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The effects of computer self-efficacy and outcome expectancy on end-user job control and stress

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ABSTRACT

This article examines the effects of computer self-efficacy and outcome expectancy on the end-user's sense of felt stress as mediated by job control. A nationwide survey of information technology end-users provided the sample. The results show that computer self-efficacy directly impacts personal and job related outcome expectancies and that computer self-efficacy and job related outcome expectancies directly affect job control. Job control is shown to mediate the impacts of computer self-efficacy and job related expectancies on stress. The results are discussed and implications for information technology managers are presented.

INTRODUCTION

The Information System literature has examined the effects of stress associated with Information Technology (IT) end-users for a number of years (Nelson, 1990; Baronas & Louis, 1988; Zuboff, 1982; Thum, Boucsein, Kuhmann, & Ray, 1995). As the use of IT continues to proliferate at an expanding rate in the workplace employers are compelled to place an increasing emphasis on end-suer performance in order to justify costs. As end-users experience this increased pressure to perform, there is an accompanying interest in the effects of stress on end-users (Carayon, 1993; Cole & Hopkins, 1995). Stress can be defined as " . . . a condition arising from the interaction of people and their jobs and characterized by changes within people that force them to deviate from their normal functioning" (Beehr & Newman, 1978). The stress literature identifies two types of stress. The first is Eustress, which is healthy and is associated with high levels of performance, and job satisfaction. The second is distress which is the opposite of eustress and often results in poor performance, lost productivity, job dissatisfaction, absenteeism, accidents, physical ailments, turnover, and increasing organizational health care expenses (Baronas & Louis, 1988; Carayon, 1993; Nelson, 1990). Distress or what is more commonly referred to as felt

stress is typically a result of a long-continued exposure to the same stressor and results in an exhaustion of "adaptation" energy (Gibson, Ivancevich, and Donnelly, 1985). Moreover, Beehr and Bhagat (1985) posit that when an individual experiences " . . . ambiguity surround change . . .." and the individual believes that he/she will be affected by unknown changes in their job over a long period of time the potential for distress increases. Thus, determining the causes of stress and developing interventions is important for a " . . . productive, motivated, and healthy workforce" (Carayon, 1993).

Stressors are events, or situations which the individual believes are disruptive (Matteson & Ivancevich, 1985). Patrickson (1986) states that many stressors associated with IT are determined by the job. Moreover, Patrickson (1986), Parker (1993), Czaja and Sharit (1993) and others' research suggests that loss of control over work can contribute to distress. Karasek's (1979) model of job demands and decision latitude is one of the most explicit models relating job control to stress. Nevertheless, Karasak's (1979) model is not the definitive model of stress in the workplace. Numerous studies have identified antecedents of stress. For example, Perrewé (1987) found that personal control was directly related to stress. In fact, many theoreticians have posited the argument that personal job control determines an individual's reaction to stressors (Averill, 1973; Miller & Norman, 1979). Thus, the individual's belief in their ability to influence the amount of job control in the workplace can directly effect stress levels (Averill, 1973). For example, Baronas and louis (1988) fund that restoring a worker's sense of control over their work during an information system implementation resulted in a reduction in stress associated with the implementation introduction. These findings suggest that job control may actually mediate the effects of other variables on stress levels.

The stress literature shows that there is a direct relationship between control and the level of felt stress at work. However, the IT literature is incomplete since many theories of stress do not always examine the determinants of control. Furthermore, control is operationalized several different ways in the literature. For example, Baronas and Louis (1988) defined personal control " . . . in terms of choice, predictability, responsibility, and ability to reduce or get relief from an unpleasant condition" (p. 114). Flannery (1986) states that ". . . personal control includes outcome expectations or the belief that the environment will be responsive to individual coping efforts, and expectations of efficacy or the belief that one can perform the specific tasks necessary for effective coping" (p. 200). Regardless of how the notion of stressors, control, and felt stress are defined, the literature shows that control has a direct effect on felt stress and that there are a number of factors that can affect the construct of "control" (Patrickson, 1986; Nelson, 1990; Jackson, 1983; Baronas & Louis, 1988). Additionally, this literature suggests that control serves as a mediating factor between felt stress and the determinants of control. This research explores the constructs of stressors, control, and felt stress for IT end-users and develops an exploratory model using constructs from Bandura's (1982, 1986) self-efficacy theory and Carayon's (1993) model of job stress.

THE THEORETICAL FRAMEWORK

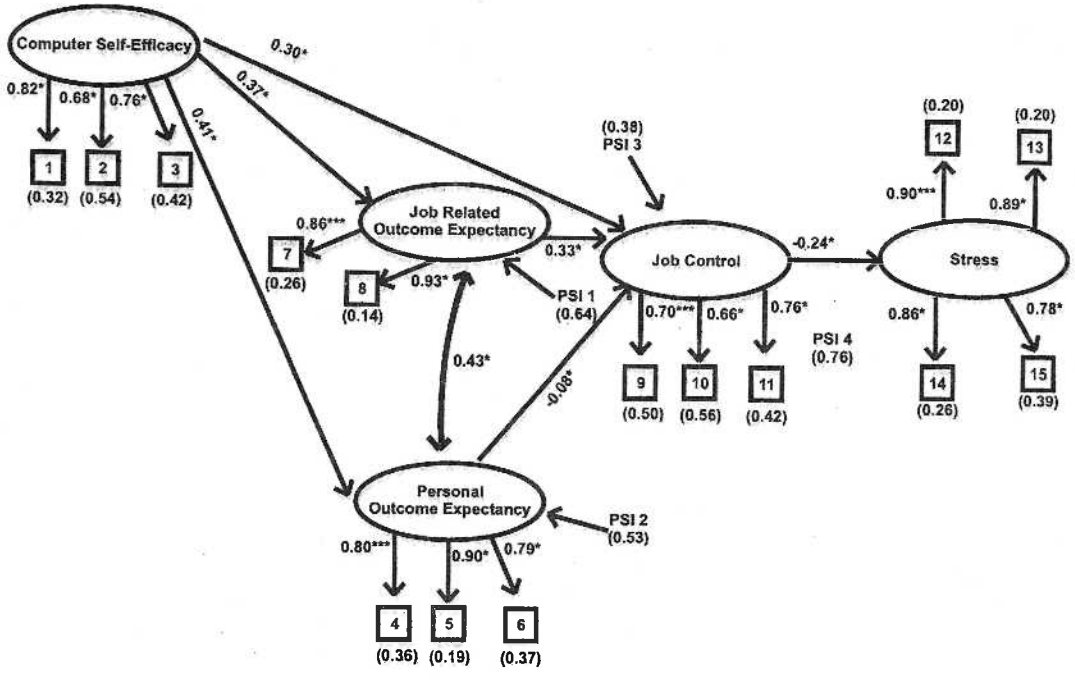
Self-efficacy theory (Bandura, 1982; 1986) provides a theoretical basis for examining the determinants of control and the subsequent effect on the level of IT end-user stress. Self-efficacy theory was originally used to explain an individual's change in behavior in clinical therapy (Bandura & Adams, 1977). Self-efficacy theory emphasizes the impact of the individual's cognitive state on outcomes such as loss of control, low self-confidence, lowered achievement motivation, and perceptions of future outcomes (Bandura, 1986; Meier, 1985; Quick & Quick, 1984; Seligman, 1990). It can be viewed as part of a larger group of psychological theories described as expectancy-value theories (Maddux, Norton, & Stoltenberg, 1986). These theories posit that expectations are the primary determinants of an individual's belief about the degree of control they have over environmental factors. Variants on these theories have been used in the IT literature to determine perceived usefulness of software (David, Bagozzi, & Warshaw, 19889) and voluntary use of a decision support system (DeSantis, 1983).

Self-efficacy theory proposes that an individual's expectations are the primary determinants of affective and behavioral reactions in numerous scenarios involving motivation, performance, and feelings of frustration associated with repeated failure. Bandura (1982; 1986) separated expectations into two distinct expectancies that affect individual behavioral and affective outcomes. He identified these expectancies as self-efficacy and outcome expectancy. Self-efficacy refers to an individual's belief in their capabilities to " . . . execute the activities required to achieve different levels of performance" (Wood, Bandura, & Bailey, 1990). Moreover, self-efficacy affects persistence and the degree of stress the individual experiences as a result of coping with environmental demands (Bandura, 1982; 1986). In addition, self-efficacy influences the individual's perception of future outcomes.

Outcome expectancy refers to an individual's belief that task accomplishment (i.e., a satisfactory level of performance) leads to desired outcomes. Outcome expectancy is defined as the consequence of an act and not the act itself. It has been shown that this construct is multidimensional, typically producing two distinct constructs of outcome expectancy; one related to personal outcomes and the other related to work outcomes (Henry & Stone, 1993). Self-efficacy and outcome expectancy have separate and distinct impacts on individual behavior and affect. Additionally, according to Bandura (1984; 1986), self-efficacy has a direct impact on outcome expectancy. The value of expectancies in research lies in the notion that not only is there a direct relationship between expectancies and behavioral and affective outcomes, but that the relationship is accepted theoretically as causal (37). Moreover, self-efficacy theory proposes that these expectancies are primarily a result of inactive mastery, vicarious experience, verbal persuasion, and emotional arousal.

The model shown in Figure 1 depicts the causal relationships among computer self-efficacy, outcome expectancies, job control, and stress. The model proposes that computer self-efficacy and outcome expectancies have direct effects on the individual's perception of job control and that job control serves as a mediator for computer self-efficacy and outcome expectancy and directly influences the individuals' level of felt stress.

Figure 1. The Model of Computer Self-Efficacy, Outcome Expectancy, Job Control, and Stress with Standardized Path Coefficients



*** Significant at a 1% level**
**** Significant at a 5% level**
***** Used to scale the corresponding latent variable**
( ) Contains estimates of the corresponding disturbance term
All are dignificant at a 1% level.

RESEARCH METHODOLOGY

In order to empirically examine these hypotheses, a questionnaire was developed. Included on the questionnaire were demographic questions regarding the respondents and their firms. Questionnaire items measuring computer self-efficacy, outcome expectancy (i.e., job and personal), job control, and stress regarding the use of a computer system were also included. Self-efficacy in this research is labeled computer self-efficacy and measured following the approach of Henry and Stone (1993). The measurement of outcome expectancy (personal and work) developed by Henry and Stone (1993) is also employed. The measures for the construct of job control are taken from Carayon (1993) and consists of questions which reflect instrumental and conceptual control. According to Carayon (1993) stress effects can be psychological, physiological, and behavioral. The emphasis in this research is psychological stress and the measures for the stress construct are taken from Martinko (1991).

For all but the stress related questions, the respondents were given a give-point Likert-type scale upon which to respond using the following scale and weights: 1-Strongly Disagree; 2-Disagree; 3-Neutral; 4-Agree; 5-Strongly Agree. For the stress related questions this scale was a five-point scale with antonyms used to anchor the extreme ends of the scale.

The questionnaire was mailed to 1200 executives from a variety of functional business areas. These individuals were selected in a systematic random fashion from a national mailing list. A systematic random sampling design was used to avoid any geographic bias in the sample since the mailing list was ordered by zip codes. The systematic portion of the sampling design was provided by selecting every second name on the mailing list. The stochastic element was introduced by using a random number to select the first name from the mailing list. Due to mailing list restrictions, no attempts were made to contact the individuals after the questionnaires were mailed. From the 1200 mailed surveys, 202 usable responses were received, producing a 16.83% response rate. Since the hypotheses and the examination focus on end-users' perceptions regarding the use of computer systems, only individuals who reported at least one year of computer experience were included in the sample. This eliminated five respondents, producing 197 responses in the employed sample.

Response Bias

In order to confirm the absence of a meaningful response bias, the demographics regarding the respondents were compared between early and late respondents. Late respondents were defined as the upper quartile of the responses when ordered by response date. The early respondents were identified as the lower quartile of order responses (Armstrong & Overton, 1977). The results of the comparison showed no meaningful differences between early and late respondents for the demographic variables of the respondent's position in the organization (t=.023); gender (t=0.70); age (-1.14); educational level (t=-0.79), years of computer experience (t=-1.75; the computer applications used (t=0.96); use of the computer system (i.e., number of times each day) (t=0.79); types of computer systems used (t=0.64) (e.g., decision support systems); and perceived perfor-

mance using the system (t=0.52). the results indicate that response bias should not present a serious problem in this study.

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The Measures and Their Psychometric Properties

The measures of the constructs used in the analysis were developed based upon 15 questionnaire items. Each item was theoretically implied to measure only one of the measures. In order to empirically confirm the grouping of these questionnaire items into the measures, a confirmatory factor analysis was performed. The factor analysis made use of a structural equations approach allowing all the measures to be pair-wise correlated. The questionnaire items were the indicants of the latent variables forming each measure. An error term impacted each indicant. These error terms were allowed to vary with the associated paths set equal to one. Each measure was an exogenous variable. The estimation of the model was performed using the previously discussed 197 questionnaire responses and items using CALIS (i.e., Covariance Analysis of Linear Structural Equations) in PC SAS version 6.08. The estimation method was maximum likelihood.

The fit of the confirmatory factor analysis to the data is described by several statistics. The Goodness of Fit Index was 0.92. The similar value corrected for degrees of freedom was 0.88. The Root Mean Square Residual was 0.05 and the Chi-Square Statistic was 122.47 with 80 degrees of freedom and was statistically significant at a 1% level. The Normed Chi-Square statistic was 1.53. Bentler's Comparative Fit Index was 0.97, while Bentler and Bonnett's Non-Normed and Normed Indices were 0.96 and 0.92. Further, The Bollen Normed and Non-Normed Indices were 0.89 and 0.97, respectively. These results indicate an acceptable fit of the confirmatory factor analysis to the data. The measures used in the analysis, the questionnaire items which formed them, and the factor loadings for each item are displayed in Table 1.

Table 1. The Questionnaire Items, Results from the Confirmatory Factor Analysis, and the Average Percentages of Shared Variance

	Factor Loading	Reliability	Shared Variance
Computer Self-Efficacy		0.80	57%
1. I know enough about the computer system to get my job done.	0.82		
2. I fully understand how the computer system works.	0.68		
3. I am successfully using the computer system at work.	0.76		
Personal Outcome Expectancy		0.87	69%
4. Knowing how to use the computer system will help advance my career.	0.80		
5. Knowing how to use the computer system will increase the types of jobs for which I am qualified.	0.90		
6. Knowing how to use the computer system will make me more attractive for other firms to hire.	0.79		
Job Related Outcome Expectancy		0.89	80%
7. If I am able to use the computer system, I will have more time for other work.	0.86		
8. The computer system makes it easier to perform other duties at work.	0.93		
Job Control		0.75	51%
9. I often give input for the decisions that affect my job.	0.66		
10. It is my decision about how much time I spend using the computer system.	0.70		
11. I have a great deal of freedom to do as I like at work.	0.76		
Stress			
When using the computer system, I feel:		0.92	74%
12. Anxious/not anxious	0.90		
13. Stressed/not stressed	0.89		
14. Nervous/not nervous	0.86		
15. Hurried/not hurried	0.78		

The first psychometric property examined was the reliability of each measure. The reliabilities for the measures were calculated from the confirmatory factor results and ranged from a low of 0.75 for the measure of job control to 0.92 for the measure of stress. The remaining reliability coefficients were: 0.87 for outcome expectancy related to personal outcomes; 0.89 for outcome expectancy related to the respondent's work outcomes; and 0.80 for computer self-efficacy. These measures, displayed in Table 1, indicate that the measures possess acceptable reliability (Nunnally, 1978).

The second psychometric property examined was the average percentage of shared variance for each measure. The shared variance for each measure was calculated from the confirmatory factor analysis results. These percentages were: 57% for computer self-efficacy; 60% for outcome expectancy related to personal outcomes; 80% for outcome expectancy related to the

respondent's job; 51% for the measure of job control; and 74% for the stress measure. These percentages of shared variance are displayed in Table 1 and indicate that the measures possess acceptable levels of shared variance (Igbaria & Greenhaus, 1992).

Discriminant validity was the final psychometric property examined. If a pair of constructs demonstrates discriminant validity, the squared correlation between the constructs is less than the average percentage of shared variance for both. These squared correlations were: 0.17 for the measures of computer self-efficacy to personal outcome expectancy; 0.14 for computer self-efficacy and job related outcome expectancy; 0.27 for the measures of job related outcome expectancy and personal outcome expectancy; 0.14 for the measures of computer self-efficacy and job control; 0.04 for personal outcome expectancy and job control; 0.16 for job related outcome expectancy and job control; 0.10 for computer self-efficacy and the stress measure; 0.00 for the measure of job related outcome expectancy and the stress measure; 0.01 for the measure of job related outcome expectancy and the stress measure; and 0.05 for the job control and the stress measure. Comparing these squared correlations to the average percentage of shared variances displayed in Table 1 indicates that all the measures display discriminant validity.

From these results, the psychometric properties of the measures can be evaluated. Since all of the indicant's standardized path coefficient were greater than 0.60, item reliability is satisfied (Igbaria & Greenhaus, 1992). Further, because each reliability coefficient was greater than 0.75, the measures display satisfactory composite reliability. These results, coupled with the average percentage of shared variance for each measure being greater than 50%, imply that the measures satisfy convergent validity (Igbaria & Greenhaus, 1992). As previously discussed, discriminant validity was satisfied. Because convergent validity and discriminant validity were satisfactory, it is implied that the measures display construct validity (Rainer & Harrison, 1993).

The correlations among these 15 questionnaire items were also computed. These correlations are displayed in Table 2.

The Estimation of the Job Control and Stress Model

The empirical technique used to estimate the model and test the significance of the hypotheses was structural equations with latent variables. The questionnaire items were the indicants of the latent variables forming the measured constructs. Each indicant was impacted by an error term which was free to vary while its associated path was set equal to one. The measures of outcome expectancy, job control, and stress were endogenous to the model and had error variances which were free to vary with the associated paths set equal to one. The computer self-efficacy measure was exogenous to the model and had an error variance set equal to one.

The developed model was estimated based upon the previously discussed 197 responses, corresponding measures of the constructs, and questionnaire items using the procedure CALIS in SAS PC version 6.11. The estimation method used was maximum likelihood.

Table 2. The Inter-Item Correlations

	1	2	3	4	5
1	1.99				
2	0.53	1.00			
3	0.62	0.49	1.00		
4	0.32	0.30	0.27	1.00	
5	0.28	0.13	0.23	0.72	1.00
6	0.38	0.25	0.31	0.61	0.72
7	0.29	0.19	0.30	0.38	0.39
8	0.29	0.19	0.27	0.40	0.43
9	0.25	0.18	0.33	0.17	0.04
10	0.21	0.10	0.12	0.16	0.09
11	0.22	0.11	0.20	0.22	0.12
12	-0.24	-0.15	-0.30	0.02	-0.01
13	-0.02	-0.17	-0.21	0.01	0.04
14	-0.29	-0.25	-0.33	-0.04	-0.07
15	-0.16	-0.15	-0.11	-0.05	-0.05
	7	8	9	10	
7	1.00				
8	0.77	1.00			
9	0.20	0.21	1.00		
10	0.22	0.23	0.48	1.00	
11	0.25	0.28	0.51	0.55	
12	-0.14	-0.06	-0.08	-0.12	
13	-0.19	-0.08	-0.03	--0.18	
14	-0.17	-0.10	-0.09	-0.15	
15	-0.18	-0.13	-0.02	-0.16	
	11	12	13	14	15
11	1.00				
12	-0.14	1.00			
13	-0.12	0.79	1.00		
14	-0.11	0.78	0.76	1.00	
15	-0.11	0.64	0.72	0.65	1.00

The Results

The summary statistics for the fit of the model to the data are shown in Table 3. The Goodness of Fit Index was 0.91, while this same index adjusted for the degrees of freedom in the model had a value of 0.88. The Chi-Square Statistic was 132.64 with 83 degrees of freedom. It was significantly different from zero at a 1% level. The Normed Chi-Square Statistic had a value of 1.60. A Normed Chi-Square Statistic with a value of 2 or less is often taken to imply that no significant improvement in the fit of the model to the data can be made by adjusting the model (Hair et al., 1992). The Root Mean Square Residual was 0.07. Bentler's Comparative Fit Index was 0.97. Thefour incremental fit indexes of Follen's Normed and Ono-normed Indexes and Bentler and Bonnett's Normed and Non-normed Indexes were 0.89, 0.97, 0.91, and 0.96, respectively.

Table 3. The Summary Statistics of the Model's Fit

Goodness of Fit Index	0.91
Adjusted Goodness of Fit Index	0.88
Root Mean Square Residual	0.07
Chi-Square Statistic - degrees of freedom 202	132.64*
Normed Chi-Square Statistic	1.60
Bentlelr's Comparative Fit Index	0.97
Bentler & Bonnett's Non-Normed Index	0.96
Bentler & Bonnett's Normed Index	0.91
Bollen's Normed Index	0.89
Bollen's Non-Normed Index	0.97

*Statistically significant at a 1% level.

The details of the estimated model and the empirical results are shown in Figure 1. All the indicants were significantly different from zero, using a 1% significance level. It is also the case that these indicants had standardized path coefficients with the expect signs and were sufficiently large to be meaningful. The values of these coefficients ranged from 0.68 to 0.93. Similarly, the standardized path coefficients between all the measures are also displayed in Figure 1. All were significantly different from zero at either a 1% significance level except for one. This insignificant path was between personal outcome expectancy and job control. Further, all the significant paths had coefficients which were meaningfully large with the expected signs. These estimated path coefficients in standardized form ranged from -0.24 to 0.41. The estimated correlation between the two outcome expectancy measures was 0.43 and is displayed on Figure 1. It was statistically significant at a 1% level. Further, it was also the case that all the estimates of the error terms demonstrated that no Heywood cases existed. These error terms included those for the

indicants as well as the measures of the latent variables. The magnitudes of these estimates ranged from 0.14 to 0.76. All were significantly different from zero and are shown in Figure 1.

DISCUSSION

The results show that computer self-efficacy directly impacts personal and job related outcome expectancies. The results also show that computer self-efficacy and job related outcome expectancies directly affect job control. The results also show that job control mediates the impacts of computer self-efficacy and job related outcome expectancies on stress. However, the path from personal outcome expectancy to job control was not supported. Two possible explanations for this insignificant path are plausible. First, Bandura (1986) states that the effect of outcome expectancies is typically less than that of self-efficacy. This is due in part to the difficulty that individuals have separating personal and work expectancies as well as problems with questionnaire development (Maddux & Stanley, 1986). Secondly, individuals may perceive job control as being the domain of the organization. Thus, the individual perceives that intrinsic personal outcomes are independent of the action of the individual. As such, personal outcomes are evaluated in a more general context and are not directly perceived to be related to a specific job. This notion is supported by the literature on generalized expectancies where expectancies are characterized as a global construct or personality trait.

The remainder of the significant paths are consistent with the theories of self-efficacy and job stress. The evidence rests in the positive effects of computer self-efficacy on both outcome expectancies and job control as well as the effect of work expectancies on job control and the effect of job control on stress. The results of this research are consistent with the sparse literature on the relationship between stress, technological change, individual consequences, and organizational consequences (Nelson, 1990). Moreover, these results show causal relationships grounded in theory rather than a descriptive interpretation of individual consequences as a result of IT proliferation in the workplace. These results take on added significance as the use of IT becomes nonvolutional in the workplace. This is especially important when one considers the costs to the organization in terms of human and financial resources. As Nelson and Kletke (Nelson, 1990) state, "Organizations are dependent upon the productivity of individuals for their survival" (P. 262). Thus, the end-user's psychological level of stress (i.e., the individual's general well-being) and the organization's well-being are interrelated (Quick & Quick, 1984). Therefore, the impact of stress as a result of IT or IT change affects both the individual and the organization (Nelson, 1990). Evidence for this explanation has been consistently demonstrated in the stress literature where stress is related to turnover, absenteeism, low productivity, job dissatisfaction, accidents, physical ailments, and increases in organizational health costs (Baronas & Louis, 1988) (see review in Carayon, 1993; Nelson, 1990).

Previous research in this area has focused on end-user stress related to technical aspects of IT (e.g., visual display units ([VDU] [Carey, 1992]). As Carey (1992) states " . . . academic

researchers and practitioners alike have been slow to explore the relationship between technology and human factors (p. 338)." Thus, although exploratory in nature, the results of the current research represent a growing interest in the antecedents of psychological stress related to it> Moreover, the current study provides a theoretical explanation for the effects of human factors in IT research.

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The results indicate that perceived job control has a significant, negative impact on stress when using a computer-based system. First, lower stress levels are apparently inherent for IT end-users when they can exercise greater control regarding their job. Second, since computer self-efficacy and job related outcome expectancy positively influence job control, increasing levels of these constructs should lower stress. The important question for researchers and management interested in reducing end-user stress and subsequent outcomes is the identification of controllable variables which can impact computer self-efficacy and job related outcome expectancy. Subsequently, as a result of planned management interventions, end-users can achieve higher levels of job control, reduce stress, and reduce the negative outcomes associated with high levels of stress.

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