

Self-efficacy specificity and burnout among information technology workers: An extension of the job demand–control model

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The aim of the present study is to test the moderating role of levels of self-efficacy specificity (i.e., generalized and computer self-efficacy) in the Job Demand–Control (JD–C) Model, and its effects on burnout (i.e., exhaustion and cynicism). Previous research on Karasek's model failed to corroborate the demand \times control interaction effect on different strain variables. In order to refine and extend the JD–C model, we propose a specific measure for job demands (i.e., quantitative overload) as well as for job control (i.e. method and time control). Furthermore, research on self-efficacy beliefs shows that the more specific the self-efficacy beliefs, the more predictive they are. In the current study, two levels of self-efficacy beliefs are introduced as moderators (i.e., generalized and computer self-efficacy). Based on data collected from 405 workers using information technology in their jobs, the expected Job Demand \times Control Interaction effect was found in both burnout dimensions (i.e., exhaustion and cynicism) as predicted by the JD–C model. In addition, the more specific level of self-efficacy (i.e., computer self-efficacy) moderated the relationship between job demands and control and levels of burnout dimensions as expected. Limitations of the study and its practical implications are discussed.

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JOB DEMAND–CONTROL MODEL

The Job Demand–Control (JD–C) model (Karasek, 1979; Karasek & Theorell, 1990) is currently perhaps the most influential theory on job stress. The model assumes that strains are produced by job stressors and job control. The stressors have their greatest negative impact when job control is low and job demands are high, whereas an increase in job control serves to attenuate the negative effects of job demands on strain. Accordingly, the model includes two hypotheses: (1) the *strain assumes additive hypothesis* assumes additive effects of both: High job demands precipitate job strain, as does low job control (main effects); (2) the *interaction or buffer hypothesis* states that job control has a moderating effect on the relationship between job demands and job strain (interaction effect). More specifically, the second hypothesis assumes that the combination of high job demands along with low job control precipitates psychological and physical strain (the so-called high strain jobs), whereas jobs in which both demands and control are high produce well-being, learning, and personal growth (the so-called active jobs). However, several recent reviews have shown that the support for the JD–C model is inconclusive, especially as far as the buffer hypothesis is concerned (see Van der Doef & Maes, 1999). For instance, Van der Doef and Maes (1999) found that of the 31 studies examining the buffer hypothesis, only 15 showed (partial) evidence in favour of that hypothesis. As far as burnout is concerned, the picture is even less clear, virtually all studies failed to corroborate the expected interaction effect of job demands and job control on burnout (see De Jonge, 1995; De Rijk, Le Blanc, Schaufeli, & de Jonge, 1998; Jimmieson, 2000; Landsbergis, Schnall, Warren, Pickering, & Schwartz, 1994; Melamed, Kushnir, Meir, 1991).

Four methodological and conceptual criticisms have been put forward that might explain the somewhat disappointing results previously mentioned. First, different strategies were used to test the interaction effect. It has been argued that interaction effects should ideally be tested with moderated regression analysis, whereas many studies used analysis of variance (Cohen & Cohen, 1983; Landsbergis et al., 1994; Zedeck, 1971). Second, in a number of studies the moderating effect of job control was only shown for particular sample subgroups, for example, for employees with high self-consciousness, with internal locus of control (Van der Doef & Maes, 1999), with high job self-efficacy (Litt, 1988; Schaubroeck & Merrit, 1997; Wortman & Dunkel-Schetter, 1979). Traditionally, research on the JD–C model has neglected such personality factors and individual differences. But Parkes (1994) points out that personality characteristics might moderate the relationship between stressors and strain in two ways: (1) congruence between personal characteristics and work environment characteristics leads to positive outcomes, whereas (2) a mismatch leads to unfavourable outcomes. In this vein, high job control could be beneficial for certain individuals (i.e., those with high job self-efficacy), whereas high job

control would suit other individuals (i.e., those with low job self-efficacy). However, in recent years, there has been more research directed towards the conceptual expansion of the JD-C model, including a range of different job (e.g., social support) and individual (e.g., locus of control) characteristics. The hypothesis is that these variables can act as conjunctive moderators within the JD-C model. For example, self-efficacy has proved to be a good second moderator variable together with job control in recent research (see next section). Third, the measure and conceptualization of job demands and job control may not be adequate. Many studies that support the JD-C model measured job demands and job control at a comparable level of specificity and thus achieved a close match between them. In contrast, studies that failed to show the expected results used a broader conceptualization of job demands (i.e., responsibility) and job control (i.e., participation). As a consequence, there was no close match between demands and control; that is, the type of job control reported does not adequately reflect the control they could exert over the type of demands experienced. Therefore, it has been suggested that occupation-specific measurement of demands and control could improve the explanatory and predictive power of the JD-C model (Jimmieson, 2000; Kasl, 1996). Finally, the examination of both hypotheses of the JD-C model concurrently has been suggested (Van der Doef & Maes, 1999), so that additive and interactive may be assessed simultaneously.

In the present study, the JD-C model is tested with these four suggestions taken into account. First, we use the recommended moderated regression analysis (cf., Landsbergis et al., 1994). Second, we include two individual characteristics as additional moderators, i.e., generalized and computer self-efficacy. Third, we use specific job demands measures (i.e., quantitative overload) as well as job control (i.e., timing and method control) that are relevant to the sample under study, i.e., information technology workers. Research among employees who work with new information technology has shown the relevance of this specific stressor: Many workers feel overloaded and time pressured (Carayon-Sainfort, 1992; Mullarkey, Jackson, Wall, Wilson, & Grey-Taylor, 1997; Wall, Corbett, Glegg, Jackson, & Martin, 1990; Yang & Carayon, 1993). In addition, recent research has highlighted the significance of distinguishing between two aspects of control in information technology settings, i.e., timing and method control (Jackson, Wall, Martin, & Davis, 1993; Mullarkey et al., 1997; Wall et al., 1990; Wall, Jackson, & Mullarkey, 1995). Method control is defined as "the extent to which the individual can carry out the work in his or her own way, rather than this being externally prescribed (by technology or associated procedures)" (Wall et al., 1990, p. 204). And timing control is defined as "the extent to which the operator can decide when to carry out given tasks, rather than having to respond as and when the technology requires" (Wall et al., 1990, p. 204). Fourth, we test the JD-C model by examining both the additive and interactive effects of demands and control on burnout.

SELF-EFFICACY BELIEFS

People differ in their beliefs about their competence and success in different domains of their life. Bandura (1977, 1986, 1997, 2001) called these cognitions “self-efficacy”, which are “beliefs in one’s capabilities to organise and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). There is considerable research evidence on the direct (main) effect of self-efficacy on performance and well-being at work (Bandura, 1999, 2001). However, to date there has been little empirical research on the moderating role played by self-efficacy in job stress processes. For example, Jex and Bliese (1999) found a two-way interaction effect between job demands and generalized self-efficacy: self-efficacy moderated the relationships between hours of work, quantitative overload, and the meaning of the task with some strain variables such as job dissatisfaction, physical symptoms, propensity to leave, and poor organizational commitment. Furthermore, only two recent studies (see Schaubroeck & Merrit, 1997; and Jimmieson, 2000) have tested the interactive role of specific self-efficacy (i.e., job self-efficacy) between job control and job demands. Schaubroeck and Merrit (1997) extended the Karasek (1979) model by integrating the role of individual differences in reactions to job demands and control. They found a three-way interaction effect between job demands and control and job self-efficacy among 110 full-time health professionals (but not a two-way interaction effect). Job control mitigated the effects of demands on blood pressure levels among individuals with high job self-efficacy and high job control had stress-enhancing effects among those with low job self-efficacy. For example, a lack of control was particularly harmful for people with high self-efficacy in demanding circumstances because uncontrollable situations challenged personal agency perceptions. As these authors stressed, these people are more likely than others to blame themselves for not coping well with stressful situations. On the other hand, high control combined with high demands and low job self-efficacy had negative health consequences. The people with low confidence in their competences may be distressed because of the responsibility of coping with demands that stem from control. These results were also replicated in a sample made up of 214 employees of a large contracting firm. On the other hand, Jimmieson (2000) also extended the JD–C model in a sample of 100 customer service representatives. Results using a specific measure of job demands for this sample characterized by high levels of customer contact (i.e., role conflict) and job control (i.e., immediate work practices) confirmed a three-way interaction with job self-efficacy only in “depersonalization” and not in other strain variables used (e.g., psychological well-being, job satisfaction, and somatic health) where findings showed a two-way interaction of Job Demand \times Job Control, thereby supporting the classical JD–C model. However, when “quantitative overload” was used as a job demands indicator instead of “role conflict”, significant main, two-, or three-way interactions effects were detected

on job strain indicators. Jimmieson argues that for that sample (high levels of customer contact), quantitative overload does not seem to be a salient source of work stress, but role conflict is. Thus, specific job demands are needed in order to detect significant effects in specific samples of employees.

Self-efficacy beliefs have also proven to be a relevant variable in theory and research on job burnout. For instance, Chemiss (1980) assumes that lack of confidence in one's own competence is a critical factor in the development of the burnout. Leiter (1992) even goes one step further by considering burnout essentially as "a crisis in self-efficacy". Research on burnout shows the potential impact of self-efficacy between different samples (Grau, Salanova, & Peiro, 2000; Leithwood, Menzies, Jantz, & Leithwood, 1996; Rabinowitz, Kushnir, & Ribak, 1996; Van Yperen, 1998). For instance, teachers with high levels of self-efficacy displayed fewer signs of burnout compared to those who rated their capability as low (see Brouwers, 1999, for a review). However, despite the potential value of self-efficacy for research on burnout, only a few specific studies have been devoted to it (Brouwers, 1999; Chemiss, 1993).

Refinements in self-efficacy research have moved towards the inclusion of different levels of measurement of the construct, i.e., degree of specificity (Eden & Zuk, 1995; Gist & Mitchell, 1992; Lent & Hackett, 1987; Schwoerer, May, & Hollensbe, in press). Basically, it is assumed that a continuum exists which ranges from generalized self-efficacy (Schwarzer, 1999) to more specific kinds of self-efficacy (Chemiss, 1993; Murphy, Coover, & Owen, 1989; Schaubroeck & Merrit, 1997). As the conceptualization of self-efficacy becomes more general, one moves toward a personality-like construct of generalised self-efficacy, i.e., a general belief in one's ability to succeed (Sherer et al., 1982). In this vein, Schwarzer (1999) defines generalized self-efficacy as a global confidence in one's coping ability across a wide range of demanding or novel situations. On the other hand, self-efficacy as a specific construct is the belief in one's competence in specific situations. For example, Murphy et al., (1989) define computer self-efficacy as the person's perception of his or her capabilities regarding specific computer-related knowledge and skills. It follows from Social Cognitive Theory that the easier a computer system is to use, the greater one's perception of self-efficacy and personal control over computer-related knowledge and skills will be. Previous research supports the need to use specific measures of self-efficacy in specific domains (Bandura, 1997; Brouwers, 1999; Brouwers & Tomic, in press; Maibach & Murphy, 1995) since it produces more robust results. Theoretically speaking, this is because self-efficacy beliefs are domain-specific; a person's self-efficacy belief is very likely to differ depending on the activity to which it is related (Bandura, 1997, 1999). Paradoxically, despite the relevant distinction between various levels of self-efficacy specificity, research does not often explicitly take this differentiation into account. In this study, however, we investigate the moderating role of two different levels of self-efficacy specificity (i.e., generalized and computer self-efficacy).

BURNOUT

The current study uses burnout as a dependent variable, which is supposedly related to job demands, job control, and self-efficacy. Burnout was originally almost exclusively studied in the human services (for reviews, see Lee & Ashforth, 1996; Schaufeli & Enzmann, 1998), but recently a shift towards other occupational fields has occurred. An important impulse comes from a recently developed self-report questionnaire that can also be used to assess burnout outside the human services: the Maslach Burnout Inventory—General Survey (MBI—GS; Schaufeli, Leiter, Maslach, & Jackson, 1996). Burnout not only includes an affective response (i.e., exhaustion) that is similar to an orthodox job strain variable, but also a cynical and sceptical attitude towards work as well as an evaluation of one's efficacy in the job. Hence, it offers the possibility of studying the relationships with three different aspects of worker's health and well-being: affective strain, negative job attitude, and perceived level of competence. In the present study, we focus on the first two dimensions of burnout (i.e., exhaustion and cynicism) as indicators of burnout. These dimensions have been considered the "core of burnout" (Green, Walkey, & Taylor, 1991, p. 463). As noted before, the third component of burnout—professional efficacy—has been criticized as being akin to a personality variable (Cordes & Gougherty, 1993; Shirom, 1989). Additionally, from an empirical point of view, professional efficacy plays a distinct role (Maslach, Schaufeli, & Leiter, 2001). For instance, Leiter (1993) shows that on the whole, professional efficacy develops independently from exhaustion and cynicism. The results of a recent meta-analysis confirm the independent role of professional efficacy (Lee & Ashforth, 1996). Finally, age and gender have been found to be related to both dimensions of burnout. Among younger employees the level of burnout is reported to be higher than among older employees. With regard to gender, although it has not been a strong predictor of burnout, there are small but consistent gender differences with males scoring higher on cynicism and females scoring higher on exhaustion (see Maslach et al., 2001, for a recent review).

So far, only three studies have been conducted on the relationship between the use of information technology and burnout that have yielded complementary results. Schaufeli, Keijsers, and Reis-Miranda (1995) found, among ICU (intensive care unit) nurses, a positive relationship between burnout and technology usage (of complex mechanical ventilation equipment): The more medical technology was used, the less burned out the nurses were. Salanova and Schaufeli (2000) showed that the appraisal of computer experience mediated the effect of technology exposure and burnout, but only for the more cognitive dimension of burnout: The greater the exposure, the more positive the attitude towards computers, and the less cynical the workers. Salanova, Grau, Cifre, and Llorens (2000) found that computer self-efficacy moderated the relationship between computer training and cynicism. In this way, workers low in computer

self-efficacy showed that when computer training was high, their levels of cynicism increased. On the other hand, for workers who were high in computer self-efficacy, the opposite effect was found: High computer self-efficacy tended to decrease cynicism as a result of computer training.

THE PRESENT STUDY

We aim to extend the JD-C model with a relevant second moderating variable: self-efficacy, following on from previous research. Schaubroeck and Merritt's (1997) study was conducted on health professionals (and then replicated in a broader sample). It was also restricted to blood pressure as indicator of job strain using a broader measure of job control (i.e., participation in organizational decisions) and job demands (i.e., a job complexity instrument addressing the work pace, complexity, conflict, and ambiguity involved in carrying out a job). Jimmieson's (2000) study only used one dimension of burnout (i.e., depersonalization) and was conducted exclusively on employees with high customer contact (work with "people"). For these reasons, the present study aims to extend this issue by exploring whether levels of self-efficacy (i.e., generalized and computer self-efficacy) act as second moderator variables in the job Demand-Control model, on both dimensions of burnout (exhaustion and cynicism) on a heterogeneous sample of employees with a common characteristic: They work with information and data (i.e., information technology workers). Moreover, we used specific job demands (i.e., overload) and specific job control (i.e., timing and method control).

Hypotheses

Hypothesis 1: We expect additive (main) effects of job demand and job control on both burnout dimensions. Job demands will be positively associated with exhaustion and cynicism, whereas job control will be negatively associated with exhaustion and cynicism.

Hypothesis 2: We expect a two-way interaction effect of Job Demand \times Job Control on both burnout dimensions. That is, the combination of high Job demands and low job control will precipitate exhaustion and cynicism.

Hypothesis 3: We expect a three-way interaction effect of Job Demand \times Job Control \times Self-efficacy on both burnout dimensions. The relationships between job demands and job control on the one hand, and burnout on the other, will be moderated by self-efficacy. More specifically, we expect that job control will buffer the effects of demands on burnout among workers with high self-efficacy, and that job control will have stress-enhancing effects among those with low self-efficacy.

Hypothesis 4: The more specific the measure of self-efficacy is, the stronger the relationship between job demands, job control, and burnout will be. That is, the strongest relationship will be found for computer self-efficacy when we compare it with generalized self-efficacy.

METHOD

Procedure and participants

The sample was made up of 405 workers (females 51% and males 49%) from Spanish private and public companies. They were working in various jobs and occupational fields, such as clerical jobs (39%), technical and support staff (26%), sales (7%), management (8%), human services (8%), laboratory settings (7%), and operators (5%). The common characteristic throughout the sample was that all study participants used information technology (IT) in their jobs. The average of frequency of technology use, measured as a percentage of time using IT per week, was 71.4% ($SD = 32.2\%$, minimum = 25% and maximum = 100%). Also the average technology experience (based on months using IT) was 20 months ($SD = 23$, minimum = 2, maximum = 150). Most of them used enterprise integrating networks (EIN—82%) such as computing tools (i.e., word and data processors)—73.6%, and communications tools (i.e., internet)—8.5%. The remains 18% used advanced manufacturing technology (AMT) such as computer-aided design—CAD, 12.2%, and computer numerical control—CNC, 5.7%. Ages ranged from 20 to 58; the mean age of the sample was 32 ($SD = 8.07$).

Subjects were asked to answer a set of self-report questionnaires. Risk prevention experts or personnel from human resources departments distributed the questionnaires, which were delivered in an envelope. A covering letter explained the purpose of the study, that participation was voluntary, and guaranteed confidentiality. Respondents were asked to return the completed questionnaires in a sealed envelope, either to the person who had distributed them or directly to the research team.

Measures

Job demands. Quantitative overload was used as an indicator of job demands. Quantitative overload is defined as having too much work to do in the time available. It was assessed with three items of the Role Overload questionnaire designed by Beehr, Waishand, and Taber (1976). Participants responded on a 5-point scale which ranged from 1 (strongly disagree) to 5 (strongly agree). Sample item: “It often seems like I have too much work for one person to do”.

Job control. Method or task control and timing control were used as a comprehensive and specific measure of job control (Jackson et al., 1993). The

scale included five items that assessed method or task control (“I have the autonomy to decide what tasks I will do everyday”) and timing control (“I have the autonomy to decide when to start a task”). Participants responded on a 5-point scale which ranged from 1 (not at all) to 7 (a great deal).

Generalized self-efficacy was assessed with a five-item shortened Spanish version (Grau et al., 2000) of Schwarzer’s Generalized Self-Efficacy scale (1999). Participants responded on a five-point scale which ranged from 1 (never) to 7 (often). Sample item: “I can solve most problems if I make the necessary effort”.

Computer self-efficacy was assessed by a three-item scale (Beas, Agut, Salanova, & Grau, 1999) which follows Bandura’s recommendation (1997, 1999) to combine measures of magnitude, strength and generality. We used a Likert-type scale because it is a practical alternative for measuring self-efficacy in work and organizational settings (Jimmieson, 2000). Participants responded on a 7-point scale which ranged from 1 (strongly disagree) to 7 (strongly agree). Sample item: “I feel very competent using information technology”.

Burnout. Burnout was assessed with two MBI—GS subscales (Maslach Burnout Inventory—General Survey, Schaufeli et al., 1996): exhaustion (five items) (e.g., “I feel emotionally drained by my work”), and cynicism (four items) (e.g., “I have become more cynical about whether my work contributes anything”). Participants responded on a 7-point scale which ranged from 0 (never) to 6 (often/everyday) to measure the frequency with which they experience this feeling. One cynicism item (13: “I just want to do my job and not be bothered”) was deleted because of its insufficient factorial validity shown in other studies (Leiter & Schaufeli, 1996, Salanova & Schaufeli, 2000; Schaufeli et al., 1995; Schutte, Toppinen, Kalimo, & Schaufeli, 2000).

Data analysis

Hierarchical multiple regression analyses were performed to detect the main and interaction effects of job demand, job control, and levels of self-efficacy on each of the two burnout dimensions. All interaction terms were computed from standardized main effects variables, thus avoiding problems of multicollinearity arising from correlations between product terms and their component parts (cf., Cohen & Cohen, 1983; Kleinbaum, Kupper, & Muller, 1988).

The independent variables were entered into the regression equation in four successive steps (cf., Aiken & West, 1991; Jaccard, Turrissi, & Wan, 1990). In the first step, following research on burnout (see Maslach et al., 2001, for a recent review), (1) age and gender were introduced as control variables; (2) job demand, job control, generalized self-efficacy, and computer self-efficacy as main

variables; (3) two-way interaction terms (i.e., Job Demands \times Job Control, Job Demands \times Generalized Self-efficacy, Job Control \times Generalized Self-efficacy, Job Demands \times Computer Self-efficacy, and Job Control \times Computer Self-efficacy); and (4) three-way interaction terms (i.e., Job Demands \times Job Control \times Generalized Self-efficacy, and Job Demands \times Job Control \times Computer Self-efficacy).

In total, *two* hierarchical multiple regression analysis were performed with the two levels of self-efficacy for exhaustion and cynicism, respectively. In order to interpret the *a priori* standardized variables, standardized regression coefficients are given (cf., Aiken & West, 1991; Jaccard et al., 1990). In addition, the significant interaction effects are graphically displayed. Following Cohen and Cohen (1983) and Jaccard et al. (1990) regression lines were drawn separately for each regression equation, in order to interpret the relationship between job demands, job control, and both burnout dimensions at high levels (+1 SD) and low levels (−1 SD) of the moderator variable.

RESULTS

Table 1 shows the empirical ranges, means, standard deviations, alpha coefficients, and zero-order correlations of the study variables. The alpha coefficients show sufficient internal consistency since, without exception, Cronbach's α meets the criterion of .70 (Nunnally, 1978).

Both burnout dimensions are positively related (cf., Maslach & Jackson, 1986), whereas they are—as expected—significantly positively related to job demands and significantly negatively related to job control. Also, both burnout dimensions are significantly and negatively related to the two levels of self-efficacy, whereby correlations with more specific self-efficacy levels tend to be higher than with the more general level. Finally, the interrelations between the self-efficacy variables are significant and positive.

In order to test the hypothesis on exhaustion, we performed a hierarchical multiple regression analysis with exhaustion as a dependent variable (Table 2). A significant multivariate *F*-value was found with all regression analyses, indicating that the included independent variables explain a significant proportion of variance in exhaustion. In our two first hypotheses, we expected significant main (hypothesis 1) and interaction (hypothesis 2) effects of job demands and job control.

Results shown in Table 2 confirm hypotheses 1 and 2. After controlling for age and gender, job demands are positively associated with exhaustion, whereas job control is negatively associated with exhaustion (hypothesis 1). Moreover, the combination of high job demands and low job control precipitates exhaustion (hypothesis 2). The significant interaction effect of job demands and job control is graphically represented in Figure 1. Values for job demands and job control were chosen 1 SD below and above the mean. When these values were entered in

TABLE 1
Range, means, standard deviations, internal consistencies (Cronbach's α), and zero-order correlations ($N = 405$)

<i>Variable</i>	<i>Range</i>	<i>M</i>	<i>SD</i>	α	2	3	4	5	6	7	8
1. Age	20–58	32	8.07	—	-.22***	-.01	-.09	-.07	.04	-.15***	.05
2. Gender	1–2	1.5	0.50	—	—	-.01	-.09	-.04	-.06	.05	.05
3. Job demand	1–5	2.7	1.15	.89	—	—	.03	-.07	-.02	.38***	.22***
4. Job control	1–5	3.5	0.98	.90	—	—	—	.19***	.16**	-.13**	-.14**
5. Generalized SE	1–5	3.9	0.54	.85	—	—	—	—	.29***	-.18***	-.15***
6. Computer SE	1–7	5.0	0.88	.71	—	—	—	—	—	-.20**	-.22***
7. Exhaustion	0–6	2.3	1.23	.85	—	—	—	—	—	—	.53***
8. Cynicism	0–6	1.7	1.35	.82	—	—	—	—	—	—	—

SE (self-efficacy).

* $p < .05$, ** $p < .01$, *** $p < .001$.

TABLE 2
Hierarchical multiple regression analysis of job demand, job control, and levels of self-efficacy on exhaustion ($N = 405$)

	β	R^2 change
1. Age	-.13**	.02**
Gender	.02	
2. Job demand	.38***	.19***
Job control	-.12***	
Generalized SE	-.09*	
Computer SE	-.10*	
3. Demands \times Control	-.10**	.02
Demand \times Generalized SE	-.03	
Control \times Generalized SE	-.01	
Demand \times Computer SE	.09*	
Control \times Computer SE	.07*	
4. Demand \times Control \times Generalized SE	-.13*	.02*
Demand \times Control \times Computer SE	.10*	
Multiple R	.49	
R^2	.24	
F	9.27***	

* $p < .05$, ** $p < .01$, *** $p < .001$.

The β values are the coefficients from the final stage of the regression analysis; due to rounding off, R^2 differs .01 from the sum of R^2 change.

the regression equation, simple regression lines were generated. The results for workers with low job control (1 SD below the mean score) showed that when job demands were high, levels of exhaustion increased. A different picture emerged for workers scoring high on job control (1 SD above the mean score). In this case, job demands were significantly more weakly associated with exhaustion than in the case of low control. Hence, as predicted by the JD-C model, high control buffers the negative effect of job demands on exhaustion.

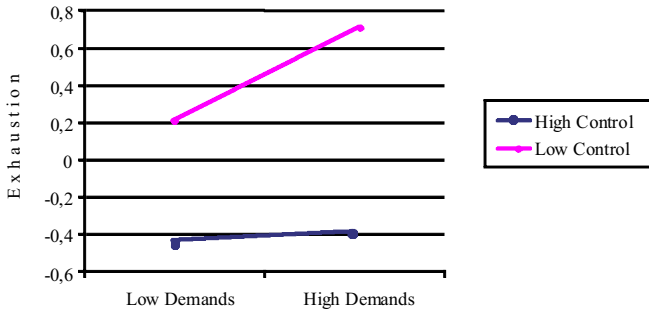


Figure 1. Two-way interaction effect of Job Demand \times Job Control on exhaustion.

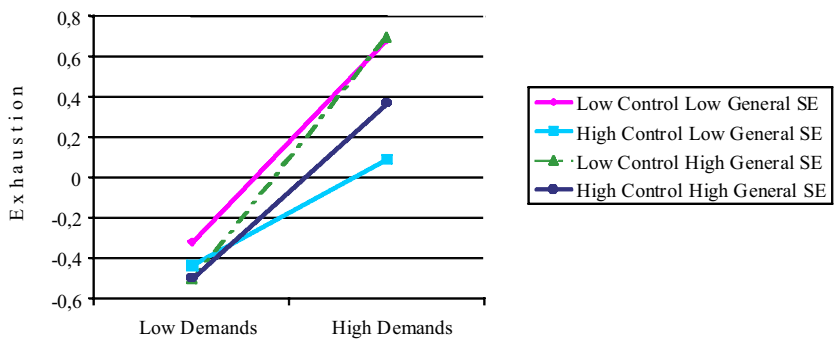


Figure 2. Three-way interaction effect of Job Demand \times Job Control \times Generalized Self-efficacy on exhaustion.

According to hypothesis 3, we found a significant three-way interaction effect of Job Demands \times Job Control \times Self-efficacy (see Figures 2 and 3). When we took into account generalized self-efficacy as the second moderator variable (see Figure 2), results showed that levels of exhaustion increased when job demands were high, especially for workers with low control and high generalized self-efficacy. In this case, the increment on exhaustion was the highest. Although workers with high control reported less exhaustion than workers with low control when demands were high, it seems that high levels of generalized self-efficacy did not attenuate the levels of exhaustion when job demands were high. Therefore, hypothesis 3 is partially supported in the case of exhaustion, when we take into account generalized self-efficacy as the second moderator variable.

With computer self-efficacy as the second moderator variable (see Figure 3), the results were different and confirmed the predictions of Job Demand-Control

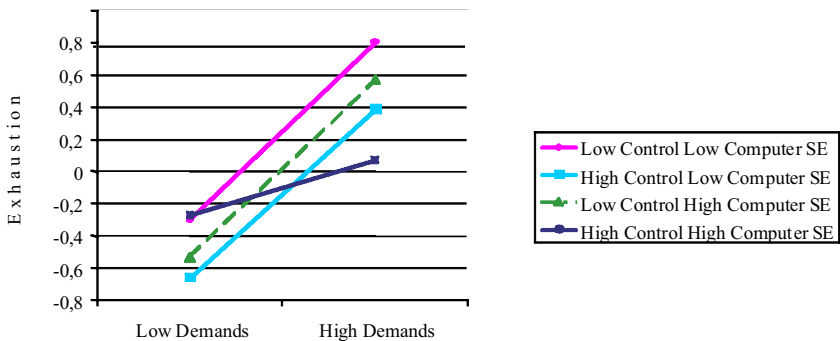


Figure 3. Three-way interaction effect of Job Demand \times Job Control \times Computer Self-efficacy on exhaustion.

model. The level of exhaustion was higher when job demands were high, especially for workers with low control and low computer self-efficacy. Moreover, according to expectations, for workers with high computer self-efficacy and with high job control, the interaction effect was consistent with the JD-C model. For workers with high levels of computer self-efficacy, when compared with workers with low levels of computer self-efficacy, high job control seemed to attenuate the increase in exhaustion from job demands. As we expected, for workers with high computer self-efficacy and low control, and workers with low computer self-efficacy and high control, the high demands also increased the level of exhaustion. Therefore, hypothesis 3 is supported in the case of exhaustion and computer self-efficacy as the second moderator variable.

On the other hand, hypothesis 4 assumes that the strength of the relationship between job demands, job control, and burnout will be stronger for the more specific measure of self-efficacy. This hypothesis is supported as we found stronger main and interaction effects on exhaustion when we took into account computer self-efficacy, than in the case of generalized self-efficacy.

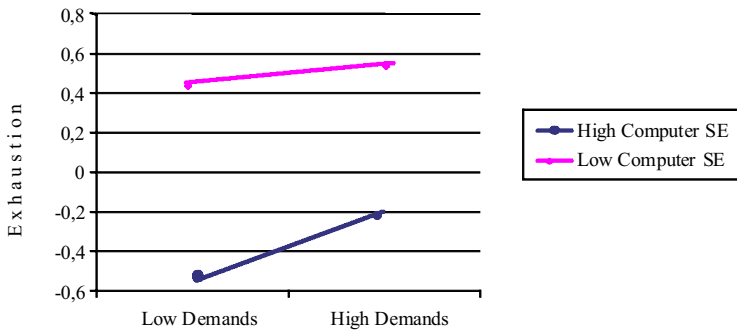


Figure 4. Two-way interaction effect of Job Demand \times Computer Self-efficacy on exhaustion.

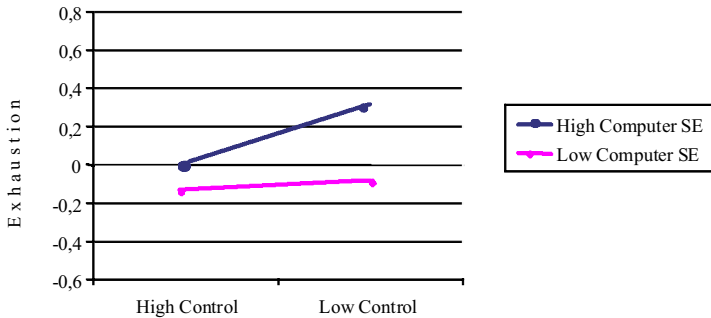


Figure 5. Two-way interaction effect of Job Control \times Job Computer Self-efficacy on exhaustion.

Finally, also the two-way interaction effects of Job Demands \times Computer Self-efficacy and Job Control \times Computer Self-efficacy were found (see Figures 4 and 5). Regarding the interaction effect of Job Demands \times Computer Self-efficacy (Figure 4), results showed that levels of exhaustion increased when demands were high. However, although workers with low computer self-efficacy showed the highest levels of exhaustion, the increase in exhaustion was higher for workers with high computer self-efficacy. Regarding the two-way interaction effect of job control and computer self-efficacy (see Figure 5), it was found that in workers with high computer self-efficacy, exhaustion increased when job control was low. A different picture emerged for workers scoring low in computer self-efficacy: Amongst them, job control was weakly associated with exhaustion. Thus, the combination of feeling efficacious in working with computers, but with a lack of job control, was the most exhausting.

Cynicism. In order to test the hypothesis on cynicism, a second hierarchical multiple regression analysis was performed with cynicism as a dependent variable (see Table 3). Again a significant multivariate F -value was observed. The expected significant main (hypothesis 1) and interaction (hypothesis 2) effects of

TABLE 3
Hierarchical multiple regression analysis of job demand, job control, and levels of self-efficacy on cynicism ($N = 405$)

	β	R^2 change
1. Age	.03	.01
Gender	.03	
2. Job demand	.20***	.10***
Job control	-.11**	
Generalized SE	-.09	
Computer SE	-.13**	
3. Demands \times Control	-.10*	.01
Demand \times Generalized SE	.01	
Control \times Generalized SE	.01	
Demand \times Computer SE	.04	
Control \times Computer SE	.06	
4. Demand \times Control \times Generalized SE	-.05	.04*
Demand \times Control \times Computer SE	-.11*	
Multiple R	.34	
R^2	.12	
F	3.99***	

* $p < .05$, ** $p < .01$, *** $p < .001$.

The β values are the coefficients from the final stage of the regression analysis; due to rounding off, R^2 differs .01 from the sum of R^2 change.

job demands and job control on cynicism were also confirmed. After controlling for age and gender, job demands were positively and significantly associated with cynicism, whereas job control was negatively and significantly associated with cynicism (hypothesis 1). Moreover, the combination of high job demands and low job control precipitated cynicism (hypothesis 2). The significant interaction effect of job demands and job control is graphically represented in Figure 6.

As can be seen from Figure 6, levels of cynicism increased when workers with low job control experienced high job demands. In contrast, a weak association was observed between demands and cynicism for those experiencing high job control. Thus, as predicted by the JD-C model, high control buffers the negative effect of demands on cynicism. Hence, the results for exhaustion and cynicism were remarkably similar—in both cases hypotheses 1 and 2 were confirmed.

As far hypothesis 3 is concerned, a significant three-way Job Demands \times Job Control \times Computer Self-efficacy interaction effect was found (see Figure 7), but it was not found with regard to generalized self-efficacy.

Results are also consistent with the Job Demands–Control model of Karasek. The level of cynicism was particularly higher when job demands were high, especially for workers with low control and low computer self-efficacy. Besides this, according to expectations, for workers with high computer self-efficacy and with high job control, the interaction effect was consistent with the JD-C model. For workers with high levels of computer self-efficacy, when compared with workers with low levels of computer self-efficacy, high job control seemed to attenuate the increase in cynicism caused by job demands. Furthermore, as we expected, for workers with high computer self-efficacy and low control, and

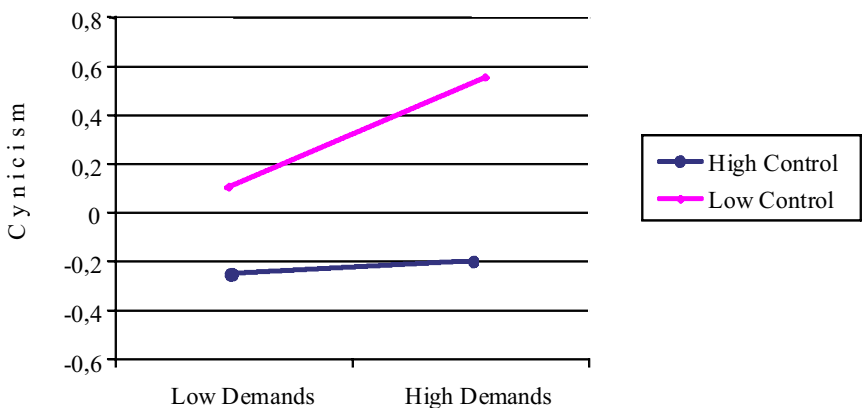


Figure 6. Two-way interaction effect of Job Demand \times Job Control on cynicism.

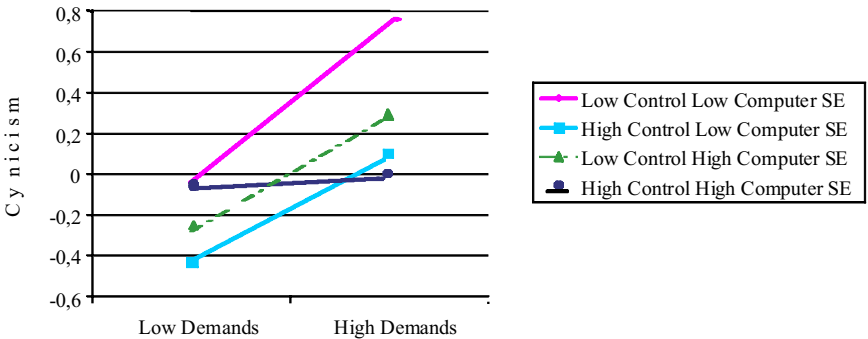


Figure 7. Three-way interaction effect of Job Demand \times Job Control \times Computer Self-efficacy on cynicism.

workers with low computer self-efficacy and high job control, the high demands increased the level of cynicism. Therefore, hypothesis 3 is also supported in the case of cynicism.

Finally, hypothesis 4 is also supported as far as cynicism is concerned. That is, only main and interaction effects were found to be significant when computer self-efficacy was taken into account, but not in the case of generalized self-efficacy.

DISCUSSION

This study aimed to refine and extend Karasek’s Job Demand–Control (JD–C) model by taking into account the main methodological and conceptual criticisms that have recently been raised. First, we used moderated regression analysis instead of analyses of variance to test our hypotheses (cf., Landsbergis et al., 1994). Second, we included two individual characteristics (i.e., levels of self-efficacy) as second moderators variables. Third, specific measures of job demands (i.e., quantitative overload) and job control (i.e., timing and method control) were included. Finally, we tested the predictions of the JD–C model examining both additive and interactive effects of demands and control on burnout (i.e., exhaustion and cynicism).

Job demand–control hypotheses

Four hypotheses were tested, two of which pertain to the traditional JD–C model. Hypothesis 1, the so-called strain or additive hypothesis, was confirmed for exhaustion as well as for cynicism. That is, as predicted, and after controlling for age and gender, high job demands (i.e., qualitative overload) and low job control

(i.e., method and timing control) precipitated burnout (i.e., exhaustion and cynicism). These findings are consistent with previous research on the JD–C model, which has often found empirical support for the main effects of job demands and job control on job strain indicators. Hypothesis 2, the so-called interaction hypothesis, was also confirmed. That is, as predicted, and again after controlling for age and gender, the *combination* of high job demands and low job control precipitated exhaustion and cynicism. More specifically, high control seemed to buffer the negative impact of high job demands on burnout. In sum: Taking into account earlier methodological and conceptual criticisms that were raised against the JD–C model seems to have paid off, since this study clearly confirms the predicted main and interaction effects.

Levels of self-efficacy

The other objective of this study was to test the moderating role of self-efficacy specificity with regard to the JD–C model, and its effects on burnout (hypothesis 3) by taking previous research further on this issue (see mainly Jimmieson, 2000; and Schaubroeck & Merrit, 1999). Results showed the three-way interaction effect, but there were more consistent moderating effects of computer self-efficacy than generalized self-efficacy. In addition, the picture was a little different for each dimension of burnout. The most relevant result was that high levels of computer self-efficacy buffered burnout when job demands and job control were high, as was expected. Moreover, for workers with high computer self-efficacy *but* low control at work, high demands increased levels of burnout, as they did for workers with low computer self-efficacy *but* high control at work. These results agree with Jimmieson (2000) and Schaubroeck and Merrit (1997) who found that Karasek's model was supported among people who experienced a high sense of self-efficacy. Among people with low job self-efficacy, increasing control at work may exacerbate the stress of demanding jobs, and also, high self-efficacy may likewise be harmful when people have no control at work. In this case, people may become discouraged when their efficacy beliefs are challenged by the objective uncontrollability of a situation (Wortman & Dunkel-Schetter, 1979; cf., Schaubroeck & Merrit, 1997). Our study tested the generalizability of this extended model. However, in the current study, a two-way interaction effect of job demands–control on both dimensions of burnout was also found, confirming the basic JD–C model. In addition, we extended the model for the case of burnout, confirming that the moderating role of computer self-efficacy was more robust than generalized self-efficacy among information technology workers.

In this vein, workers with high confidence in their competence to use computers but with a lack of control at work increase their levels of job strain.

Thus, an environmental obstacle, i.e., lack of job control, seems stressful particularly for those workers who report high levels of computer self-efficacy. It appears that when demands are high, low job control is a problem for those with high computer self-efficacy: In other words, they are confident to deal with the demands by using their competencies, but at the same time they are prevented from using these competencies because they lack the necessary autonomy. That is why they become burned out. This interpretation is in line with Bandura (1999) for whom self-efficacy, in essence, is concerned with people's beliefs in their competencies to perform in ways that give them some "control" over events. Thus, if people believe that they *can* produce desired results by their actions but the environment is hindering them they will give up and become exhausted and cynical.

Moreover, in the case of exhaustion, the two-way interaction effects of job demands and computer self-efficacy and job control and computer self-efficacy were found. Generally speaking, information technology workers with low computer self-efficacy exhibited high levels of exhaustion when job demands were high and job control was low. It seems therefore, that when workers feel confident about how to deal with computers, but they have little control on the task and the timing, they are more likely to feel exhausted compared to those who experience higher levels of control. Obviously, the combination of feeling incompetent and not having control over the task is most exhausting. This result is also shown in the three-way interaction effect when we take into account computer self-efficacy as the second moderator variable.

To sum up, our results strongly support the basic Job Demand-Control model of Karasek, and also extend it with a second moderating variable "computer self-efficacy" especially relevant to information technology workers. Previous research on Karasek's model failed to corroborate the Demand \times Control interaction effect on different strain variables. However, our results suggest that when we take into account previous criticisms on the issue (e.g., methodological and conceptual), demands and control measures relevant to the sample and specific self-efficacy beliefs (i.e., computer self-efficacy), the JD-C model is tested and extended with self-efficacy as a second moderator variable. Findings confirm previous research with other occupations (Jimmieson, 2000; Schaubroeck & Merrit, 1997). In this vein, our results also support Bandura's (1997, 1999, 2001) Social Cognitive Theory as far as the relationship between self-efficacy and burnout is concerned. It was found that both types of self-efficacy are negatively associated to both dimensions of burnout: The higher the worker's self-efficacy, the less burnout was experienced. This result supports the role played by self-efficacy as a predictor of strain outcomes (Bandura, 1997; Cherniss, 1980, 1993; Grau, et al., 2000; Jex & Bliese, 1999; Jimmieson, 2000;

Leiter, 1992; Salanova et al., 2000; Schaubroeck & Merrit, 1997; Schwarzer, 1999; Speier & Frese, 1997). Moreover, it was observed in the current study that in contrast to the general level of self-efficacy (e.g., generalized self-efficacy), the specific level of self-efficacy (i.e., computer self-efficacy) plays a more robust moderating role. Computer self-efficacy (in interaction with job control) seems to buffer the negative effects of job demands on levels of burnout. However, it is not the case for generalized self-efficacy. This result agrees with previous research that has shown that more robust results are obtained when domain specific rather than general measures of self-efficacy are used (Bandura, 1997; Brouwers & Tomic, in press; Maibach & Murphy, 1995; Salanova et al., 2000; Schaubroeck & Merrit, 1997). The reason is that self-efficacy beliefs are domain specific; a person's self-efficacy belief is likely to differ depending on the activity to which it is related (Bandura, 1999, 2001). Future studies could use specific self-efficacy according to the specific sample of workers under study. For instance, burnout has been used extensively with samples of health-care workers, and so it would be very interesting to test the present extended model on these professionals, using specific measures of self-efficacy according to the main tasks they carry out.

Limitations

Two major study limitations exist. First, our study employs a cross-sectional design, whereas a longitudinal design is necessary in order to assess causal mechanisms involved in the relationships between job demands, job control, computer self-efficacy beliefs, and burnout. So our results are tentative as far as such causal mechanisms are concerned. Second, we used exclusively subjective self-reported data, which poses a potential threat to the validity of the results due to common method variance. Although all interaction terms were computed from standardized main effects variables, in order to avoid problems of multicollinearity (cf., Cohen & Cohen, 1983; Kleinbaum et al., 1988); a useful and alternative option is to collect objective data on technological proprieties (i.e., specific demands of using information technology) either retrospectively or while carrying out longitudinal research.

Practical implications

Finally, specific guidelines for practitioners can be formulated to design an adequate approach to prevent burnout among information technology workers. These guidelines concern the reduction of quantitative overload and the improvement of levels of job control (method and time control) as well as increasing computer self-efficacy. As reducing the level of overload is difficult to achieve, an alternative approach to support IT workers in dealing with overload is

to simultaneously improve both job control and computer self-efficacy. Generally speaking, job control has a positive effect on worker's well-being. Furthermore, according to the results of the current study, workers with high demands should be given extra job control in order to counteract the development of exhaustion and cynicism. However, as the current findings indicate, increasing only job control is likely to reduce burnout only among people with high computer self-efficacy. But also, increasing *only* self-efficacy could have negative consequences for people with lack of control at work (after interventions, these people could experience burnout in demanding jobs because uncontrollable situations may challenge personal agency perceptions. It seems worth simultaneously increasing job control as well as computer self-efficacy in order to cope with demanding job circumstances. As Schaubroeck and Merrit (1997, p. 751) point out, "managers implementing job redesign interventions to increase job control should be sure (1) that employees are confident of their abilities to utilize this control and (2) that each employee directly experience the enhanced control".

In order to achieve this, the interventions to increase employee self-confidence must include a variety of components that are consistent with the current theoretical notions on self-efficacy (Bandura, 1997, 1999). These include practical exercises to provide experiences of success using computers (enactive mastery), models of performance or behaviour modelling (vicarious experiences), coaching and encouragement (verbal persuasion), and reducing the emotional threats of rejection (managing physiological states). According to Bandura (1999) the most authentic and influential way to increase self-efficacy is by fostering "mastery experiences". This can be achieved by tackling problems regarding computers in successive, attainable steps. Although successes build a robust belief in one's computer self-efficacy, failures undermine it, especially in the earlier phases of computer training. Therefore, in order to achieve resilient self-efficacy, experiences in overcoming obstacles through persistent effort are required. In a similar way, if people see others like themselves succeed by sustained effort, they come to believe that they also have the capability to succeed ("vicarious experiences"). "Social persuasion" seeks to persuade computer users that they have what it takes to succeed, and so they make more effort and are more likely to persevere if they have self-doubts when obstacles arise. Finally, people also rely on their "physical and emotional states" to evaluate their own capabilities to use computers. Negative emotions such as tension, anxiety, and depression are signs of personal deficiency. In this case, it would be apt to enhance the worker's physical condition, reduce his or her negative emotional states, and correct misinterpretations of somatic sources of information.

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