationships among the perceived characteristics of IT innovation, attitudes, intention, and behavior were not examined. Additional theoretical and practical insights may be generated by further investigating these patterns and relationships.
Table 5. Cross-Cell ANOVA Test Results at T2

<table>
<thead>
<tr>
<th>Source</th>
<th>F-Statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative advantage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>8.15</td>
<td>.0054</td>
</tr>
<tr>
<td>Training</td>
<td>11.79</td>
<td>.0009</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.04</td>
<td>.8454</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>22.60</td>
<td>.0001</td>
</tr>
<tr>
<td>Training</td>
<td>24.92</td>
<td>.0001</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>1.92</td>
<td>.1699</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>2.18</td>
<td>.1436</td>
</tr>
<tr>
<td>Training</td>
<td>.83</td>
<td>.3635</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.00</td>
<td>.9441</td>
</tr>
<tr>
<td><strong>Result demonstrability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>8.38</td>
<td>.0048</td>
</tr>
<tr>
<td>Training</td>
<td>3.80</td>
<td>.0546</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.16</td>
<td>.6906</td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>22.18</td>
<td>.0001</td>
</tr>
<tr>
<td>Training</td>
<td>14.67</td>
<td>.0002</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.09</td>
<td>.7587</td>
</tr>
<tr>
<td><strong>Trialability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>9.23</td>
<td>.0031</td>
</tr>
<tr>
<td>Training</td>
<td>.83</td>
<td>.3647</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.58</td>
<td>.4497</td>
</tr>
<tr>
<td><strong>Attitude</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>19.24</td>
<td>.0001</td>
</tr>
<tr>
<td>Training</td>
<td>10.28</td>
<td>.0019</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.04</td>
<td>.8511</td>
</tr>
<tr>
<td><strong>Intention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argument quality</td>
<td>21.19</td>
<td>.0001</td>
</tr>
<tr>
<td>Training</td>
<td>5.10</td>
<td>.0264</td>
</tr>
<tr>
<td>Argument quality × Training</td>
<td>.19</td>
<td>.6651</td>
</tr>
</tbody>
</table>
Table 6. Within Subject Mean Response Differences Between T2 and T1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (low quality, no training)</th>
<th>Group 2 (high quality, no training)</th>
<th>Group 3 (low quality, training)</th>
<th>Group 4 (high quality, training)</th>
<th>All subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>-.55</td>
<td>-1.13 **</td>
<td>.14</td>
<td>-.59 *</td>
<td>-.53 ***</td>
</tr>
<tr>
<td>Ease of use</td>
<td>-.20</td>
<td>-.68 *</td>
<td>.09</td>
<td>-.62 **</td>
<td>-.35 **</td>
</tr>
<tr>
<td>Visibility</td>
<td>1.98 ***</td>
<td>1.67 **</td>
<td>1.55 ***</td>
<td>.83 *</td>
<td>1.51 ***</td>
</tr>
<tr>
<td>Result demonstrability</td>
<td>-.80 *</td>
<td>-1.11 **</td>
<td>-.22</td>
<td>-.85 **</td>
<td>-.72 ***</td>
</tr>
<tr>
<td>Compatibility</td>
<td>1.20 *</td>
<td>-.96 *</td>
<td>.91 *</td>
<td>.09</td>
<td>.31</td>
</tr>
<tr>
<td>Trialability</td>
<td>-1.11 **</td>
<td>-1.22 **</td>
<td>-.63 *</td>
<td>-.76 *</td>
<td>-.93 ***</td>
</tr>
<tr>
<td>Attitude</td>
<td>-.80</td>
<td>-1.02 **</td>
<td>-.37</td>
<td>-.09</td>
<td>-.57 ***</td>
</tr>
</tbody>
</table>

* p < .05  ** p < .01  *** p < .001

Acknowledgments

The authors thank Alan Fine and Heather Tinkham for their assistance with the data collection and thank Jungpil Hahn and Eric Walden for their valuable comments on an earlier version of the paper.

References


