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Work-Induced Changes in Feelings of Mastery

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Abstract

Past theory and research indicate that conditions of work can have lasting effects on job incumbents. Karasek and Theorell (1990), for example, proposed that workers' feelings of mastery increase with levels of job demands and job control, and that these effects are mediated by the process of active learning. To test these propositions, 657 school teachers completed scales assessing job demands, control, active learning and mastery on two occasions, eight months apart. As hypothesized, job control predicted change in mastery, an effect that was mediated by active learning. Job demands had a weaker effect on change in mastery. The demands-mastery relationship was moderated by job control, such that under conditions of high but not low control, increasing job demands were associated with gains in mastery. The findings partially support Karasek and Theorell's predictions regarding the main, interactive and mediated effects of job conditions on employee mastery.

Keywords:

Job control, job demands, mastery, teachers.

Work-Induced Changes in Feelings of Mastery

Research conducted over the past decade has demonstrated that psychosocial development continues throughout the adult years (e.g., Roberts, Caspi, & Moffitt, 2003; Roberts, Walton, & Bogg, 2005). The nature, rate and direction of this development vary with a range of factors. Among the many possible influences is the process of occupational socialization, with studies dating back several decades (e.g., Brousseau & Prince, 1981; Elder, 1969) demonstrating that people's beliefs, values and general response tendencies are shaped by their experiences at work (for reviews, see Frese, 1982; Furnham, 1992). The current study draws on the literatures relating to adult development and occupational socialization to explore ways in which job experiences influence job incumbents.

A limitation of past research into work-induced personal change is its weak theoretical foundations. Researchers have identified several work factors (e.g., labour force participation, occupational attainment, job satisfaction, responsibility) that may influence workers, and have identified several personal characteristics that may be affected. However, there is little guidance offered by theory as to which aspects of the person change with specific work features. Similarly, theory provides few insights into the processes through which work shapes psychosocial development. One exception to this paucity of relevant theory is Karasek and Theorell's (1990) person-work environment model. This model can be used to predict (a) the personal characteristics likely to change, (b) the job conditions under which these changes occur, and (c) the mechanism through which they occur. The aim of the current study was to test predictions derived from this theory in relation to the effects of the job environment on changes in a sense of personal mastery.

Karasek & Theorell's (1990) Person-Work Environment Model

The origins of Karasek and Theorell's (1990) views regarding the effects of jobs on people can be traced to Karasek's (1979) earlier model of psychosocial strain. Karasek

maintained that two aspects of jobs have critical effects on workers: job demands and job decision latitude or job control. The central tenet of this earlier model is that strain results from a combination of *high* psychological job demands and *low* job control. According to Karasek, job demands place workers in a motivated state of "stress" and, if nothing can be done about this state because of a lack of job control, the unreleased stress has adverse effects upon worker health. However, if workers are given opportunities to control (manage, regulate) work demands, they experience their jobs not as stressful but as challenging, they are invigorated and participate broadly in work (and non-work) life, and they *actively learn* from these experiences.

Karasek's (1979, 1981) research provided evidence in support of his model. Workers in jobs that are high in demands and low in control displayed high levels of strain, whilst those in jobs that have high demands and high control reported elevated levels of active learning and participation. Moreover, Karasek's strain data showed "moderate evidence for an interactive effect, understood as a departure from a linear additive model" (1979, p. 293). This interactive effect was critical in establishing the subsequent popularity of Karasek's model. The finding was widely interpreted as showing that job control can buffer the strain-inducing effects of job demands, and implied that, if control opportunities can be designed into demanding jobs, high levels of productivity can be achieved without adverse health consequences.

Karasek and Theorell (1990) extended the demands–control model by linking the two job factors, demands and control, and the two proximal outcomes of these factors, strain and active learning, to more enduring individual difference factors. Their model proposes that jobs that are high in demands and low in control not only produce worker strain in the short-term, but also lead to the accumulation of (trait) anxiety in the longer term. In contrast, jobs characterized by the joint presence of high demands and *high* control lead to active learning in the short-term, and to feelings of mastery in the longer-term. Thus, workers who are required

to perform highly demanding jobs are likely to be challenged and invigorated by their work, if, and only if, they are also granted high levels of job control. Under such conditions, workers learn new skills, experience success, and develop feelings of increased personal mastery. It is this latter theoretical prediction that is the focus of the present study. Figure 1 provides a simplified representation of the model under examination.

Figure 1

Karasek and Theorell (1990) did not offer a formal definition of mastery, but they did liken it to such constructs as internal locus of control, hardiness, and sense of coherence, citing the works of Rotter (1966), Maddi and Kobasa (1984) and Atonovsky (1987), respectively. The mastery construct also partially overlaps with self-efficacy (Bandura, 1997), optimism (Scheier & Carver, 1985), and learned helplessness (Seligman, 1975). Common to these is a positive response to hardship that comes from having a sense of self-directedness and self-confidence. Semmer (1996) refers to these attributes collectively as "resourcefulness belief systems" (p. 65). Such qualities are important links in causal chains that run from the conditions of work to such outcomes as job performance, job satisfaction, well-being, and life satisfaction (Kohn & Schooler, 1982; Rode, 2004; Seeman & Seeman, 1976; Stajkovic & Luthans, 1998). Karasek and Theorell's ideas about mastery also link nicely with Kanfer and Ackerman's (1989) cognitive ability-motivation framework and with work by others on mastery goal orientation (see, e.g., Elliot & Dweck, 2005). In terms of Kanfer and Ackerman's framework, for example, self-regulatory processes are critical determinants of performance and the development of competencies, but these processes are triggered only when task demands exceed some threshold and when self-confidence (or *mastery*) is high. More broadly, Karasek and Theorell's ideas about the role of control and

activity in developing competencies are congruent with Luthans' (2002) positive

organisational behavior approach, and much of the human relations and adult education

literature (Landsbergis, 1988).

Past Evidence of Job-Induced Changes In Mastery

Limited past research has sought to test Karasek and Theorell's (1990) person-

environment model. However, there is some evidence showing that workers' levels of

mastery (or locus of control, self-efficacy, or similar) varies with a range of job-related factors

including occupational attainment, salary and job re-entry (Andrisani & Nestel, 1976),

participation in management (Seeman & Seeman, 1976), work performance (Anderson,

1977), and job involvement and resource power (Roberts et al., 2003). Whilst these studies

provide evidence of associations between work variables and employee mastery, they do not

examine the dimensions of work (i.e., job demands and control) that are the focus of Karasek

and Theorell's (1990) theory. There is also some research (e.g., Landsbergis, Schnall, Deitz,

Friedman, & Pickering, 1992; Mortimer, Lorence, & Kumka, 1986; Roberts et al., 2003) that

links job demands and control to worker characteristics, but rather than assessing mastery,

this research has examined qualities such as locus of control and attributional style

(Lansdbergis et al.), self-competence (Mortimer et al.), and agentic positive emotionality

(Roberts et al.). In sum, the available evidence does not directly address the variables, or the

relationships between the variables, that lie at the heart of Karasek and Theorell's model.

Two other limitations of past research should be noted. First, most past studies have

employed cross-sectional designs (or the effects have been found in cross-sectional analyses

only), and therefore are not able to test possible reverse effects (e.g., mastery leads to

placement in jobs that are high in both demands and control) or reciprocal effects (e.g., the job

factors both affect, and are affected by, worker mastery). Yet, the stress literature contains

numerous examples (e.g., de Jonge, Dormann, Janssen, Dollard, Landeweerd, & Nijhuis,

2001; de Lange, Taris, Kompier, Houtman & Bongers, 2004; Gelesma, Ven Der Doef, Maes,

Janssen, Akerboom, & Verhoeven, 2006) of reversed and reciprocal relationships involving work and personal variables, and these relationships can be explained theoretically in terms of "drift" or "self-selection" mechanisms (de Lange, Taris, Kompier, Houtman, & Bongers, 2005). The second limitation relates to the failure to test interactive effects. Only one prior study (Holman & Wall, 2002) appears to have tested the possibility that demands and control interactively affect mastery. Yet, an enhancing or synergistic effect of the two job factors follows logically from Karasek and Theorell's thesis. These propositions, that job demands, job control and their interaction are positively associated with changes in mastery, were put to the test in the current research.

Also currently under investigation was the mechanism – increases in active learning – that Karasek and Theorell propose to mediate the relationship between jobs that are high in both demands and control and gains in mastery. Despite some inconsistency in the conceptualization and labeling of this intervening variable (Karasek 1979; 1981; Karasek & Theorell, 1990; see also Taris, Kompier, De Lange, Schaufeli, & Schreurs, 2003), several studies have shown it to be predicted by levels of job demands and/or control. The evidence is stronger in respect of control than demands (Cheng, Kawachi, Coakley, Schwartz, & Colditz, 2000; De Jonge Janssen, & van Breukelen, 1996; De Jonge, Mulder, & Nijhuis, 1999; Holman & Wall, 2002; Landsbergis, 1988; Landsbergis et al., 1992; Parker & Sprigg, 1999; Taris et al., 2003). Also, studies have investigated the interactive impact of demands and control on various indices of active learning. Findings have been mixed, with the demands x control interaction predicting job challenge (De Jonge, Dollard, Dormann, Le Blanc, & Houtman, 2000), job involvement (De Jonge et al., 1999), and vigour (Rodriguez, Beerteloot, Del Libano, & Salanova, 2006), but not skill utilization (Holman & Wall, 2002), learning motivation, personal accomplishment (Taris et al., 2003), or any of three learning-oriented outcomes assessed by Parker and Sprigg (1999).

The Present Study

The study reported here is part of a larger investigation of work and wellbeing among school teachers. This part of the project made several contributions to knowledge in the field. It not only tested predictions derived from an under-researched aspect of Karasek and Theorell's (1990) model, but it also did so using a longitudinal design, an established measure of mastery, and a set of analyses that compared hypothesized-, reversed- and reciprocal-direction models. Self-report data were collected on two occasions, eight months apart. Analyses entailed testing the effects of job factors measured in the first wave of data collection on mastery measured at the second wave, having controlled for baseline mastery. Consistent with Karasek and Theorell's model and the evidence presented above, it was hypothesized that:

H1. (a) Job demands and (b) job control are positively associated with mastery.

H2. Control enhances the positive effects of demands on mastery.

Karasek (1979; Karasek & Theorell, 1990) proposed that conditions of high job demands and high job control lead to enhanced levels of active learning. A scale assessing states of vigor and activity at work was chosen to measure active learning, thereby tapping into workers' experiences of arousal, effort and persistence. In light of past evidence that control is positively associated with active learning, and more modest evidence suggesting that demands and the demands x control interaction effect are also linked to this outcome, it was hypothesized that:

H3. (a) Job demands and (b) job control are positively associated with vigor-activity.

H4. Control enhances the positive effects of demands on vigor-activity.

Karasek and Theorell (1990) proposed that job conditions have their effects on mastery through the process of active learning. However, no research appears to have

investigated this mediation pathway. Thus, it remains possible that a direct effects model, or a partially-mediated model, may better fit the data than one specifying that the effects of the job factors are fully-mediated through active learning. The current study tested the hypothesis that active learning, operationalized as a measure of vigor-activity, fully mediates the job factors-mastery relationship.

H5. Vigor-activity mediates the effects of (a) demands and (b) control on mastery.

Method

Participants.

The names of 1483 elementary and secondary teachers employed in over 700 public schools in Queensland, Australia, were selected from the employing authority's personnel records. Of these, 987 teachers returned a completed questionnaire at Time 1 (T1) and 719 did so at Time 2 (T2). This paper is based on data from the 657 teachers for whom all data were present at both waves. The sample comprised 483 females (73.5%) and 174 (26.5%) males. Ages varied from 21 to 63 years, with a mean of 35.2 years. Years of teaching experience ranged from one to 40 years. Respondents taught at schools that varied from remote single-teacher schools to large suburban and inner-urban institutions.

The sample did not differ significantly from the population of Queensland teachers (N > 30,000) in terms of gender or school sector. Additional analyses examining the pattern of participant attrition revealed that the T2 sample did not differ significantly from those who responded at T1 on nine dimensions (gender, age, marital status, school sector, years of teaching experience, number of teachers in the school, number of students in the school, school location, and socio-economic status of school area).

Materials.

The questionnaire completed at both T1 and T2 contained the following scales.

Job Demands and Control. Scales to measure job demands and control were constructed for this study. As recommended by many authorities (e.g., Schonfeld, 1992; Van

der Doef & Maes, 1999), the content of these scales was occupationally-specific, the job

demands items were worded in an affectively-neutral way, and the content of the demands

and control items were congruent, but not overlapping. The scale development process

comprised several pilot studies, beginning with interviews with experts in the field (three

teachers, two school principals, two teacher educators, a school counsellor, an organizational

psychologist, etc.). Each interviewee first commented on the demands and control

opportunities currently faced by teachers working in the region and then evaluated the

relevance and salience of each of 33 stressor items drawn from past teacher stress research

(e.g., Borg & Riding, 1993; Hart, Wearing, & Conn, 1995). Initial versions of the scales were

further refined through two small pilot studies, before final versions of each of the demands

and control scales were evaluated in a cross-sectional survey of 421 teachers.

Whilst the pilot studies provided initial evidence as to the psychometric qualities of

the scales, validity data were not available before this study. However, some evidence of the

two scales' concurrent validity was obtained in the current study by correlating scores on the

scales with Motowidlo, Packard, and Manning's (1986; study 2) job stress scale and

McLaney and Hurrell's (1988) job satisfaction scale. Past research consistently shows

measures of demands to be correlated positively, and measures of control correlated

negatively, with job strain (see, e.g., Van der Doef & Maes, 1999). Correlations using the

current scales closely matched those previously reported: at T1, for example, demands was

correlated at $r = .50$ with stress and $-.40$ with job satisfaction, whilst the corresponding

correlations involving control were $-.40$ and .36.

Both the demands and the control scales comprised 16 items. The content of these

scales spanned many facets of the job of a teacher, including quantitative load, school

curriculum and student learning, classroom management, timetabling and resource issues, and

relations with superiors, colleagues and parents. Instructions for the demands scale

emphasised the need to "describe the requirements of your job as objectively as possible".

Response alternatives ranged from 1 (*completely false in relation to my job)* to 5 (*completely*

true in relation to my job). For the control scale, participants indicated the extent which they

felt able to "change, influence or exercise control over these aspects of your job". Possible

responses ranged from 1 (*have virtually no control*) to 5 (*have complete control*). The items

for the two scales directly paralleled one another. For example, for the demands item, "The

demands of my job take up many hours on my personal time", there was a corresponding

control item tapping whether the respondent felt able to "change, influence or control the

extent to which work makes demands of [their] personal time?" Similarly, participants

responded to items indicating the extent to which it is true that "students frequently

misbehave" in their class (demands item), and the extent to which they felt able to "change,

influence or control the extent to which students misbehave" in their class (control item).

Active Learning. This was assessed using the Vigor-Activity sub-scale from the

Profile of Mood States (POMS: McNair, Lorr, & Dropplemann, 1992). This sub-scale

presents participants with eight adjectives (e.g., "active", "energetic", "lively") describing a

condition of "vigorousness, ebullience, and high energy" (McNair et al., p. 5). Respondents

indicated the extent to which they had felt these ways at work during the preceding week, on a

scale from 1 = *not at all* to 5 = *extremely*. McNair et al. report extensive data to support the

scale's reliability and validity: for example, it correlates at $r = -.42$ with depressive

symptoms, and its internal reliability is .90 for both male and female normative samples.

Mastery. Feelings of mastery were measured using Pearlin and Schooler's (1978)

Mastery Scale. This seven-item scale was designed to measure "the extent to which one

regards one's life-chances as being under one's control in contrast to being fatalistically

ruled" (Pearlin & Schooler, p. 5). Karasek and Theorell (1990) refer to the work of Kohn and

Schooler (1982) on mastery when developing their theory. The scale items (e.g., "What

happens to me in the future mostly depends on me") are worded to be context-free, rather than

refer to work (or other specific) situations. Respondents indicate their agreement with each

item on a scale ranging from 1 (*strongly disagree)* to 4 (*strongly agree).* Pearlin, Menaghan,

Lieberman, and Mullan (1981) report a coefficient alpha of .75 and a four-year test-retest

correlation of .44 for this scale.

Procedure.

Survey materials were mailed to members of the T1 sample early in a school year.

Questionnaires were numbered to assist with follow-up procedures. Three weeks after initial

dispatch, non-respondents were sent a reminder letter and a replacement questionnaire. T2

survey materials were mailed eight months after the first phase of data collection. This time

lag provided an opportunity for the respondents' job conditions to have an impact (Schonfeld,

1992), it was of sufficient duration to neutralize short-term testing effects, it ensured that both

questionnaires were completed in months of the year that were similar climatically, and it

avoided the large attrition problems likely to be associated with a change of school years. T2

reminder letters were sent three weeks after initial dispatch.

Results

Descriptive statistics are given in Table 1. As can be seen, alpha reliability

coefficients for all measures were satisfactory ($.74 < \alpha < .89$). Standardized skewness values

demonstrate that the measures were not so severely skewed as to represent a threat to the

validity of SEM maximum likelihood estimation procedures. T1 to T2 stability coefficients

ranged from .55 (vigor-activity) to .69 (mastery).

Table 1

Table 1 contains the zero-order correlations between the study variables. Contrary to

H1(a) and H3(a), respectively, demands was not positively associated with mastery or with

vigor-activity. However, consistent with hypotheses 1(b) and 3(b), control was positively

associated with these outcomes. Whilst *static* (i.e., single occasion) measures of demands and mastery were negatively correlated, T1 demands was positively correlated, albeit weakly, with T1 to T2 *change in* mastery, $r = .10$, $p < .01$.

None of the study variables varied by teacher gender or subject area taught, and none varied with school socio-economic status (all ps $> .05$). Both age and job tenure (i.e., years of teaching experience) were positively correlated with job demands and negatively correlated with each of control and mastery (all rs $< .20$). As age and tenure were correlated at $r = .80$ with each other, and, of the two, tenure was the more highly correlated with other study variables, only job tenure was controlled in the models subsequently tested.

Structural equation modelling (SEM) was performed using LISREL 8.70 (Joreskog & Sorbom, 1996). Variables included in all models were demands, control, the demands x control interaction term and mastery, each measured at both Times 1 and 2, and vigor-activity averaged across Times 1 and 2. In the absence of three waves of data collection, the use of predictors measured at T1, a mediator that was the mean of measures taken at T1 and T2, and a criterion measured at T2 (residualised for T1 levels) is consistent with the temporal relationships identified in Karasek and Theorell's mediation model. To account for measurement error, latent variables were formed using each observed scale score as the manifest indicator of the corresponding latent construct. Values were fixed for (a) the loadings of the latent variables on their respective observed composite scale (computed by multiplying the standard deviation of the measure by the square root of its reliability coefficient), and (b) the error variance for each variable (calculated by subtracting the reliability coefficient from unity and multiplying this by the variance of the measure). Demands x control interaction terms were formed using Ping's (1995) two-step procedure.

Covariance and asymptotic covariance matrices were used as input for all models. T1 variables (including job tenure) were exogenous, with vigor-activity and the T2 variables endogenous. All models estimated the following parameters: (a) variances of the latent

variables, (b) covariances between the T1 latent variables, (c) covariances between the

disturbances of the four T2 latent variables, (d) autocorrelations (stability paths) for the four

variables that were assessed at both Times 1 and 2, and (e) error covariances between

corresponding T1 and T2 job factors. The baseline model (M1) contained only these

parameters. The hypothesized model (M2) was based on Karasek and Theorell's (1990)

theory. It was identical to the baseline except for the addition of paths from the T1 job

factors, through vigor-activity, to T2 mastery. The key structural components of this fully-

mediated model are shown in Figure 2.

Figure 2

To assess whether the hypothesized model provided a better fit to the data than did

plausible alternatives, eight other models were specified and tested. See Table 2. These rival

models represented all possible remaining combinations of three directions of influence

(hypothesized, reversed, reciprocal) x three levels of mediation (full, partial, and none (i.e.,

direct effects only)). So, for example, model 3 specified direct effects (i.e., not mediated by

vigor-activity) in the hypothesized direction (i.e., job factors predict mastery), model 4

specified partially-mediated effects (i.e., job factors have their effects both directly, and

indirectly through vigor-activity) in the hypothesized direction, and so on. Consistent with

the "drift" or "self-selection" hypothesis, the three reversed-effects models (M5 - M7) tested

the fully-mediated (M5), direct (M6) or partially-mediated (M7) effects of T1 mastery on the

T2 job factors. The reciprocal effects models included bidirectional paths between the job

factors and mastery. Importantly, the temporal sequence from T1 variables to T2 variables

was maintained in all ten models.

Model fit was assessed using the Satorra-Bentler adjusted chi-square statistic (χ^2), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Parsimony Normed Fit Index (PNFI). Good to very good-fitting models are indicated by non-significant chi-square values, RMSEA values of less than .06, and values greater than .95 for GFI, AGFI, NNFI and CFI. Higher PNFI values indicate greater model parsimony (Tabachnick & Fidell, 2007). The relative fit of nested models was compared using the chi-square difference test ($\Delta\chi^2$ test). As can be seen in Table 2, all indices, other than the chi-square statistic, indicated that the hypothesized model (M2) fitted the data well. The model explained 57% of the variance in T2 mastery. None of the paths involving job tenure was significant in this (or any other) model.

Table 2

Several generalizations can be made regarding the fit of the full set of models. First, the reciprocal effects models (M8, M9 and M10) provided a better fit, but were less parsimonious, than the corresponding unidirectional effects models. Second, fully-mediated models (M2, M5 and M8) provided a better fit than the corresponding direct effects models (M3, M6 and M9, respectively). This is consistent with hypothesis 5, namely, that the job factors affect mastery via vigor-activity. Third, the partially-mediated versions of the hypothesized and reciprocal models (M4 and M10) provided a better fit, but were less parsimonious, than the corresponding fully-mediated (M2 and M8) and direct effects models (M3 and M9).

Inspection of the parameter estimates within specific models permitted further testing of all hypotheses. Table 3 presents estimates of the parameters leading from the job factors to

the mean vigor-activity in all models in which these paths were specified (as noted above, paths in this direction were not included in the reverse-effects models). As shown, in all models, demands was negatively related, control positively related, and the interaction unrelated, to vigor-activity. Thus, only the link involving control was consistent with expectations (H3b).

Table 3

Table 4 presents the estimates of the parameters leading to T2 mastery. (Again, information about the reverse-direction models (M5 – M7) is not included because these models did not include paths in this direction). For the two partially-mediated models (M4 and M10), three types of effects on mastery (direct, indirect, and total) are given. The right-hand column of this table shows that vigor-activity was positively associated with mastery in all models. In three of the four mediated models (M2, M4 and M8), control predicted mastery. In the two direct effects models (M3 and M9), demands and the interaction, but not control, predicted mastery. Thus, the effect of control on mastery was (a) significant in models where its effect was through vigor-activity, but (b) not significant where it had only a direct effect and where vigor-activity was a rival direct predictor. These findings are consistent with the control → vigor-activity → mastery mediation path specified in H5. The direction of the demands-mastery coefficient is also noteworthy: when forced to pass through vigor activity (e.g., in M2), demands was negatively associated with changes in mastery, but when predicting mastery directly (e.g., M3), the effect was positive.

Table 4

The most highly saturated model, Model 10, included all possible paths in both directions. This model yielded the best goodness-of-fit statistics, but it lacked parsimony and several (six out of fourteen) of its parameters were non-significant. In this model, the T1 job factors significantly predicted T2 mastery either directly (in the case of demands and the interaction), indirectly (in the case of control), or in total (in the case of the interaction, and, indeed, also in the case of demands and control if a one-tailed test is applied). In contrast, T1 mastery did not have significant direct effects or significant total effects on any T2 job factor. These results suggest that the data more strongly support the hypothesized, than the reversed, direction of influence between the variables.

Examination of the parameter estimates and modification indices suggested that none of the a priori models represented the best possible fit to the current data set. Specifically, two paths (the direct path from control to mastery and the indirect path from the interaction term to mastery) were non-significant in all models. Thus, whilst the model (M4) that included all possible direct and indirect paths from the job factors to mastery fitted the data well, fit could be improved by deleting the two non-significant paths. Estimation of this post hoc model indicated that (a) it provided a good fit, $\chi^2 (12) = 43.5$, RMSEA = .06, GFI = .99, AGFI = .93, NNFI = .94, CFI = .98, (b) it was a better fit than both M2, $\Delta\chi^2(1) = 5.5, p < .05$, and M3, $\Delta\chi^2(1) = 58.1, p < .001$, and (c) its fit was no worse, $\Delta\chi^2(2) = 3.7$, ns, and more parsimonious, PNFIs = .26 vs. .22, respectively, than M4. Thus, this was judged to be the best of all models tested.

Writers (e.g., Holman & Wall, 2002; Ping, 1996) recommend that when SEM analyses involve interactions between continuously-measured latent variables, findings should be verified using more conventional modes of analysis. Following this advice, the final analysis was a hierarchical multiple regression analysis that assessed the extent to which scores on the job factor scales predicted changes in mastery. Predictors were: step 1 – job tenure and T1 mastery; step 2 – T1 demands and T1 control (both in mean deviation form); step 3 – the T1

demand x T1 control interaction term. After all variables had entered the equation, control (β = .09, p = .012), and the demands x control interaction (β = .07, p = .015), but not demands (β = .05, p = .150), predicted T2 mastery. Figure 3 shows the results of the simple slopes analysis of the demands x control interaction on change in mastery. It shows that, under conditions of high (but not low) control, demands was associated with increasing levels of mastery. This provides additional support for H2.

Figure 3

In sum, analyses of this data set provided strong support for hypotheses 1b (main effect of control on mastery), 2 (enhancing effect of control on the demands-mastery relationship), 3b (main effects of control on vigor-activity), and 5 (vigor-activity as a mediator of the effects of the job factors on mastery). Support for H1a (main effect of demands on mastery) was equivocal. Hypotheses 3a (main effect of demands on vigor-activity) and 4 (demands x control interactive effect on vigor-activity) must be rejected.

Discussion

This study provided a partial test of Karasek and Theorell's (1990) person-work environment model. The key finding was a prospective association between exposure to particular job conditions and changes in workers' feelings of mastery. Both cross-sectionally and longitudinally, control was correlated in the expected (positive) direction with this outcome. In contrast, job demands was negatively related to mastery at T1 and T2, but was positively related to *changes in* mastery. Together, the results more strongly supported hypothesis 1(b) (positive effects of control on mastery) than hypothesis 1(a) (positive effects of demands on mastery).

Some of the findings relating to control and mastery are unsurprising. After all, mastery is a global characteristic that would be expected to be linked with beliefs in control in more specific (work) contexts. Such correlations between *static* variables can be explained by the process of self-selection into jobs (that is, high mastery individuals may seek out, be appointed to, or create, jobs in which they can exercise high levels of control). However, the finding that initial levels of control predicted *changes* over time in mastery is not readily explained by selection mechanisms. Occupational socialization – the effects of work on people – seems to be a more plausible explanation. Furthermore, the demonstration of this effect over a relatively short time-frame, and with job tenure and job demands statistically controlled, provides additional reasons to suggest the effect is a robust one.

The finding of a positive association between demands and changes in mastery is of particular interest given the weak (e.g., De Jonge et al., 1996; 1999), and even negative (e.g., Taris et al., 2003), pattern of effects previously reported. Whilst the current finding may run counter to intuitions regarding the erosive effects of demands upon feeling of competence, it is consistent with Karasek and Theorell's reasoning. For these theorists, job demands can challenge workers, and thereby enhance motivation, self-efficacy and personal growth. However, the current results did not entirely accord with predictions, in that the positive effect of demands on mastery was direct rather than mediated through active learning (and the mediated effect was negative rather than positive). This suggests that, while increases in job demands are associated with reduced vigor and a depletion of worker energy, the net effect of demands is an enhancing one: workers may be exhausted by onerous jobs, but they appear to grow in mastery whilst employed in such positions. Given that changes in vigor-activity seem not to be the mechanism through which this enhancing effect occurs, further research is required to tease out the processes that are involved. The sense of accomplishment that follows successful task completion is one plausible mediator of this relationship between demanding jobs and gains in mastery.

Consistent with hypothesis 2, both the SEM and the regression analyses showed significant demands x control interaction effects on changes in mastery. The form of this interaction approximated that predicted, that is, when control was high (but not when it was low), increasing levels of demands were associated with gains in personal mastery. The finding of this significant interaction is believed to be unprecedented in the literature, and provides support for the interactive component of the model.

Hypothesis 3 predicted positive effects of each of demands (H3a) and control (H3b) on vigor-activity, whilst H4 predicted these effects to be enhanced by a significant demands x control interactive effect. Of these predictions, only the positive association between control and vigor-activity was supported. Whilst consistent with prior research, this finding has seldom been demonstrated in longitudinal studies (c.f., Cheng et al., 2000; Taris et al., 2003). The finding that demands was negatively related to vigor-activity does not necessarily disconfirm Karasek and Theorell's (1990) hypothesis regarding the positive effects of demands on active learning. Like most past studies that have grappled with this issue, the current research could be criticised for its operationalization of active learning. That is, whilst the POMS vigor-activity scale captures the hypothesized energizing or motivating effects of high demands–high control jobs, and whilst similar operationalizations have been used previously (e.g., Rodriguez et al., 2006), this measure may not adequately capture the by learning, or skill enhancement, component of Karasek and Theorell's construct. Greater validity may be achieved in future by including additional measures (such as Taris et al.'s "learning motivation") that together capture all facets of the active learning construct.

Hypothesis 5 predicted the (positive) effects of demands and control to be mediated vigor-activity. This hypothesis was supported in relation to control. However, whilst demands had a positive direct effect on change in mastery, its mediated effect was not in the expected (positive) direction. Given these findings, a model was developed post hoc that specified that mastery varies as a function of (a) direct and indirect effects of job demands, (b) a fully-

mediated (indirect) effect of control, and (c) a direct effect of the interaction term. Whilst the model was parsimonious and fitted the data well, it was not developed from theory and does require testing in an independent sample. It is possible that this model will not be replicated in studies that operationalize active learning in ways other than a measure of vigor-activity.

Limitations of the Study

Some limitations of the study should be acknowledged. First, the non-experimental design prevents causal relations being inferred. Second, only two waves of data collection were available, despite the value of using multiple waves to help clarify temporal relations (Zapf, Dormann, & Frese, 1996) and to fully test Karasek and Theorell's claims regarding the reciprocal inhibitive effects of accumulated anxiety and mastery. Third, the exclusive reliance upon self-report measures meant that response biases may have affected the assessment of single variables, and common method variance may have affected the assessment of relations between variables. Furthermore, the scales measuring demands and control were highly correlated, and had not been extensively validated. Last, Queensland teachers comprised the entire sample: Thus, findings may not generalize to other places or occupations. In weighing up the impact of these concerns, note must also be taken of the advantages associated with the current scales (e.g., they may be more subjectively and ecologically valid for this sample than are off-the-shelf instruments) and the current sample (e.g., its homogeneity helped to control extraneous factors such as educational attainment and learning potential).

Implications and Conclusions

This study investigated an under-researched aspect of Karasek and Theorell's (1990) extended model. Effect sizes were generally small, but this is unsurprising given that mastery is a "context-free" variable and, as such, is likely to be affected by many other work and non-work factors. Notwithstanding this, there are grounds for believing that the effects currently obtained represent under-estimates of the true relationships. First, the time lag between data collection points may not have been sufficient for the full impact of the job factors to be

realized. Effects may have been greater over a longer study period. Second, sampling from a single occupational group, within a defined geographical area, potentially restricted the variance in all the study variables. Effects may have been greater if a more heterogeneous sample had been studied. Third, the use of correlated, self-report measures to assess both demands and control, and the consequent risk of common method variance, reduced the probability of finding unique main and interaction effects. Effects may have been greater if the job factors were assessed using different methods.

Past studies (e.g., Holman & Wall, 2002; Morrison, & Payne, 2003; Van der Doef & Maes, 1999) have demonstrated that a sense of job control is positively linked to worker wellbeing and active learning. The current findings add weight to this conclusion. In particular, they suggest that the benefits of control may extend beyond immediate and transient states (such as vigor-activity) to include more global and enduring personal qualities (such as a sense of mastery). Moreover, there is evidence from the current study that, in addition to its main effect, control has a moderating effect on the relationship between demands and change in mastery. These effects have wide implications, especially given the accumulating evidence that feelings of mastery can, in turn, enhance the effectiveness with which people function in task, health, clinical and organisational domains (see, e.g., Bandura, 1997; Stajkovic & Luthans, 1998; Younger et al., 2008). Recent research (e.g., Logan & Ganster, 2005) has demonstrated that workers' sense of control can be enhanced by flattening organisational structures, enriching jobs, providing access to information, and involving staff in decision-making processes. If replicated in future research, the current findings suggest that control-enhancement strategies such as these should be more widely implemented.

In summary, the study provided support for several hypotheses based on Karasek and Theorell's (1990) dynamic person-work environment model. Most importantly, (a) job control predicted changes over time in mastery, (b) this effect was mediated by vigor-activity, and (c) control moderated the relationship between demands and changes in mastery. These findings

require replication and extension. Future studies should use independent measures of job

demands and control, samples drawn from a range of occupations, diverse operationalizations

of active learning, and multiple data collection points spread over several years. It is hoped

that the current study encourages such research, as well as promoting further investigations of

occupational socialization processes and outcomes.

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Table 1.

Descriptive Statistics and Correlations for Study Variables (N= 657) [ab]

Variable	M	SD	Stdd Skew [c]	1	2	3	4	5	6	7	8
1. T1 Demands	3.02	0.56	1.83	.75							
2. T1 Control	2.91	0.54	1.02	−.58	.82						
3. T1 Vigor-Actvity	3.11	0.78	−1.78	−.25	.25	.88					
4. T1 Mastery	3.03	0.52	−1.07	−.28	.35	.28	.80				
5. T2 Demands	3.01	0.55	1.54	.56	−.41	−.21	−.23	.74			
6. T2 Control	2.89	0.52	1.48	−.46	.60	.25	.33	−.55	.81		
7. T2 Vigor-Activity	3.04	0.80	−2.02	−.19	.25	.55	.25	−.23	.31	.89	
8. T2 Mastery	3.03	0.52	−2.36	−.20	.30	−.27	.69	−.26	.35	.31	.82

[a] All correlations are significant ($p < .001$, two-tailed).   [b] Alpha reliability coefficients appear along the diagonal.

[c] Standardized Skew (i.e., skewness/standard error of skew).

Table 2.

Goodness-of-Fit of Competing Structural Models

	Model		Goodness of Fit Statistics					
No.	Direction of Effect(s)	Nature of Effect(s)	χ^2 (df)	RMSEA	GFI (AGFI)	NNFI	CFI	PNFI
M1	Baseline (no cross-lagged effects specified)		121.9 (17)	.10	.96 (.87)	.86	.95	.36
M2	Hypothesized	Fully-mediated	49.0 (13)	.06	.98 (.93)	.94	.98	.28
M3	Hypothesized	Direct	101.6 (13)	.10	.97 (.86)	.84	.95	.27
M4	Hypothesized	Partially-mediated	39.8 (10)	.07	.99 (.92)	.93	.99	.22
M5	Reversed	Fully-mediated	48.6 (13)	.06	.98 (.93)	.94	.98	.28
M6	Reversed	Direct	60.9 (13)	.07	.98 (.92)	.92	.98	.28
M7	Reversed	Partially-mediated	49.3 (10)	.08	.98 (.91)	.92	.98	.22
M8	Reciprocal	Fully-mediated	11.6 (9)	.02	1.00 (.97)	.99	1.00	.20
M9	Reciprocal	Direct	44.9 (9)	.08	.99 (.91)	.92	.98	.20
M10	Reciprocal	Partially-mediated	1.1 (3)	.00	1.00 (.99)	1.01	1.00	.07

Table 3.

Standardised Parameter Estimates for Time 1 Job Factors on Mean Vigor-Activity

	Description of the Model		Predictors of Vigor-Activity		
No.	Direction of effect(s) on Mastery	Nature of effect(s) on mastery	T1 Demands	T1 Control	T1 Demands x T1 Control
M2	Hypothesized	Fully-mediated	−.13 **	.21 ***	−.02
M3	Hypothesized	Direct	-	-	-
M4	Hypothesized	Partially- mediated	−.13 **	.21 ***	−.03
M8	Reciprocal	Fully-mediated	−.11 *	.12 *	−.03
M9	Reciprocal	Direct	-	-	-
M10	Reciprocal	Partially-mediated	−.11 *	.12 *	−.03

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

Table 4.

Standardised Parameter Estimates for Predictors on Time 2 Mastery

	Description of the Model		Type of	Predictors of T2 Mastery			
No.	Direction of effect(s) on Mastery	Nature of effect(s) on mastery	effect of job factors on mastery	T1 Demands	T1 Control	T1 Demands x T1 Control	Mean T1/T2 Vigor- Activity[a]
M2	Hypothesized	Fully- mediated	Indirect	−.02 *	.03 **	.00	.14 ***
M3	Hypothesized	Direct	Direct	.08 *	.06	.08 *	.13***
M4	Hypothesized	Partially- mediated	Direct	.09 *	.06	.08 *	.14 ***
			Indirect	−.02 *	.03 **	.00	-
			Total	.07	.09 *	.07 *	.14 ***
M8	Reciprocal	Fully- mediated	Indirect	−.02 *	.02 *	.00	.13 ***
M9	Reciprocal	Direct	Direct	.09 *	.06	.08 *	.11 **
M10	Reciprocal	Partially- mediated	Direct	.09 *	.06	.08 *	.14 ***
			Indirect	−.02 *	.02 *	.00	-
			Total	.07	.08	.07 *	.14 ***

[a] All effects of vigor-activity on mastery are direct.

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

Figure Captions

Figure 1. Hypothesized fully-mediated model of the job factors on mastery

Figure 2. Structural paths in the hypothesized longitudinal model

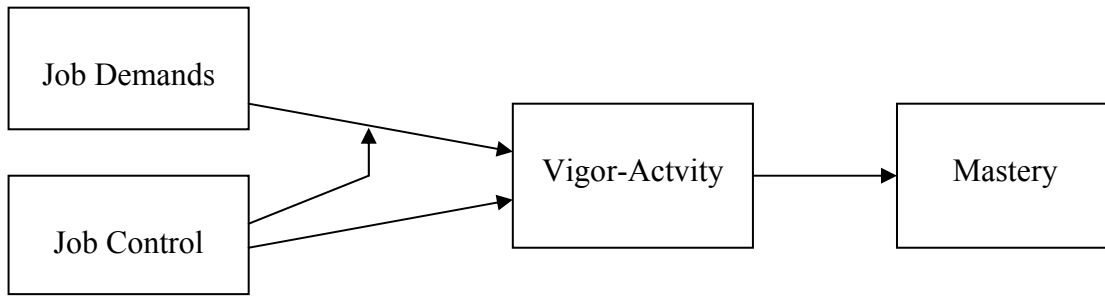*Figure 3*. Interactive effect of Demands x Control on change in mastery
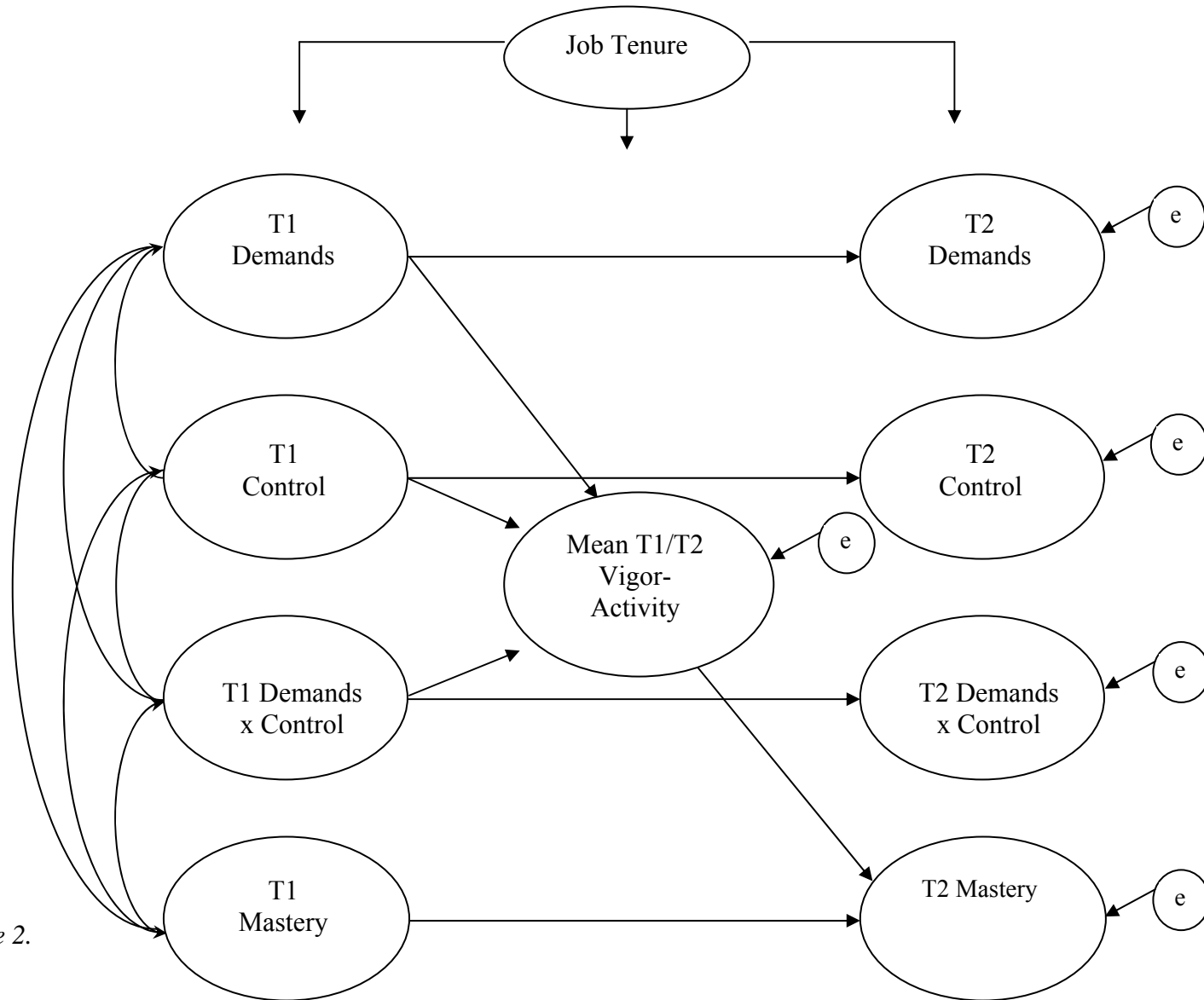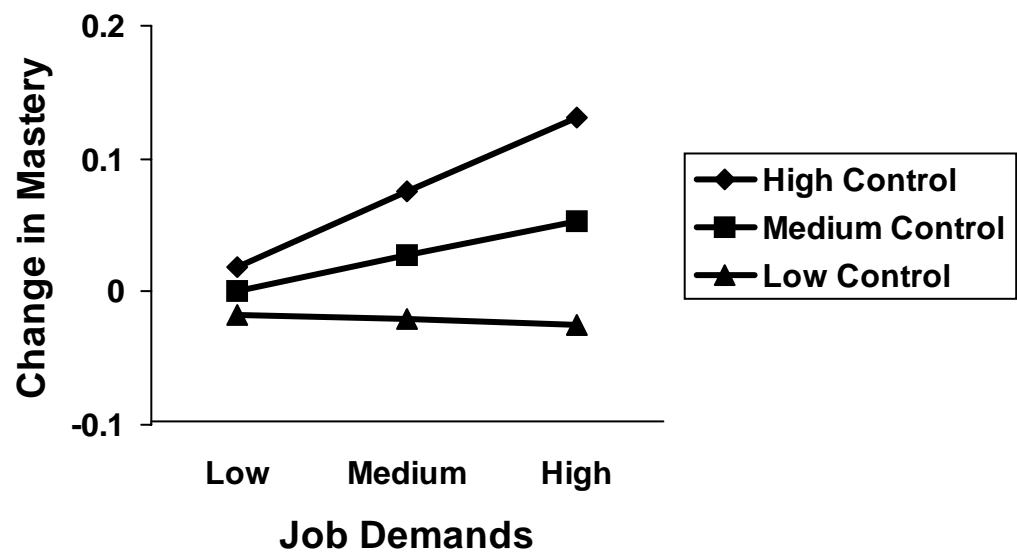
Figure 1.

Figure 2.

Figure 3.