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The Role of Technology Anxiety and Self-Efficacy in Information Technology Training

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ABSTRACT

Technology anxiety (TA) and self-efficacy (SE) have received enormous attention from researchers and practitioners because of their critical effects on individuals' beliefs and performance. This study empirically extends the existing literature by exploring the effects of TA and SE in a training process where individuals' beliefs are sequentially changed through experience. This paper describes how two different types of TA and SE, general and system specific, are constructed across different technologies, and how TA and SE influence consequent beliefs. The results of this paper will allow IT educators and trainers to select and design more effective training methods depending on the objective of training and also help technology product engineers and marketers to design better technology products which fit user's psychological needs.

Key words: Technology Anxiety, self-efficacy, ease of use, direct experience, vicarious experience, technology acceptance, IT training

INTRODUCTION

Information systems (IS) benefits cannot be realized without adoption by individuals who ultimately use them within organizations. Therefore, individuals' usage behavior and its antecedents have received enormous attention from researchers and practitioners and have become a main structure of IS adoption and utilization studies (e.g. Ajzen 1991; Bhattacherjee and Premkumar 2004; Davis 1989; Fishbein and Ajzen 1975; Lewis *et al.* 2003). Such studies highlight that individual beliefs or perceptions about a new technology are significant determinants of usage behavior (e.g. Bhattacherjee 2001; Marakas *et al.* 1998).

Perceived ease of use (PEOU) (Davis 1989; Hackbarth *et al.* 2003; Venkatesh 2000) is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989 pg. 320), and its critical role in predicting and determining a user's technology acceptance behavior has broad empirical support (Venkatesh *et al.* 2003). Various determinants of PEOU have been introduced, but direct, or hands-on, experience has been the strongest determinant of perceived ease of use (Hackbarth *et al.* 2003; Taylor and Todd 1995). It is believed that experienced users employ the knowledge gained from their prior experiences to form their intention to use (Fishbein and Ajzen 1975) and that users generally perceive a system easier to use as they gain more knowledge and confidence through experience.

However, the effect of direct experience on PEOU is significantly mediated by negative and positive user reactions (Hackbarth *et al.* 2003), and technology anxiety (TA) and self-efficacy (SE) have consistently represented both sides of user reactions in prior research. (Agarwal *et al.* 2000; Hackbarth *et al.* 2003; Venkatesh 2000; Venkatesh and Davis 1996). Individuals' experience with a system will decrease TA while increasing SE, and the modified TA and SE will determine their PEOU level. TA, a negative side of user reaction, is defined as an individual's emotional fear, apprehension or phobia when faced with the possibility of using general technology (Herdman 1983). Computer anxiety (CA) narrowly focuses on anxiety related to personal computer usage, but TA or technophobia in this paper focuses on individuals' state of mind about general technology (Meuter *et al.* 2003). SE, a positive side of user reaction, is defined as an individual's belief about his or her ability to successfully perform a certain task or behavior (Bandura 1986) and also has been a significant determinant of usage behavior and performance (Agarwal *et al.* 2000; Fagan *et al.* 2003; Marakas *et al.* 1998; Venkatesh 2000).

The purpose of this research is to empirically extend the existing literature by exploring the effects of TA and SE in a training process where individual beliefs are sequentially changed through experience. Thus, this paper adds vicarious experience to direct experience, which refers to experience gained by observing the performances of others (Bandura 1986). Even though vicarious experience has been considered as a weaker source of experience than direct experience, it significantly influences SE and TA (Bandura 1986; Wang *et al.* 2004) and will provide more insight into the effect of system experience on TA and SE. In addition, this paper will separate TA and SE into general (or non system specific) TA and SE and system-specific TA

and SE to provide a better insight into the relationship between perceived ease of use and system characteristics of the target system. The results of this paper will benefit IT educators and trainers as well as software engineers. Some important research questions include:

1. Do direct and vicarious experiences modify TA and SE over time?
2. Which side of individual reaction, positive (=SE) or negative (=TA), is a better predictor of perceived ease of use?
3. What is the relationship between system specific beliefs and the perception of ease of use, and non system specific beliefs and the perception of ease of use?

BACKGROUND

The technology acceptance model (TAM) suggests that behavioral intention to use a new system results from a rational analysis of perceived usefulness and perceived ease of use (Davis 1989; Venkatesh 2000) (See Figure 1). Predicting and increasing the level of perception of ease of use is one of the main concerns for IS adoption and training researchers (Hackbarth *et al.* 2003; Venkatesh 1999; Venkatesh 2000; Venkatesh and Davis 1996). An individual's perceived ease of use is formed initially by self-efficacy, facilitating conditions, playfulness, and anxiety, and it is modified by objective usability and perceived enjoyment over time with increasing direct experience with the target system (Venkatesh 2000).

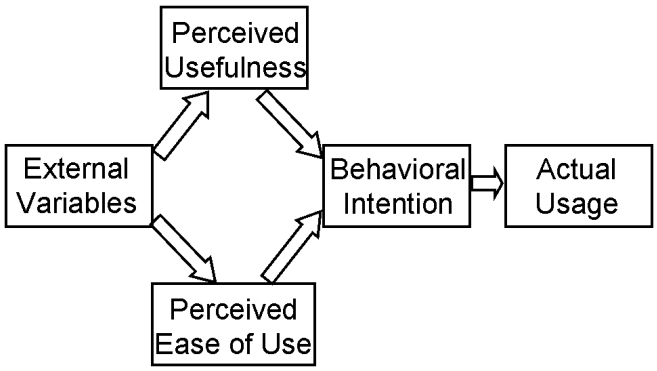

Figure 1. The TAM and the focus of this research

Source: Davis, F.A. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), 1989, pp 319-339.

Direct experience has been identified as a significant predictor of PEOU and performance (Agarwal *et al.* 2000; Hackbarth *et al.* 2003). According to social cognitive theory (Bandura 1986), enactive mastery attained through direct experience is the strongest source that raises an individual's confidence in attaining effective performance level. Venkatesh and Davis (1996) highlight that individuals without direct experience are more likely to base their perceptions on abstract criteria. Taylor and Todd (1995) also suggest that there are significant differences in the relative influence of the determinants of usage depending on experience. They add that it is important to assess the utility of IS adoption models for understanding the behavior of inexperienced users since most IS models are based on experienced users.

Technology anxiety (TA) is a common symptom of modern times and has received enormous attention from researchers and practitioners in such disciplines as marketing, psychology, education, and IS (Beckers and Schmidt 2001; Chua *et al.* 1999; Meuter *et al.* 2003; Venkatesh 2000).

The emphasis of previous technology anxiety (TA) research (Beckers and Schmidt 2001; Chua *et al.* 1999; Meuter *et al.* 2003; Venkatesh 2000) has been on computer related anxiety (CA) due to the importance of computers today. TA is caused by the rapidly changing nature of new technology and the subsequent pressure for social change (Brosnan 1998). Surprisingly, 55% of Americans suffer from some degree of TA, and nearly five million American college students suffer from some type of TA (Scott and Rockwell 1997). Also, about 50% of the British general public do not use a computer nor any form of new technology due to TA (Gilbert *et al.* 2003). Therefore, TA has been a significant predictor for utilization and acceptance of technology (Hackbarth *et al.* 2003; Meuter *et al.* 2003; Venkatesh 2000), and it has consequently influenced

the performance and attitudes of people, such as students, teachers, and medical employees, who use information technology (IT) for certain tasks (Anderson 1996; Brosnan 1998; Kjerulff *et al.* 1992).

Self-efficacy (SE) also has been a significant factor in predicting an individual's IT adoption and performance (Agarwal *et al.* 2000; Compeau and Higgins 1995; Marakas *et al.* 1998). SE is formed through "a gradual and dynamic weighing, integration, and evaluation of complex cognitive, linguistic, social, and/or enactive experiences" (Marakas *et al.* 1998, pg. 127). SE reflects not only an individual's perception of his or her ability to perform a particular task, but also forms a critical influence on future intentions. More than 23 antecedents, including prior success and task difficulty, have been identified by previous research (Agarwal *et al.* 2000; Bandura 1986; Marakas *et al.* 1998).

The strong relationship between TA and SE has been also supported by numerous studies (Beckers and Schmidt 2001; Brosnan 1998; Fagan *et al.* 2003). Some studies empirically found that SE is an antecedent of TA (Beckers and Schmidt 2001; Fagan *et al.* 2003), while others found the opposite (Brosnan 1998), but all concluded that TA and SE are closely related. Marakas *et al.* (1998) state that "Somewhat counterintuitive, however, is the apparent lack of global recognition by the CSE (Computer Self-Efficacy) literature of the importance of the anxiety relationship and by the computerphobia literature of the potential value of CSE manipulation and enhancement in reducing anxiety. ..[these] two streams of research are highly complementary and should be given careful consideration within the realm of future SE research."

THEORETICAL FRAMEWORK

Prior research has identified actual behavioral experience as a significant source of beliefs such as perceived ease of use. According to Hackbarth *et al.* (2003) however, the impact of system experience on perceived ease of use is more strongly supported with mediation effects by positive and negative side of user reactions (Figure 2). In their research, perceived playfulness, a positive side of user reaction, and TA, a negative side of user reaction, were proved to be significant mediators of the impact even though the negative side of the user reaction, TA, is a much stronger mediator than the positive side of the user reaction. Further, "system experience" connotes only direct, hands-on experience with the system.

In today's business environment where new equipment, procedures, and information technology are frequently introduced, updated, and replaced; having direct experience or training with the target system is not always possible. Therefore, observing performance of a similar task by another person, or vicarious experience, (Bandura 1986) is widely used in IS training (Compeau and Higgins 1995; Simon *et al.* 1996). Even though vicarious experience has been considered as a weaker source of experience than direct experience (Bandura 1986), it significantly influences user's beliefs and performance (Compeau and Higgins 1995; Marakas *et al.* 1998; Simon *et al.* 1996). Therefore, this paper includes vicarious experience with traditional direct experience as a source of perceived ease of use.

This paper also replaces the perceived playfulness, which is a weaker mediator than TA (Hackbarth *et al.* 2003), with self-efficacy which has been supported as a strong positive factor of perceived ease of use (Agarwal *et al.* 2000; Venkatesh 2000). Unlike trait anxiety, TA and SE are a kind of state anxiety which is susceptible to change (Chua *et al.* 1999). This simply implies that with increasing experience, TA can be reduced and SE can be increased. Experience has been a strong positive factor of self-efficacy (Agarwal *et al.* 2000; Bandura 1986; Marakas *et al.* 1998), and the strong inverse relationship between TA and experience also has been supported by a significant body of research (Beckers and Schmidt 2001; Chua *et al.* 1999; Scott and Rockwell 1997). Finding and comparing the effect of experience on TA and SE will provide a good guideline for IS educators and trainers when they choose an effective training method. For example, depending on the objective of the training, one which reduces TA (Compeau and Higgins 1995; Simon *et al.* 1996) or enhances SE (Venkatesh 2000) can be selected .

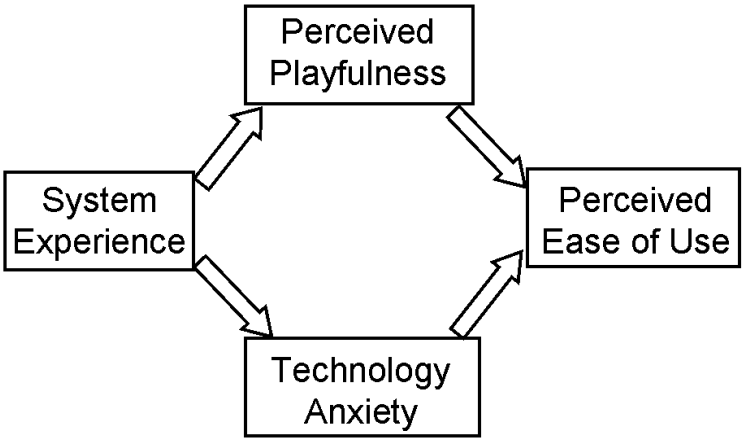

Figure 2. The link between experience and ease of use with mediation effects

Source: Hackbarth, G., Grover, V., and Yi, M.Y. "Computer playfulness and anxiety: Positive and negative mediators of the system experience effect on perceived ease of use," *Information & Management* (40:3), 2003, p 227.

Before direct experience, individuals form perceptions of ease of use based on their general beliefs regarding IS, but with increasing exposure, they adjust their perceptions (Venkatesh 2000). This is consistent with Marakas *et al.* (1998)'s concept of separation of general SE, which refers to an individual's judgement of efficacy across multiple (computer) applications, and specific SE, which refers to an individual's perception of efficacy in performing specific (computer-related) tasks. General (system independent) beliefs form initial PEOU, while specific (system dependent) beliefs modify that given PEOU with increasing experience. Venkatesh (2000), however, highlights that with increasing experience, the general beliefs regarding the IS continue to be important factors driving the perceived ease of use about the target system. Therefore, this paper separates TA as well as SE into the two different types, general and system dependent, to provide more insight into the impact of experience on TA and SE. This separation will help find the nature of general beliefs and system characteristics in the link between experience and perceived ease of use.

THE CONCEPTUAL MODEL

Figure 3 presents the theorized relationships and seven constructs in our model, which describes the link between system experience and PEOU, which is mediated by two different types of TA and SE. Experience is categorized as direct or vicarious. We also identify general and system specific TA and SE. Each of the seven constructs will be measured by a set of separate items. The twelve paths represent the twelve hypotheses to be tested in order to address the three research questions, which follow.

H1: Direct experience is positively associated with general SE.
H2: Direct experience is positively associated with system specific SE.
H3: Direct experience is negatively associated with general TA.
H4: Direct experience is negatively associated with system specific TA.
H5: Vicarious experience is positively associated with general SE.
H6: Vicarious experience is positively associated with system specific SE.
H7: Vicarious experience is negatively associated with general TA.
H8: Vicarious experience is negatively associated with system specific TA.
H9: General SE is positively associated with perceived ease of use.
H10: Specific IT SE is positively associated with perceived ease of use.
H11: General TA is negatively associated with perceived ease of use.
H12: Specific IT TA is negatively associated with perceived ease of use.

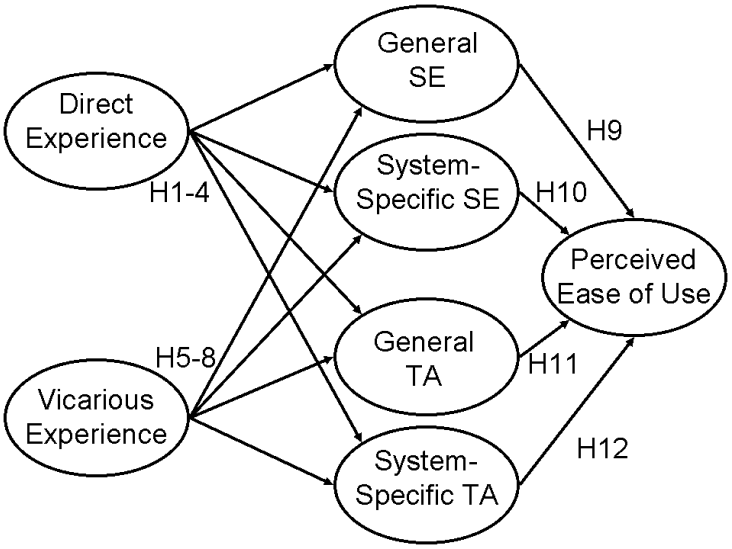

Figure 3. Theorized Model with Twelve Hypotheses

RESEARCH PLAN

To test these hypotheses, a series of surveys will be conducted. We will test the change of perception and attitude of students who start to learn new IS software. Results of this analysis will be presented at the conference in August 2005.

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