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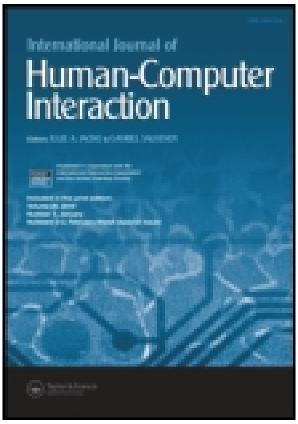

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The Impact of Computer Self-Efficacy and Technology Dependence on Computer-Related Technostress: A Social Cognitive Theory Perspective

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Professionals and end users of computers often experience being constantly surrounded by modern technology. One side effect of modern technology is termed *technostress,* which refers to the "negative impact on attitudes, thoughts, behaviors, or body physiology that is caused either directly or indirectly by technology" (Well and Rosen, 1997). Based on social cognitive theory, this study developed a conceptual model in which computer-related technostress was studied as consequences of computer self-efficacy and technology dependence. Results show that (a) employees with higher level of computer self-efficacy have lower level of computer-related technostress, (b) employees with higher level of technology dependence have higher level of computer-related technostress, and (c) employees under different individual situations may perceive different levels of technostress. Contributions of this research and implications for theory and managerial practice are also discussed.

1. INTRODUCTION

As the importance of computers and the Internet grows in our society, people may experience negative emotions in actual or anticipated interactions with computers (Heinssen, Glass, & Knight, 1987; Korunka, 1997). For example, people have to take the time and make the effort to keep up with new software and hardware. In addition, many individuals are fearful of new information and communication technologies (ICTs) because they anticipate that computers will eventually replace humans and the jobs they carry out in the workplace (Garland & Noyes, 2008).

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These negative emotions take the form of fear, anxiety, hostility, and resistance in both psychology and behavior, inhibiting the best use of computer-based ICTs. In recent years, some scholars have focused on the new construct called technostress (Brillhart, 2004; Weil & Rosen, 1997). Technostress is defined as any negative effect on human attitudes, thoughts, behavior, and psychology that directly or indirectly results from the use of computer-based ICTs (Tu, Wang, & Shu, 2005). Why do we feel technostressed? The rapidly advancing nature of technology is one of the major creators of this phenomenon. Human cognitive limitations and the inability to adapt to the rapid changes in technology may generate a negative impact on effective information technology (IT) use and individual productivity.

It should be noted that this new phenomenon of modern, computer-related technostress is very different from the earlier generation of stress caused by automation. First, modern computer technology is now deeply integrated into our lives and has brought down the walls between work and life. Second, thanks to the wide application of ICTs in various industries and the prevalence of the Internet and mobile commerce, employees, especially those at the management level, are now dealing with an explosively expanding amount of information. Third, computer-based ICTs are advancing unprecedentedly fast, thus imposing a tougher demand for employees to keep up with the ever-growing technology. In contrast, automation-related technostress is more likely to happen only in the workplace and may not be as intertwined with one's life outside of work (Karuppan, 1997; Smith, 1995).

Existing studies have investigated the negative relationship between computer-related technostress and individual productivity (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007), as well as organizational outcomes (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008). However, relatively fewer studies in the organizational behavior and information systems (IS) literature provide insights on how to effectively reduce computer-related technostress perceived by employees and increase IT productivity. It is important to identify and validate the sources of negative psychological and behavioral reaction toward computer-based ICTs (Conway, 1999). From the birth of the first computer to the predictable near future, the development of computers and ICTs seems unlimited, and Moore's Law is, and will be, still valid. On the other hand, the ability of humans to deal with information is limited. As computers and ICTs burrow ever deeper into our lives, it is less and less likely that we will be freed from the technostress they bring. In this study, we focus on the reasons that people feel technostressed in relation to both human factors and the characteristics of ICTs.

The article proceeds as follows. In the next section, we review the theoretical background and the relevant literature in the present study. In section 3, we summarize the related concepts—including technostress, computer self-efficacy, and technology dependence—and propose the conceptual model and research hypotheses regarding the relationships between computer-related technostress and computer self-efficacy and technology dependence. In section 4, we validate the concepts and test the model using data from survey responses of 350 employees who use computers in their routine work. Section 5 presents the result of data analysis. Section 6 discusses the findings of the present study.

Section 7 concludes the contributions, highlights the limitations, and identifies future research directions in this field.

2. THEORETICAL BACKGROUND

To investigate the key factors thought to affect an individual's perceived computer-related technostress, this study draws on Bandura's social cognitive theory (SCT) from the social psychology field. In addition, the literature on technostress provides some support for the conceptual model and hypotheses. The following section is a brief overview of the relevant theoretical foundations.

2.1. Social Cognitive Theory

SCT is a "theoretical framework for analyzing human motivation, thought, and action" that "embraces an interact model of causation in which behavior, cognition and other personal factors, and environmental influences all operate as interacting determinants that influence each other bidirectionally" (Bandura, 1986, p. xi, 2001). The model is regarded as "triadic reciprocal determinism" and widely accepted in predicting individual behavior and identifying methods in which behavior can be modified or changed.

The fact that behavior varies from situation to situation may not necessarily mean that behavior is controlled by situations but rather that the person is construing the situations differently and thus the same set of stimuli may provoke different responses from different people or from the same person at different times (Jones, 1989). Within the IS research area, many researchers have investigated individual computer-related behaviors and attitudes based on all or part of SCT (Bolt, Killough, & Koh, 2001; Compeau, Higgins, & Huff, 1999; Liaw, Chang, Hung, & Huang, 2006). According to SCT, self-efficacy is a major determinant of an individual's task performance and has been found to have diverse psychological and behavioral effects in many areas of human psychosocial functioning (Bandura, 1986, 1997).

The concept of computer self-efficacy has received much attention. (Compeau & Higgins, 1995). Bandura and other researchers have identified more than 23 antecedent and consequent factors that are theoretically related to computer self-efficacy (Marakas, Yi, & Johnson, 1998), including computer attitude, computer use, computer anxiety, and so on.

2.2. Technostress Literature

The term "technostress" was first proposed in 1984 by psychologist Craig Brod in his book *Technostress: The Human Cost of the Computer Revolution*. He defined technostress as "a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner" (p. 16). Weil and Rosen, in their 1997 book *TechnoStress: Coping With Technology @WORK @HOME @PLAY*, expanded the definition of technostress to include "any negative impact on attitudes, thoughts, behaviors, or body psychology caused directly or indirectly by technology" (p. 5). Clear symptoms of technostress include the inability to concentrate on a single issue, increased irritability, and the feeling of loss of control (Ibrahim, Bakar, & Nor, 2007). At the same time, it may inhibit an individual's further learning or using computer and information technology (Wang, Shu, & Tu, 2008).

The construct most frequently confused with technostress is computer anxiety, although there are important differences between the two concepts. Computer anxiety usually is defined as a fear of computers when using one, or fearing the possibility of using a computer (Barbeite & Weiss, 2004; Chua, Chen, & Wong, 1999; Howard & Smith, 1986; Maurer, 1994). By contrast, computer-related technostress always refers to a kind of fallout of an individual's inability to deal with constantly evolving ICTs and the changing cognitive and social requirements related to their use (Tarafdar et al., 2007). In other words, it is a general construct that describes the direct and indirect impacts of ICTs. Computer anxiety typically refers to one's emotional reaction toward using computer (Heinssen et al., 1987), which is regarded as an affective response (Barbeite & Weiss, 2004). For example, a professional IT programmer may have low computer anxiety because of his or her well-informed knowledge of and experience with the hardware and software. At the same time, he or she may have high technostress about the invasion of technology into his or her personal life.

3. CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

Based on the aforementioned theoretical streams of research, this study explores the relationships between the cognitive factors and computer-related technostress. We summarize the proposed relationship to be tested in this study in Figure 1.

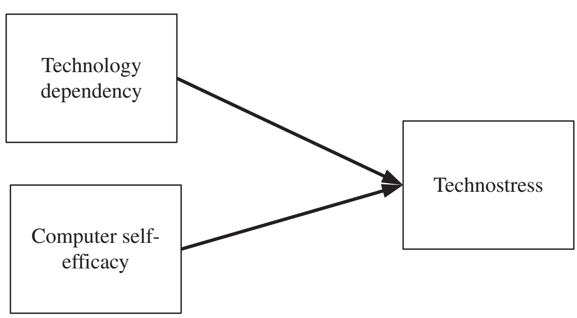

FIGURE 1 Conceptual model.

3.1. Computer Self-Efficacy

Bandura (1986) defined self-efficacy as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances, which is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses. Thus, computer self-efficacy refers to a belief of one's capability to use a computer (Compeau & Higgins, 1995). This belief has an influence on choice of activities, degree of effort expended, and persistence of effort (Bandura, 1986).

According to Lazarus's cognitive theory of psychological stress, individual stress is formed as the relationship between the person and the environment that is appraised by the person becomes taxing or exceeds his or her resources and endangers his or her well-being (Lazarus & Folkman, 1984). It includes two processes: cognitive appraisal and coping. Cognitive appraisal, by which the person evaluates whether he or she is in trouble and what can be done to prevent harm, is a critical mediator of a stressful person–environment relationship (Folkman, Lazarus, Gruen, & DeLongis, 1986).

Therefore, the individual ability of self-appraisal significantly affects the level of perceived stress. As previously mentioned, computer self-efficacy, as a belief in one's capabilities to successfully perform a computer-related task, is related to computer-related stress when people use these technologies. According to SCT, self-efficacy influences individuals' feelings of stress and anxiety, including thought patterns and emotional reactions (Bandura, 1986). Studies have found that perceived high computer self-efficacy increase the use of a computer and decrease an individual's computer anxiety (Compeau & Higgins, 1995; Fagan, Neill, & Wooldridge, 2003). Meanwhile, individuals with higher computer self-efficacy will more easily adapt to the changes and developments in computer technology and IT than those with lower computer self-efficacy. Some researchers empirically confirmed that self-efficacy is negatively correlated with resistance to technology change. That is, people who perceive lower self-efficacy will be more resistant to technology change than those with higher self-efficacy (Ellen, Bearden, & Sharma, 1991). In addition, positive self-efficacy may encourage learning new skills, whereas negative self-efficacy may create resistance in operative capabilities (Zhang & Espinoza, 1998). This leads to the following hypothesis:

H1: Computer self-efficacy is negatively related to computer-related technostress.

3.2. Computer-Related Technology Dependence

Internet and computer-related technology has become an indispensable part of our routine work (Hoffman, Novak, & Venkatesh, 2004). Many companies have adopted all kinds of IS products (including hardware and software) to improve business performance. In other words, people become increasingly dependent on computer-related technology at work. McCune (1999) described the phenomenon of technology dependence that exists in our daily work and developed a technology-dependence instrument to evaluate the level of dependence. However, research among sociologists and psychologists has not formally identified technology dependence as an academic construct. In this study, we focus on the development of this construct and explore the relationship between technology dependence and computer-related technostress.

Generally, computer end-users can be classified into four types based on the extent of computer use in their work (Streeter, 1975). Types A and B end-users are those who make no use or some use of a computer, and Types C and D end-users are those who have to rely on computers in their work. The former types may not care too much about the availability of computers, but the latter types often worry because they don't know what to do when their computers break down or the Internet is not accessible (Seppala, 2001). According to the previous discussion, we define computer-related technology dependence as the extent that employees depend on computer-based technology to finish their job. Thus, the former types of end-users have lower computer-related technology dependence, and the latter types of end-users have higher computer-related technology dependence.

Higher computer-related technology dependence means closer personal relevance of computer-related technology in routine work. Researcher have concluded that user involvement, which is a subjective psychological state reflecting the importance and personal relevance of an object or event (Barki & Hartwick, 1994), will positively affect their behavior intention to use the technology (Amoako-Gyampah, 2007). So an individual with higher technology dependence is more likely to face the trouble of computer-related technology, such as technology overload, complexity, uncertainty, and so on. For example, this individual must attend computer training to perform his or her job successfully because computer-related technology changes constantly. Therefore, we hypotheses the following:

H2: Technology dependence is positively related to computer-related technostress.

Further, from an SCT perspective, personal and environmental factors influence one's behavior and attitude together. We consider the extent of computer self-efficacy and computer-related technology dependence on an individual's work as two dimensions to categorize an individual situation. The extent of computer self-efficacy is divided into high level and low level according to the mean value. Computer-related technology dependence is divided into high dependence and low dependence according to the mean value. Therefore, four different individual situation configurations can be formed: (a) low computer self-efficacy/low computer-related technology dependence, (b) low computer self-efficacy/high computer-related technology dependence, (c) high computer self-efficacy/low computer-related technology dependence, and (d) high computer self-efficacy/high computer-related technology dependence. An additional research question is to find out whether employees perceive different levels of technostress under different configurations of individual situation.

4. RESEARCH DESIGN

4.1. Questionnaire Development Process

This article is part of a larger research framework. The questionnaire items are either adopted from previous studies or developed and validated in the current study. An initial list of items for the questionnaire was generated based on literature review. Pretest of the questionnaire (including all construct measures) was conducted with 35 academic faculty members and business managers. During the pretest process, we first used the Q-sort method (Nahm, Solis-Galvan, Rao, & Ragu-Nathan, 2002) to access the reliability and construct validity of questionnaire items. Based on the Q-sort and structured interviews, the definitions and measurement items were revised. Next, we conducted a pilot study with a sample size of 30 to further purify the scales. Factor analysis was performed on each subdimension scale to assess unidimensionality and discriminant validity. Reliability score (Cronbach's alpha) was used to assess scale consistency. The final version of the questionnaire was confirmed after necessary revisions and was ready for large-scale data collection.

4.2. Data Collection

The target respondents of this study are employees who use computer technology in their routine work, including IT professionals and general end-users. The organizations are mainly located in Xi'an, Beijing, Suzhou, Changchun, and Shenzhen in China. They cover a broad range of industries including government, manufacture, services, IT industry, retailing, and finance.

All respondents were assured that their anonymity would be preserved, and no identification marks were made. The survey was distributed in May 2008 to a random sample of 350 employees in 22 organizations. A total of 305 questionnaires were completed. We carefully checked these questionnaires and removed the ones that were incomplete. A total of 289 usable questionnaires were retained in the following analysis, with a response rate of 82.6%. Sample demographics are given in Table 1.

Among the 289 respondents, 62% were male and nearly 38% were female; 87% were younger than 35 years of age; 77.5% had earned at least a bachelor's degree, and 15% had completed graduate-level education.

4.3. Construct Measurement Instruments

Tarafdar et al. (2007) identified five components of computer-related technostress from the perspective of sources of stress:

1. techno-overload: technostress caused by information overload
2. techno-invasion: technostress caused by technology invading personal life
3. techno-complexity: technostress caused by the inability to deal with the complexity of technology

Table 1: Sample Demographics

	Frequency	%	*Cumulative %*
1. Gender			
Male	180	62.3	62.3
Female	109	37.7	100.0
Total	289	100.0	
2. Age			
<26	82	28.4	28.4
26∼35	169	58.5	86.9
36∼45	30	10.4	97.2
46∼55	7	2.4	99.7
>56	1	.3	100.0
Total	289	100.0	
3. Education			
High school	7	2.4	2.4
2-year college	57	19.7	22.2
4-year college	181	62.6	85.1
Graduate degree	43	14.9	100.0
Total	288	99.7	
Missing value	1	.03	

4. techno-insecurity: technostress caused by technology induced job insecurity
5. techno-uncertainty: technostress caused by the uncertainty of technology

This study adopts the same technostress measurement instrument with minor revisions. The instrument describes typical situations that create technostress as just mentioned. There are 22 items for measuring the five factors. Reliability scores for the five factors are confirmed by data from the current study to be all above the minimum acceptable level of 0.7.

The computer self-efficacy instrument was originally developed by Compeau and Higgins (1995). It consists of 10 items on a 7-point Likert scale, ranging from 1 (*not at all confident*) to 7 (*totally confident*). It asked responders to indicate whether you could use an unfamiliar software package under a variety of confident levels. Reliability for the original scale was above 0.9 and was confirmed in the present study with very good reliability score ($\alpha = .95$).

There are no generally accepted measures of technology dependence in existing literature. Thus we developed a seven-item scale based on the works of McCune (1999) and Hoffman et al. (2004). This instrument also uses the 7-point Likert scale, ranging from 1 (*strongly agree*) to 7 (*strongly disagree*). The scale exhibits good reliability ($\alpha = .80$) based on data from the current study.

5. ANALYSIS AND RESULTS

Exploratory factor analysis revealed seven clear factors with all factor loadings above 0.50 and most above 0.7, indicating good convergent and discriminant validity. The means, standard deviations, reliability, and factor loadings of the seven factors involved in this study are reported in Table 2. Item X118 has a cross-loading problem and was removed from analysis.

Table 2: Mean, Standard Deviation, Reliability, and Measurement Items of the Constructs

Items	*M*	*SD*	*Factor Loading*
Techno-uncertainty (reliability = 0.7652)	3.36	0.798	
X101. There is always new developments in the technologies we use in our organization.			.757
X102. There is constant changes in computer software in our organization.			.820
X103. There is constant changes in computer hardware in our organization.			.746
X104. There is frequent upgrades in computer networks in our organization.			.696
Techno-overload (reliability = 0.8265)	3.07	0.813	
X105. I have a higher workload because of increased technology complexity.			.777
X106. I am forced by this technology to work with very tight time schedules.			.758
X107. I am forced to change my work habits to adapt to new technologies.			.593
X108. I am forced by this technology to do more work than I can handle.			.825
X109. I am forced by this technology to work much faster.			.736
Techno-invasion (reliability = 0.7261)	3.42	0.684	
X110. I feel my personal life is being invaded by this technology.			.703
X111. I have to be in touch with my work even during my vacation due to this technology.			.746
X112. I have to sacrifice my vacation and weekend time to keep current on new technologies.			.692
X113. I spend less time with my family due to this technology.			.596
Techno-complexity (reliability = 0.7665)	2.08	0.751	
X114. I do not know enough about this technology to handle my job satisfactorily.			.762
X115. I need a long time to understand and use new technologies.			.693
X116. I do not find enough time to study and upgrade my technology skills.			.840
X117. I find new recruits to this organization know more about computer technology than I do.			.644
Techno-insecurity (reliability = 0.8144)	3.01	0.744	
X119. I have to constantly update my skills to avoid being replaced.			.824
X120. I am threatened by coworkers with newer technology skills.			.848
X121. I do not share my knowledge with my coworkers for fear of being replaced.			.806
X122. I feel there is less sharing of knowledge among coworkers for fear of being replaced.			.670
Computer self-efficacy (reliability = 0.9497)	5.23	1.295	
I COULD COMPLETE THE JOB USING THE NEW SOFTWARE PACKAGE . . .			
X401. If there was no one around to tell me what to do as I go.			.741
X402. If I had never used a package like it before.			.812
X403. If I had only the software manuals for reference.			.897
X404. If I had seen someone else using it before trying it myself.			.892

(*Continued*)

Table 2: (Continued)

Items	*M*	*SD*	*Factor Loading*
X405. If I could call someone for help if I got stuck.			.871
X406. If someone else had helped me get started.			.871
X407. If I had a lot of time to complete the job for which the software was provided.			.844
X408. If I had just the built-in help facility for assistance.			.782
X409. If someone showed me how to do it first.			.844
X410. If I had used similar packages before this one to do the same job.			.798
Computer-related technology dependence (reliability = 0.7989)	3.85	0.649	
X701. The computer technology has become part of the daily routine in the office.			.704
X702. The computer has replaced the paper, calculator, fax and telephone as the major communication device in the office.			.648
X703. I would be difficult to image my work without a computer.			.637
X704. My work is done more than 80% on a computer.			.670
X705. All of knowledge sharing and information transferring are carried out by internet or intranet in my organization.			.596
X706. I have ever been unable to perform work because of a technology glitch such as hardware problem, software snafu and network failure.			.612
X707. Job-related data and information must be acquired from computer in my work.			.587

Further, we conducted correlation analysis for the Pearson correlations of age, gender, education, and the three main constructs. Table 3 shows the matrix of correlations among the variables. The results show that technostress (including five dimensions) has a significant negative correlation with computer self-efficacy ($r = -.169$, $p < .05$) and has a significant positive correlation with technology dependence ($r = .264$, $p < .01$). Age has a significant positive relationship with Technostress, whereas education has no significant impact on technostress. These results, expected in the light of previous research, are very interesting and provide some new insights for the study.

Table 3: Pearson Correlation Matrix

Variables	*Gender*	*Age*	*Education*	*Technology Dependence*	*Computer Self-Efficacy*	*Technostress*
Gender						
Age	−0.099					
Education	−0.059	−0.041				
Technology dependence	0.039	0.049	0.102			
Computer self-efficacy	−0.227**	−0.093	0.115	0.164**		
Technostress	−0.091	0.122*	0.035	0.264**	−0.169**	

*$p < .05$. **$p < .01$.

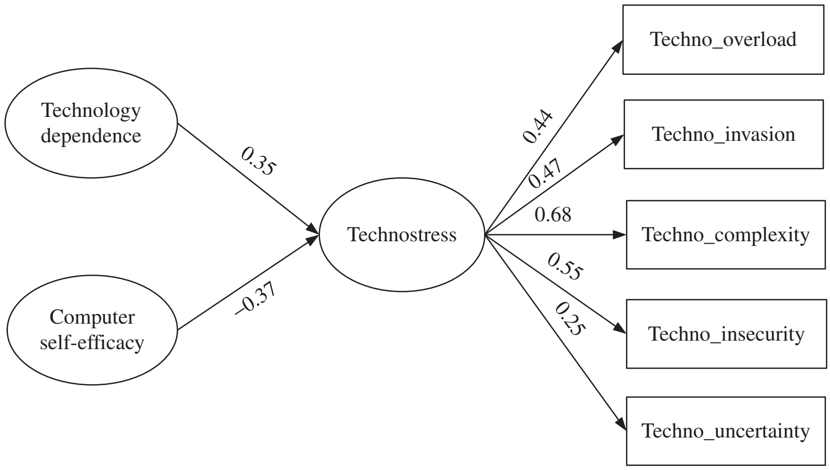

FIGURE 2 LISREL structure model.

Table 4: Results of Structural Equation Modeling Analysis

	χ^2	*df*	χ^2/df	*GFI*	*AGFI*	*NFI*	*CFI*	*IFI*	*RMSEA*
Model	354.48	191	1.856	0.90	0.87	0.95	0.98	0.98	0.055

Note. GFI = goodness of fit; AGFI = adjusted GFI; NFI = normed fit index; CFI = comparative fit index; IFI = incremental fit index; RMSEA = root mean square error of approximation.

Structural equation modeling was used to test the relationship among technostress, computer self-efficacy and technology dependence, and the results are shown in Figure 2. The model fit indices are root mean square error of approximation = 0.055, goodness of fit index = 0.90, adjusted goodness of fit index = 0.87, comparative fit index = 0.98, and the ratio of chi-square to degrees of freedom is 1.856. These measures indicate a good fit (see Table 4) and all the path coefficients are significant (see Figure 2).

Hypothesis 1, which states that there is a negative relationship between technostress and computer self-efficacy, is supported. The path coefficient is –0.37, which is statistically significant at $p < .01$ ($t = -4.69$). The result indicates that employees with higher computer self-efficacy may perceive lower technostress, that is, computer self-efficacy can reduce technostress to some extent.

To gain further insights, we also analyzed the influence of computer self-efficacy on the five individual components of computer-related technostress. The result indicated that computer self-efficacy has significant negative relationship with both techno_complexity ($\beta_{T3} = -0.152$) and techno_insecurity ($\beta_{T4} = -0.375$), but there's no statistically significant relationships between computer self-efficacy and the other three components of technostress (techno_overload, techno_invasion, and techno_uncertainty).

Hypothesis 2, which specifies that technology dependence has a direct and positive impact on technostress, is also supported. The path coefficient is 0.35, which

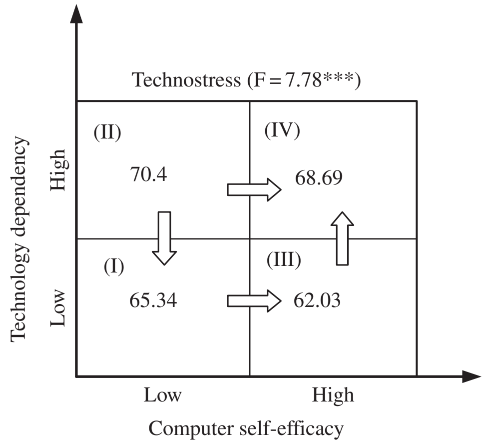

FIGURE 3 Multivariate analysis of variance results (with Scheffe's method).

is statistically significant at $p < .01$ ($t = 4.29$). The result indicates that when technology dependence is high, technostress perceived by employees may increase.

Finally, we conducted a multivariate analysis of variance (MANOVA) followed by a Scheffé's test (for pairwise comparisons) to test whether the level of technostress is different across individual situations. With the individual situation (computer self-efficacy [CSE] vs. computer-related technology dependence [CTD]) as the classification variable and technostress as the dependent variable, the MANOVA results show that the level of technostress is statistically significant under different individual situations (shown in Figure 3). The mean value of technostress under the four different individual situations (I = low CSE/low CTD; II = low CSE/high CTD; III = high CSE/low CTD; IV = high CSE/high CTD) are 65.34, 70.4, 62.03, and 68.69 respectively.

According to the result of multiple compare using Scheffé's method, employee with low computer self-efficacy and high technology dependence (type II) perceives the highest level of technostress, whereas those with high computer self-efficacy and low technology dependence (type III) perceive the lowest technostress. The difference of technostress level between II and III is statistically significant ($p = .001$). Employees with high computer self-efficacy and high technology dependence (type IV) perceive more technostress than those with low computer self-efficacy and low technology dependence (type I). But the difference between type IV and I is not statistically significant.

6. DISCUSSION

The study developed a conceptual model based on SCT and the technostress literature. Two of the hypotheses drawn from this theoretical and empirical literature were supported.

As expected from SCT, computer self-efficacy had a negative relationship with technostress. This is consistent with findings of prior studies (Johnson & Marakas, 2000; Thatcher & Perrewe, 2002), in which they found a negative link between computer self-efficacy and anxiety. According to Bandura's (1986, 1997) theory, the outcomes of self-efficacy generally fall into four major categories. First, self-efficacy influences the situations and activities that affect individual's choice behavior. Second, self-efficacy influences the extent to which individuals will exert the effort required to overcome obstacles and persist when confronted with aversive circumstances. Third, self-efficacy influences individuals' feelings of stress and anxiety (thought patterns and emotional reactions). Fourth, self-efficacy predicts performance and coping behavior. Therefore, employees with high computer self-efficacy are willing to overcome the troubles caused by computer technology and adopt a positive coping behavior, decreasing the level of perceived technostress.

When looking at the impact of computer self-efficacy on the five individual components of technostress, we can conclude that improving computer self-efficacy can significantly decrease technostress caused by technology's complexity and fear of coworker replacement. As noted in SCT, employees with higher computer self-efficacy have stronger confidence to use computer-related technology to perform a specific task. This kind of confidence leads individuals to overcome technology's complexity and sense of job insecurity. Therefore, these findings also support and extend the theory of self-efficacy and SCT.

Our second finding is related to technology dependence. The results indicate that dependence on technology may increase technostress. This is consistent with previous studies (Kiggundu 1981; Sharma & Yetton, 2003). High level of technology dependence is frequently accompanied by the introduction of new computer technologies, including hardware and software. Such changes require end-users to develop new skills required for work. As a result, employees may perceive more technology complexity and uncertainty. In addition, there are often troubles and failures related to computer technology. Employees have to deal with these problems during routine work, which leads to more technology overload.

Finally, the results show that employees under different individual situations may perceive different levels of technostress. Employees with lower computer self-efficacy and higher technology dependence experience significantly more technostress than those who have higher computer self-efficacy and lower technology dependence. There is also an important implication from the MANOVA results, that is, the impact of technology dependence on technostress is higher than that of computer self-efficacy. Furthermore, the 2×2 MANOVA result matrix (Figure 3) is also useful in providing a different tactical path to deal with high technostress situations. For an employee whose task is highly dependent on technology but who has lower computer self-efficacy, there are several ways to reduce his or her technostress level: First, if changing jobs is an option, then it is best to switch that employee into a job position that depend less on technology (II $\rightarrow$ I). Second, if the employee changing jobs is not an option, there are two ways to cope with the technostress issue. The direct way is to improve his or her computer self-efficacy through self training while on the job (II $\rightarrow$ IV). In the indirect way, the employee can be temporarily placed in a position with low technology dependence, which will give the employee an opportunity to improve computer self-efficacy in a less stressful environment. The employee can then be placed back into the previous job position with higher technology dependence (II → I → III → IV). In most cases, the indirect way should be a better tactic in IS human resources management, as it provides an easier transition for the employee through a less stressful process.

7. IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

This article makes several important contributions. First, it contributes to SCT in that it provides empirical evidence that computer self-efficacy is associated negatively with technostress. More important, the effect of computer self-efficacy on the five components of technostress is different. The result of this study indicate that technostress caused by technology's complexity and fear of coworker replacement can be alleviated by improving one's computer self-efficacy, whereas technostress caused by technology's uncertainty, overload, and invasion do not change significantly under different computer self-efficacy levels.

In addition, our research contributes to the theory of job design by developing the construct measurement instrument for technology dependence and examining the positive relationship between technology dependence and technostress. Accordingly, technology dependence can be regarded as a core job characteristic and the original theory of job design can be expanded to better illustrate today's computer-enabled work environment.

Our findings also enrich the technostress literature by demonstrating that computer self-efficacy negatively impacts technostress and technology dependence positively impacts technostress. At the same time, the results of the MANOVA also provide some insight into effectively reducing individual technostress. In addition, we can further explore appropriate coping mechanisms at different workplaces and offer customized training of computer-related technology.

From a managerial perspective, our findings emphasize the importance of understanding individual computer self-efficacy and the concept of technology dependence. In other words, organizations should actively manage their employees' computer self-efficacy in order to help them reduce perceived technostress. In a broader sense, organizations need to closely monitor the relationship between computer information technology and employees who use these technologies, and consequently design better approaches to alleviate potentially high levels of technostress. For example, when an employee feels high technostress, which may negatively impact his or her normal work productivity, management should provide customized training to improve his or her computer experience and confidences. Meanwhile, management may also consider reducing his or her task dependence on technology during the training process. After building up enough confidence and experience, the employee can then go back to the original job post with higher dependence on technology.

Like all empirical research, this study does have a few limitations. The first limitation is the use of a hypothetical scenario for respondents to judge their computer self-efficacy. Second, there may be some response bias associated with the self-reported data of technostress. Despite these limitations, this research contributes to the technostress literature by demonstrating the impact of computer self-efficacy and technology dependence on technostress.

Considering the multilevel and multifaceted character of computer self-efficacy (Marakas et al., 1998), one interesting area for future research is the inclusion of some additional variables into this study, such as task or job characteristics, situational support, and so on, which will help us further clarify the influence of computer self-efficacy on technostress under varying situations. Subsequent studies can also look into alternative models that involve other important factors such as industry differences and end-users versus IT professionals.

Another possible area for future research is the reexamination and revalidation of the technology-dependence measurement scale by collecting another data set under different settings and using other methods, so that the generalizability of the measurement scale can be further expanded. For example, given the widespread applications of mobile computing, it will be especially interesting to collect some new data and study the technostress phenomenon in the mobile business environment.

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