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Testing the relationship between personality, computer self-efficacy and computer anxiety

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Keywords
self, computer, efficacy, personality, anxiety, between, relationship, testing

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Abstract

This paper discusses research in progress that examines the relationship between personality, computer self-efficacy and computer anxiety. An extension of the model proposed by Thatcher and Perrewe (2002) is discussed. This extended model considers the role of personality in determining the antecedents of variables affecting computer anxiety and self-efficacy, and how in turn computer anxiety and computer self-efficacy influence task performance. The methodology for testing the model is also presented.

Keywords

Computer self-efficacy, computer anxiety, personality, task performance.

INTRODUCTION

Much of the research on IT adoption and user acceptance has drawn on social psychological approaches posited by Azjen and Fishbein (1980). These theories include the Theory of Reasoned Action, the Theory of Planned Behaviour and other modifications to predict user behaviour. Davis (1989) replaced the attitudinal determinants of the Theory of Reasoned Action with the variables Perceived Usefulness and Perceived Ease of Use and proposed the Technology Acceptance Model, the predominant model used in research in the 1990s. Recently, Venkatesh and Davis (2000) and Ventkatesh (2000) highlighted the limitations of the Technology Acceptance Model and the importance of Perceived Usefulness and Ease of Use. They extended the Technology Acceptance Model to encompass a number of trait and state factors. One of the factors included in the model was Computer Self Efficacy (CSE).

Agarwal and Prasad (1999) defined individual differences in the context of IS research to include factors such as personality, demographic variables and circumstantial variables such as user expertise. They investigated the role of stable individual differences such as personal innovativeness in IT (PIIT: Agrawal & Prasad, 1998), as well as demographic and situational variables (Agrawal & Prasad, 1999) that influence the adoption of IS. Agarwal and Prasad (1998) defined Personal Innovativeness in IT (PIIT) as "the willingness of an individual to try out any new information technology" (p. 206). PIIT is a situation-specific stable trait that is "enduring and predisposes individuals to respond to stimuli in a consistent manner within a narrowly defined context" (Thatcher & Perrewe, 2002, p.383). A distinction was made between, stable situation specific (e.g. PIIT) and dynamic situation specific (e.g. CSE) individual differences (Thatcher & Perrewe, 2002). As dynamic situation specific individual differences have been linked to behaviour, an understanding of how they arise is of value to IS implementation.

Bandura's (1986, 1997) Socio-Cognitive Theory has also influenced user acceptance research. For instance, Compeau and Higgins (1995) and Compeau, Higgins and Huff (1999) tested this theory with managers and demonstrated how CSE and outcome expectation impact on affect, anxiety and behaviour. Compeau et al (1999) stated that investments during the implementation of new technologies in activities to increase CSE and outcome expectation will pay off in the short and long term and called for studies that induce change in CSE.

There are gaps in our knowledge of the antecedents to CSE in user acceptance in information systems. In an extensive review of the construct of CSE, Marakas, Yi and Johnson (1997) pointed to a number of issues including insufficient understanding of the role of computer anxiety (and emotional arousal) on CSE and performance. The role of computer anxiety (CA) has been researched in the past. For instance, Deane et al

(1995) proposed a state-trait theory of CA. Computer anxiety was associated with elevated levels of state anxiety, but more importantly, it was found that CA had a significant effect on task completion latencies independent of computer experience and state anxiety levels (Maher, Henderson & Deane, 1997).

Therefore, there is a need for a better understanding of the antecedents of dynamic computer-related constructs such as computer self-efficacy and computer anxiety, especially stable individual difference traits and dispositions. This elaboration would extend the existing knowledge of CSE, CA and the usage of IS by identifying how stable individual differences affect these dynamic constructs. In turn this will allow future research to assess how certain training and intervention programs affect these constructs with specific reference to individual difference profiles. This paper outlines research in progress to test a model of antecedents to dynamic computer related individual differences. A model that links individual differences (both stable and dynamic) and computer performance is proposed and preliminary results presented.

Review of past researcgh

The role computer self-efficacy and computer anxiety in IS adoption and task performance has received more attention than their stable individual differences counterparts (Brosnan, 1998, Compeau & Higgins, 1995, Martoochio, 1994). Brosnan (1998) argued for a reciprocal relationship between CSE and CA given that CA increases emotional arousal. In addition there is an association between this aversive emotional arousal and an individual's judgment of CSE (Marakas, Yi & Johnson, 2000).

Martocchio (1994) found that participants in an acquirable skill condition showed an increase in CSE and a decrease in CA at pre and post training measurements; while participants who believed that their ability was not malleable displayed increased CA and a related decrease in CSE between the pre and post training measures. Numerous studies have shown that CSE and CA have a significant impact on computer related task performance (Marakas, Yi & Johnson, 2000). Brosnan (1998) found that CA directly contributed to task performance, with less anxious individuals making fewer mistakes. However it was found that the level of CSE had an impact upon how the individual performed the task. Therefore CA is related to task performance and CSE is associated with the method by which the task is performed.

Thatcher and Perrewe (2002) examined the relationships between CSE and CA (dynamic variables), and PIIT, negative affectivity and trait anxiety (stable variables). They found that individuals who scored high on PIIT also displayed higher levels of CSE and lower levels of CA. Individuals who are generally predisposed to feelings of anxiety were more likely to exhibit CA, which in turn, had an inverse effect on CSE. Their model also postulated an effect of NA on CA. However this relationship failed to reach significance. Furthermore Thatcher and Perrewe found that CA only mediates the effect of PIIT on CSE. The current study extends Thatcher and Perrewe (2002) by including personality variables as antecedents to the situation-specific stable individual difference trait of PIIT and the stable disposition of negative affectivity.

Thatcher and Perrewe (2002) defined computer anxiety as anxiety pertaining to "... the implications of computer use such as the loss of important data or fear of other possible mistakes" (p.383). High levels of arousal adversely affect computer task performance. In performance situations this generates further arousal leading to increasing avoidance and fear related to computer usage (Marakas, Yi & Johnson, 2000). Therefore an individual who reports low CA should perform better on a computer related task than an individual with high CA. Studies have also shown that treatment interventions such as repeated exposure and the implementation of user-friendly software do not reduce CA. These interventions appear to precipitate the problem (Marakas, Yi & Johnson, 2000). Agarwal and Prasad (1998) hypothesised that PIIT would have moderating effects upon both the antecedents and the consequences of perceptions and usage of new information technology. They found only partial moderation through the construct of compatibility with the individual's job. Watson and Clark (1984) conceived "negative affectivity as a mood dispositional dimension that reflects pervasive individual differences in negative emotionality and self-concept" (p.465). Negative affectivity (NA) is a dimension of subjective distress and aversive mood states such as nervousness, fear and anger (Watson, Clark & Tellegen, 1988). Woodroof and Burg (2003) investigated the effects of NA on user computer satisfaction of a web application within a student population. They found that individuals who reported higher levels of NA also reported lower levels of satisfaction with the web application.

These findings provide further justification for the inclusion of the external variable of personality into the TAM conceptual model. The psychological literature shows that individuals who are high in extraversion and neuroticism are more likely to have greater positive mood and negative affect. It follows that personality variables such as extraversion, and neuroticism may have considerable impact in the way individuals respond to technology. In this study we have opted to use Costa and McCrae's (1992) model of personality given its widespread use in psychological studies. This model posits that personality can be understood in terms of 5

dimensions, namely, Openness to Experience (imaginative, curious, creative), Conscientiousness (goal-oriented, cautious, organized), Extraversion (talkative, optimistic), Neuroticism (anxious, nervous, worrying) and Agreeableness (good-natured).

THE CURRENT STUDY

Figure 1 is a schematic representation of the research model proposed in this study. The model postulates that the personality factors of extraversion (E), openness to experience (O) and conscientiousness (C) have a direct effect on PIIT, which in turn mediates the effect of personality upon both CSE and CA. The model also proposes that neuroticism (N) will directly affect NA, which in turn mediates the relationship between N and CSE and CA. also It also posits an effect of CSE and CA upon task performance.

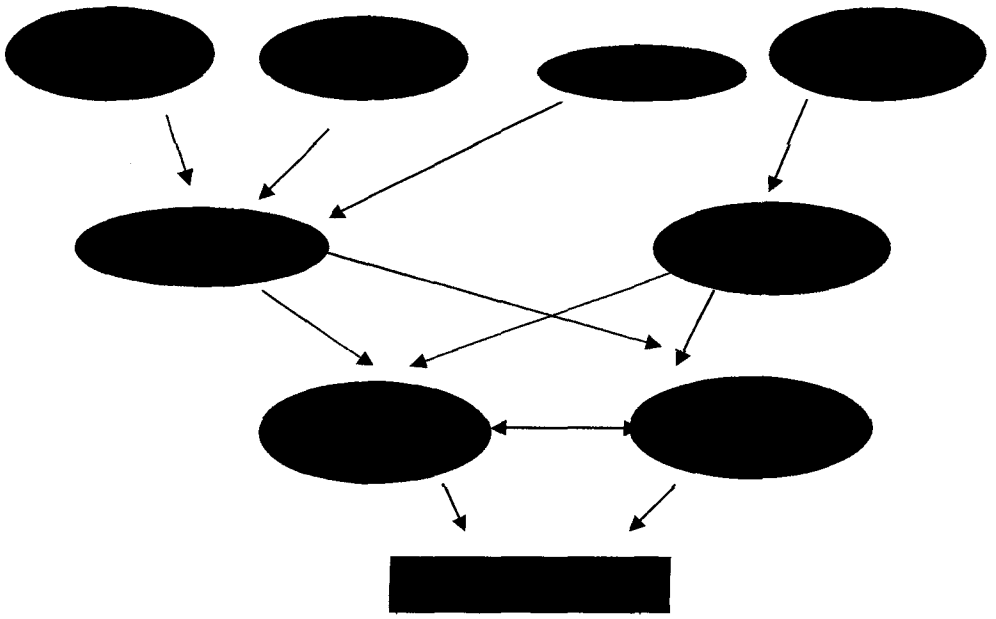

Figure 1: Proposed Research Model.

In the present model (See Figure 1) it is hypothesized that (i) PIIT will act as a mediator between the personality dimensions of E, O and C and the dynamic constructs of task-specific CSE and CA.

An individual who is high on dimension of E has a need for excitement, activity and stimulation (Costa & Mc Crae, 1992). Therefore it is thought that they will be more inclined to try out new information systems and perceive themselves as having higher levels of task-specific CSE. (ii) Individuals who are high on the personality dimension of E are predicted to have higher perceived levels of CSE and subsequently will exhibit lower levels of CA. In addition it is hypothesized that (iii) CSE will be positively related to performance, while CA will be negatively related to performance (iv) negative affectivity will mediate the association between computer anxiety and computer self-efficacy, and (v) computer self-efficacy will be negatively related to computer anxiety.

METHODOLOGY

Approximately 50 second year psychology students completing a psychology statistics subject will participate in the study. Psychology students taking the course were chosen for this sample because they are heavy users of IT in an environment in which a good working knowledge of the software is imperative for successful progress in their degrees. We acknowledge that there are issues relating to the generalisability of the results but we still contend that this sample is valid in a model-development situation.

Materials

Participants will complete a battery of measures reflecting the research variables presented in Figure 1. The personality dimensions N, E, O and C will be assessed using the International Personality Item Pool Representation of the NEO-PI-R (IPIP-NEO, 2001). CSE will be measured using Compeau and Higgins'

(1995) 10-item measure; the measure is task specific in accordance with Bandura's conception of self-efficacy and reflects both the strength and magnitude of efficacy judgments. CA will be measured using 4-items reported in Thatcher and Perrewe (2002). Previous researchers have argued for the validity of these items to capture CA (Compeau & Higgins, 1995). PIIT will be assessed using a 4-item scale developed by Agarwal and Prasad (1998). NA will be assessed using Watson, Clark and Tellegen's (1988) measure derived from the PANAS, which is reported to be a valid measure of the negative emotional disposition. Measures will also be employed to control for computer experience and familiarity. The Computer Usage Scale (CSU) developed by Smith and Caputi (2001) that assesses how frequently the individual has used certain computer applications such as word processing, games, and web page design over the past twelve months. The Perceived Proficiency Scale (PCPS: Smith and Caputi, 2001), assesses perceived level of experience in using specific software applications such as word processing, databases, and Internet. All of the abovementioned measures have demonstrated good internal consistency.

Task performance will be assessed using time taken to complete a task, and both number and type of error performed while completing the task. We will use a theoretically based taxonomy of error proposed by Zapf et al (1992). This taxonomy describes errors as mismatches and distinguishes between functional mismatches (errors that result from the system-task interaction) and usability mismatches (errors resulting from the user-system interaction).

Task and Procedure

Participants will complete 2 tasks (varying in difficulty) using the statistical software package SPSS. The simpler task involves conducting a one-sample t-test. The second more demanding task involves conducting a factorial analysis of variance. In both tasks the participants are required to enter the data in the correct format to perform the statistical required, label the variables and run the analysis. However the participants do not interpret the output, as this interpretation would be linked to cross-domain knowledge rather than a reflection of their ability to use the software package.

Initially, participants are instructed to fill out the questionnaires. After the questionnaires are completed participants then complete the SPSS tasks. Task presentation is counterbalanced across participants.

Participants are timed while completing each task individually. On screen activities (error estimates) are captured using Lotus Screen Cam.

SOME PRELIMINARY RESULTS

At the time of presentation of this paper, data for 21 participants had been collected. Given the relatively small sample size, a correlational analysis was used to investigate the associations among variables implicit in the research model. Once the sample size increases, a partial least squares regression approach will be used to test the model.

It was anticipated that the personality variables O, E and C would correlate with PIIT. However, these relationships were not observed in the data. PIIT did not correlated with O ($r = 0.08$, $p = .745$), E ($r = .16$, $p = .49$) or C ($r = .10$, $p = .66$). We also proposed that Neuroticism would be associated with Negative Affectivity. This relationship was confirmed ($r = .63$, $p = .002$). That is, people who score high on Negative Affectivity also score high on Neuroticism. The research model also posits that PIIT and NA would be associated with CA and the strength and magnitude of CSE. Preliminary results indicate that PIIT is negatively associated with CA ($r = -.54$, $p = .013$), but not related to CSE both strength ($r = -.03$, $p = .910$) and magnitude CSE ($r = .15$, $p = .523$). The results also indicated that NA was positively associated with CA ($r = .38$, $p = .09$), although this relationship was not statistically significant. There was a weak negative relationship between NA and CSE magnitude ($r = -.18$, $p = .448$) and no relationship between NA and CSE strength ($r = .09$, $p = .697$). Task performance was assessed in two ways: time taken to complete the task and the types and number of errors made while completing the task. At this point, we have results for only one of the tasks completed by the participants, namely, an easy task. Only three of the error categories, TE5, TE6 and TE13 showed sufficient variance to warrant further analysis. TE5 and TE6 are sensorimotor errors. T5 refers to typing errors and data entry errors. TE6 refers to errors in using the mouse, exiting or entering menus. TE13 refers to knowledge-based errors such as not knowing certain commands or rules. Correlations among these variables are presented in Table 1.

Table 1: Correlations among task performance measures and Computer Anxiety and Computer Self efficacy.

	Time	TE13	TE5	TE6
Computer Anxiety	.29	.43*	.38	-.26
CSE- Strength	-.13	-.18	-.12	.23
CSE- magnitude	-.16	-.20	-.11	.32

* $p < .05$

As one might expect computer anxiety is positively associated with time taken to complete a task and knowledge based errors. Although not significant there was an association between TE5, but negatively correlated with TE6. Similarly, CSE-magnitude and CSE strength were positively associated with TE6. These relationships are interesting and warrant further, more detailed investigation.

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