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When Are Workload and Workplace Learning Opportunities Related in a Curvilinear Manner?

The Moderating Role of Autonomy [a]

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[a] For this study, the researchers made use of SERV-data from the Flemish Workability Monitor. Only the authors are responsible for the content of this article.

Abstract

Building on theoretical frameworks like the Job Demands Control model and Action Theory we tested whether the relationship between workload and employees' experiences of opportunities for workplace learning is of an inverted u-shaped nature and whether autonomy moderates this relationship. We predicted that – at moderate levels of autonomy - workload was positively associated with learning opportunities at low levels of workload, but negatively at high levels of workload. Also, we predicted that low autonomy prevents positive effects of moderate workload from materializing whereas high autonomy makes high workload less destructive to the learning process. Furthermore, we examined whether learning opportunities increase particularly as a function of higher matched levels of workload and autonomy and whether mismatch between workload and autonomy is particularly detrimental to the learning process. We found support for these ideas in two large and heterogeneous samples of working adults using moderated and polynomial regression analysis and subsequent response surface methodology. These results integrate conflicting prior findings and extend Karasek's (1979) active learning hypothesis. They also have clear implications for job redesign practices aiming to promote workplace learning opportunities.

When Are Workload and Workplace Learning Opportunities Related in a Curvilinear Manner? The Moderating Role of Autonomy

Today's dynamic and increasingly complex society requires that employees continuously engage in formal and informal learning activities to develop their competencies at work (Coetzer, 2007; Mayer & Solga, 2008). Informal learning opportunities (i.e., opportunities to learn whilst doing the job) have been suggested to provide an effective way to acquire and develop the required skills and competencies (Rau, 2006). In fact, the resulting type of learning is often superior to more formal forms of learning (e.g. Skule, 2004; Desjardins & Tuijnman, 2005). Offering employees opportunities for workplace learning is considered beneficial to corporate productivity, economic growth and long-term competitiveness (Desjardins & Tuijnman, 2005), as well as employment and employability (Coetzer, 2007; Mayer & Solga, 2008). Moreover, informal learning opportunities also have positive consequences for employees as they increase their adaptive potential to organizational change (Skule, 2004) and improve their well-being and health by reducing stress (Holman & Wall, 2002; Paulsson, Ivergård & Hunt, 2005; Rau, 2006) and increasing work motivation (Parker, Chmiel & Wall, 1997; Morrison, Cordery, Girardi & Payne, 2005; Schaufeli, Bakker & van Rhenen, 2009).

Given these many benefits of informal learning opportunities for organizations and employees, we believe that one important task for scholars is to develop an understanding of how the characteristics of the specific job that employees are in promote or obstruct these learning opportunities (cf. Karasek & Theorell, 1990; Frese & Zapf, 1994; Morrison et al., 2005; Rau, 2006; Wielenga-Meijer, Taris, Kompier & Wigboldus, 2006). Such knowledge can make work design interventions aimed at improving workplace learning opportunities more effective. Regretfully, a number of issues regarding the influence of specific job related factors on the availability of opportunities for informal workplace learning remain as yet unresolved or ambiguous (Marsick & Volpe, 1999; Desjardin & Tuijnman, 2005).

One important class of job related factors that arguably provide opportunities for informal workplace learning are the demands associated with a specific job (e.g. Karasek, 1979; Frese & Zapf, 1994). More specifically, job demands such as a high workload should challenge employees to develop new competences and skills (Karasek & Theorell, 1990). This effect should result because demanding tasks instill a discrepancy between the desired state (i.e. the demands or goals) and one's actual competence level. Attempts at closing this gap require learning (Wielenga-Meijer, Taris, Kompier & Wigboldus, 2010). However, empirical support for the job demands – workplace learning relationship is mixed (for an overview, see: Taris & Kompier, 2005). This led Wielenga-Meijer et al. (2010) to suggest that the relationship between job demands such as workload and workplace learning is nonlinear, as such reviving an idea proposed earlier by Karasek (1979; 1998) and de Jonge and Kompier (1997).

In the present study, we examine the relationship between one specific job demand - employees' workload - and the experience of workplace learning opportunities. More specifically, we will identify two conditions that together define when workload advances opportunities for workplace learning and when it hampers such opportunities. First, we will develop the argument that at relatively low levels of workload, it positively influences employees' experience of learning opportunities, whereas at relatively high levels, workload is negatively related to learning opportunities. We thus, in fact, propose that workload moderates its own effect on learning opportunities, making that workload is generally related to workplace learning opportunities in an inverted u-shaped manner.

Second, we will also identify employees' task autonomy as a moderator of the effectiveness of workload in promoting (or hampering) learning opportunities. More specifically, we will argue that low levels of autonomy make it impossible for the potential positive effects of workload on learning opportunities (i.e., at relatively low levels of workload) to materialize. In contrast, high levels of autonomy may make the potential negative effects of (high) workload less destructive to the learning process. We thus expect the inverted u-shaped relationship between workload and learning opportunities to be most pronounced at moderate levels of autonomy. Figure 1 presents a visual representation of how we propose workload influences employees' experience of workplace learning opportunities as a function of the level of task autonomy.

Finally, we will also explicitly examine two specific theoretically relevant combinations of workload and autonomy. That is, we examine whether workplace learning is promoted most when workload and autonomy *both* increase (i.e., increasing towards a match between high workload and high autonomy, which implies an active job type; Karasek & Theorell, 1990). Further, we examine whether workplace learning is obstructed the most when the mismatch between workload and autonomy increases. In examining these specific combinations of workload and autonomy, we rely on polynomial regression analysis and response surface methodology (Edwards, 1994; Edwards & Parry, 1993).

INSERT FIGURE 1 ABOUT HERE

Workload and Opportunities for Workplace Learning

Marsick and Volpe (1999) qualify informal learning as unstructured, experimental, non-institutional learning that is integrated in daily work routines. Informal learning thus equals learning whilst doing the job, rather than as part of a formal training course (Rau, 2006). The effects of various job related factors in providing opportunities for workplace learning such as workload have mainly been studied in the context of Karasek's JDC model (Karasek, 1979; Karasek & Theorell, 1990). This model notes that high demands such as workload promote learning activity (Karasek, 1979, p. 288), presumably because they provoke employees to search for more effective work strategies and behaviors in order to achieve their challenging work goals. This search triggers reflection on alternative solutions to work problems, and exploration and experimentation with these alternatives. If the new behavioral responses are effective, they will be incorporated into the employee's repertoire of strategies to cope with the demands of the job, that is, they will be 'learned' (Karasek, 1998; see also Taris & Kompier, 2005). In sum, workload should promote learning because it instills a sense of urgency to develop more effective work strategies and behaviors (e.g. Rau, 2006; De Witte, Verhofstadt & Omey, 2007).

Taris and Kompier (2005), reviewing the results of eighteen studies, found, however, no clear-cut empirical indications that workload provides positive opportunities for workplace learning (Taris & Kompier, 2005). Some studies reveal positive effects of workload on learning-related outcomes (e.g. Skule, 2004; Rau, 2006; De Witte et al., 2007), others find no effects (e.g. De Jonge, Janssen & Van Breukelen, 1996; Houkes, Janssen, De Jonge & Nijhuis, 2001; Morrison et al., 2005), and some studies even reveal negative effects (e.g. Parker & Sprigg, 1999; Taris, Kompier, de Lange, Schaufeli & Schreurs, 2003). As noted, one possible explanation for these mixed results is that this relationship is non-linear in nature (Wielenga-Meijer et al., 2010). For instance, Karasek (1998) noted that high, *but not overwhelmingly high* job demands stimulate active learning. Based on these conflicting empirical findings, we suggest that the relationship between workload and workplace learning opportunities may be of an inverted u-shaped nature. In other words, workload may promote opportunities for learning at relatively low levels of workload and curb learning opportunities at high levels of workload (e.g. de Jonge & Kompier, 1997; Taris & Kompier, 2005).

There is also theoretical reason to expect that high levels of workload negatively affect employees' experience of learning opportunities. For instance, theoretical stress models such as the JDC model (Karasek, 1979), Conservation of Resources (COR) theory (Hobfoll, 2002; see also Lee & Ashforth, 1996) and the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007; Schaufeli et al., 2009) note that job demands such as high workload evoke a process of energy-depletion that leads to burnout and health problems (see also LePine, LePine & Jackson, 2004). For instance, in the JD-R model, job demands refer to those aspects of the job that require sustained physical or mental effort and are therefore associated with psychological costs, such as increased emotional exhaustion because they deplete one's energy reserves (Bakker & Demerouti, 2007; Schaufeli et al., 2009). In support of this claim, experimental studies (e.g. Eysinck & Calvo, 1992; Warr & Downing, 2000) show that indicators of energy depletion, e.g. depression, are associated with reduced energy to perform cognitive tasks that allow for learning (see also Holman & Wall, 2002). For instance, anxiety thwarts the effectiveness of information processing, which is crucial for learning (Eysinck & Calvo, 1992), and inhibits understanding and experimentation with new ideas (Warr & Downing, 2000). In sum, as a result of the energy-depleting properties of workload, high levels of workload could negatively affect employees' experiences of learning opportunities.

Another relevant mechanism underpinning the assumption of a negative relationship between high workload and workplace learning opportunities can be derived from action theory (Frese & Zapf, 1994). Based on this theory, Taris, Kompier, and Wielinga (2006) noted that high job demands such as workload may disturb task regulation, leading to obstruction of intended learning behavior, causing employees to lapse into automated behavior (see also LePine et al., 2004; Taris & Kompier, 2005; Wielenga-Meijer et al., 2006). In fact, at high levels of workload, employees are "pinned down" to immediate work goal realization. While they focus on strictly productive behaviors, the time needed for behaviors such as reflection, exploration and experimentation -actions that are necessary for workplace learning to occur- gradually shrinks. Hence, workload becomes a hindering factor because – at high levels - it reduces the time available for critical learning activities (Ellström, 2001). As a consequence, high levels of workload should affect employees' experience of workplace learning opportunities negatively (Parker & Sprigg, 1999; Taris et al., 2003; Wielenga-Meijer et al., 2006).

This analysis leads to Hypothesis 1:

At relatively low levels of workload, increases in workload positively influence employees' experience of opportunities for workplace learning, whereas at relatively high levels, increases in workload are negatively associated with the experience of opportunities for workplace learning. We thus propose that workload is generally related to workplace learning opportunities in an inverted U-shaped manner.

Workload, Workplace Learning Opportunities, and Autonomy

It has been theorized that whether workload provides opportunities for workplace learning depends on other factors in the job, most notably task autonomy. In fact, one important hypothesis in the JDC model - the active learning hypothesis - notes that jobs characterized by high job demands *and* high autonomy (i.e., active jobs) promote learning the most (Karasek & Theorell, 1990). In line with the active learning hypothesis, we consider autonomy to be a necessary condition for workload to stimulate learning: Workload can trigger a search for more effective work strategies and behaviors (Taris et al., 2006). However, successful implementation of these new work strategies (which is essential for learning to take place) depends on opportunities for flexible adjustment to unforeseen circumstances (Frese & Zapf, 1994). Hence, for workload to create learning opportunities, it is necessary that employees can take autonomous decisions on the job, for instance regarding work method and task sequence (Holman & Wall, 2002; Wielenga-Meijer et al., 2010).

More specifically, we argue that at low levels of autonomy, the potential positive effects of workload (which we expect at relatively low levels of workload; see Figure 1) in creating learning opportunities will not materialize. Although workload provides employees with challenging goals, low autonomy deprives them from the resources necessary to adjust relevant aspects of the job to the intended change in work practices. Hence, the challenging potential of raising workload evaporates, leaving employees with little choice than to fall back on automated behavior (Frese & Zapf, 1994; Taris et al., 2006), which makes them experience reduced feelings of self-efficacy and mastery (e.g. Karasek & Theorell, 1990; Parker & Sprigg, 1999; Taris & Kompier, 2005). In sum, at low levels of autonomy, we expect that increasing workload will always be related to decreased learning opportunities, even at relatively low levels of workload.

Moreover, we expect the negative relationship between workload and learning opportunities when autonomy is low to become *progressively stronger* at higher levels of workload (see Figure 1). As noted, higher workload makes that the energy-depleting properties of workload become more manifest, gradually draining the energy needed for learning (Karasek & Theorell, 1990; Eysinck & Calvo, 1992; Warr & Downing, 2000; Holman & Wall, 2002). Further, because of a gradually larger shrinkage of time available for non-productive behaviors conditional to learning, such as reflection, exploration and experimentation, the employee is compelled even more to relapse into automated behavior (Frese & Zapf, 1994; Ellström, 2001; Taris et al., 2006).

This leads to Hypothesis 2:

When employees have low autonomy in their job, increased workload is associated with fewer opportunities for workplace learning and this negative relationship is stronger at higher levels of workload.

Conversely, workload should promote opportunities for workplace learning particularly when employees have high autonomy (Karasek & Theorell, 1990; Taris & Kompier, 2005; De Witte et al., 2007). This is because workload triggers employees to develop new work strategies and behaviors, while autonomy assures that they also have the opportunity to actively intervene in the way the job is done.

However, we expect that workload is increasingly less effective in advancing workplace learning opportunities at higher levels of workload. This is because, as noted, at high levels, workload becomes more and more an hindering factor in learning processes, because it drains the energy needed for learning to be effective, and because the time available for non-productive behaviors conditional to learning gradually shrinks.

This analysis leads to Hypothesis 3:

When employees have high autonomy in their job, increased workload is associated with more opportunities for workplace learning but this positive relationship becomes gradually weaker as workload increases.

Congruence and Incongruence between Autonomy and Workload

The JDC model (Karasek, 1979; Karasek & Theorell, 1990) predicts workplace learning outcomes essentially on the basis of combinations of workload *and* autonomy. Its basic prediction is that the highest level of workplace learning results when workload and autonomy are both high (i.e., the active job). This is because two essential conditions are both met: employees are both challenged to learn and capable of flexible adjustment, which allow for learning (e.g., Frese & Zapf, 1994; Holman & Wall, 2002; Karasek, 1998; Karasek & Theorell, 1990; Morrison et al., 2005; Taris & Kompier, 2005; Rau, 2006).

INSERT FIGURE 2 ABOUT HERE

A second relevant situation in which workload and autonomy match is that of the combination of low workload and low autonomy (i.e., the passive job). This type of job should contain the least opportunities for workplace learning because neither of the two essential conditions for learning is met: At low levels of workload, employees perceive no sense of urgency to develop more effective work strategies and behaviors (Karasek & Theorell, 1990; Taris et al., 2006). Moreover, low autonomy implies that employees experience little opportunities for exploration, reflection, and experimentation (Frese & Zapf, 1994; Holman & Wall, 2002; Wielenga-Meijer et al., 2006).

Between these two matching points (at high versus low levels of both workload and autonomy) there is a line of congruence on which workload and autonomy match (see figure 2). This line of congruence refers to the active learning diagonal as identified within the JDC model (Karasek & Theorell, 1990). As workload and autonomy both increase along this line, workplace learning should also increase.

This analysis leads to Hypothesis 4:

Along a line of congruence between workload and autonomy, opportunities for workplace learning increase when workload and autonomy both *increase.*

A final relevant issue is how workplace learning develops along a line of *in*congruence, i.e. a line representing different levels of *mis*match between workload and autonomy. Within the JDC model, mismatches between workload and autonomy are described as high-strain jobs (i.e., high workload and low autonomy) or low strain jobs (i.e., low workload and high autonomy; Karasek & Theorell, 1990; Taris et al., 2006; Wielenga-Meijer et al., 2006). Both types of mismatch represent a situation in which one of the two conditions for workplace learning is not met. In high strain jobs, opportunities for flexible adjustment diminish. In low strain jobs, there is no challenge through workload.

In line with prior empirical work, we expect a lack of autonomy to be more detrimental to workplace learning than a lack of workload (Taris et al., 2003). There is also theoretical basis for this idea (see also Holman & Wall, 2002; Morrison et al., 2005; Rau, 2006; Wielenga-Meijer et al., 2010). When the level of workload gradually exceeds the level of autonomy (line of incongruence right to the line of congruence in figure 2), the challenge associated with rising workload cannot be satisfactorily met because the condition of ‘opportunities for flexible adjustment through autonomy’ is gradually violated (Wielenga-Meijer et al., 2010). As a result, learning opportunities should reach their lowest level when the discrepancy between high workload and low autonomy is largest.

Conversely, as the level of autonomy exceeds that of workload (line of incongruence left to the line of congruence in figure 2), learning opportunities continue to increase. This is because employees experience opportunities for exploration, reflection, experimentation and actively solving work related problems, while they continue to be triggered by (moderately) challenging workload (Frese & Zapf, 1994; Holman & Wall, 2002; Rau, 2006). However, at increasing levels of autonomy (along the line of incongruence) this positive association with learning opportunities should gradually weaken, because the low level of workload should result in less challenge.

In conclusion, Hypothesis 5 reads:

Along a line of incongruence or discrepancy between workload and autonomy, opportunities for workplace learning increase as the level of autonomy increases towards the level of workload; this effect will become gradually weaker as the level of autonomy more substantially exceeds the level of workload.

Method

Sample and Procedure.

We obtained the data for this research from the Flemish Workability Monitor (FWM), a large scale cross-sectional survey conducted under the supervision of the Flanders Socio-Economic Council. The FWM monitors every three years the working conditions in a large sample of the Flemish working population (Bourdeaud'hui & Vanderhaeghe, 2007). In order to provide a stringent test of our hypotheses, data from the 2004 and 2007 samples were used. In both years, the sample was representative of the Flemish working population with respect to gender, age and sector of employment (Bourdeaud'hui & Vanderhaeghe, 2007; Vanroelen, Levecque, & Louck, 2009).

A random sample out of the population of wage-earners living in the Flemish region of Belgium, was drawn making use of the official personnel registry covering all wage-earners in Flanders (Vanroelen et al., 2009). A postal questionnaire was sent to the 20,000 wage-earners from the initial sample. From the respondents who returned a usable copy, those individuals were excluded who stopped working as wage-earners between the moment of sampling and the completion of their questionnaires.

The 2004 sample consisted of 11.099 respondents (for a response rate of 61%). The sample included 52% male respondents. Respondents' age varied between 20 and 64 years (*M* = 39.16 years; *SD* = 10.01 years). Six percent of the respondents had primary school as highest completed education; 53% completed secondary school; 41% had finished higher education, of whom 14% held a master degree. Most respondents had a permanent contract (93%) and worked full-time (76%).

The 2007 sample consisted of 9.738 respondents (for a response rate of 53%). Fifty-one percent of the respondents were male. Respondents' age varied between 20 and 64 years (*M* = 40.38 years; *SD* = 10.32 years). Six percent of the respondents had completed primary school only; 53% secondary school; 41% had finished higher education, of whom 14% held a university degree. Most respondents had a permanent contract (94%) and worked full-time (74%).

Measures

We measured our three constructs using validated scales from the Questionnaire on the Experience and Evaluation of Work (QEEW, see van Veldhoven, Meijman, Broersen, & Fortuin, 2002), which is considered a bench-mark instrument for psychosocial workload and work stress in the Netherlands and Flanders (Vanroelen et al., 2009). The QEEW is based conceptually on the Job Content Questionnaire (Karasek & Theorell, 1990; Karasek et al., 1998) with the goal of improving psychometric quality (van Veldhoven et al., 2005). The QEEW is widely used in Dutch occupational health services in the Netherlands. It has been tested frequently and the scales have been shown to be one-dimensional, reliable, valid (Evers, van Vliet-Mulder & Groot, 2000), and internally consistent, while the scales are only moderately intercorrelated (Vanroelen et al., 2009).

We measured *workload* with the QEEW-scale 'pace and amount of work'. This scale comprises eleven items that are answered on a four-point Likert-type scale ranging from 0 (= *never*) to 3 (= *always*). A sample item is "Do you experience a high workload?" (Cronbach's alpha = .89).

We measured *autonomy* with the QEEW-scale 'task autonomy'. This scale consists of eleven items that are answered on a four -point Likert-type scale ranging from 0 (= *never*) to 3 (= *always*). A sample item is "Can you decide on the planning of your work activities?" (Cronbach's alpha = .91).

We measured *learning opportunities* with the QEEW-scale 'learning opportunities' (van Veldhoven et al., 2002), which consists of four items. The items are answered on a four -point Liker-type scale (0 = *never;* 3 = *always*). A sample item is "Do you learn new things in your job?" (Cronbach's alpha = .85).

Traditionally used demographic characteristics, gender (0 = female, 1 = male), age, and educational level were entered as control variables into the analyses, because they could play a confounding role when testing our hypotheses (De Witte et al., 2007; see also Holman & Wall, 2002; Taris et al., 2003; Rau, 2006).

INSERT TABLE 1 ABOUT HERE

Results

Descriptive statistics and correlations among the study variables are presented in Table 1.

Measurement Model.

Before testing our hypotheses, we conducted CFAs to test our measurement model at the item level to determine whether scale items adequately indicate their intended underlying constructs (Anderson & Gerbing, 1988; Bandalos & Finney, 2001). The initial measurement model had three latent factors and 26 indicators (i.e., workload, autonomy, and learning opportunities. We estimated a model with three latent variables (workload, autonomy and learning opportunities) as well as a one-factor model in which all items loaded onto one factor. We also fitted a four-factor model, which included the three latent variables together with a common method factor that was uncorrelated to the theoretically derived factors (cf. Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To judge the goodness of fit of the measurement model, we relied on the root-mean-square error of approximation (*RMSEA*, Steiger, 1990), the comparative fit index (*CFI*, Bentler, 1990), and the parsimony adjusted comparative fit index *PCFI*; Mulaik et al., 1989).

In the FWM 2004 sample, the three-factor model (with workload, autonomy and learning opportunities as latent variables) fitted the data well (χ^2(279) = 7715.71, *RMSEA* = .049 (90% CI = .048 - .050), *CFI* = .95, *PCFI* = .81). The fit of the one-factor model was clearly insufficient (χ^2(281) = 40718.59, *RMSEA* = .114 (90% CI = .113 - .115), *CFI* = .72, *PCFI* = .61). The four-factor model (adding a common method factor to the three-factor model), also fitted the data well (χ^2(253) = 4006.50, *RMSEA* = .037 (90% CI = .036 - .038), *CFI* = .97, *PCFI* = .75). Although some fit indices indicate a slightly better fit for the four-factor model (i.e., *CFI*, *RMSEA*), the *PCFI* for this model is clearly lower than for the three-factor model and, in fact, clearly below the accepted threshold of .80 (Byrne, 2001).

In the 2007 sample, the 3-factor model fitted the data well (χ^2(279) = 7710.26, *RMSEA* = .049 (90% CI = .048 - .050), *CFI* = .95, *PCFI* = .81) with all items loading significantly onto their predicted factor ($p < .05$). The fit of the one-factor model was unacceptable (χ^2(281) = 40811.59, *RMSEA* = .114 (90% CI = .113 - .115), *CFI* = .72, *PCFI* = .62). The four-factor model, also fitted the data well (χ^2(253) = 3970.21, *RMSEA* = .036 (90% CI = .035 - .037), *CFI* = .97, *PCFI* = .76). Again, although some fit indices indicate a slightly better fit for the four-factor model (i.e., *CFI*, *RMSEA*), the *PCFI* for of this model is clearly lower than for the three-factor model and, in fact, clearly below the accepted threshold of .80. In sum, the CFAs indicate that the three-factor model fitted the data well, and the fit of this model was at least as good as that of the more complex four-factor model, as such supporting the validity of our specified measurement model.

Hypotheses Testing.

In order to test our hypotheses, we relied on polynomial regression analysis (Edwards, 1994; Edwards & Parry, 1993; Edwards & Rothbard, 1999). This analysis involves estimating a quadratic regression model with learning opportunities as the dependent variable (*Z*) and both task characteristics in our model, workload (*X*) and autonomy (*Y*), as the independent variables, along with three quadratic terms constructed from these measures (workload squared, the product of workload and autonomy and autonomy squared). The full polynomial equation is (Edwards, 1994):

$$Z = b0 + b1X + b2Y + b3X^2 + b4XY + b5Y^2 + e$$

Polynomial regression analysis entails estimating this regression equation (while controlling for age, gender, and education). We relied on this type of regression for two reasons. First, scholars advice to add squared terms (i.e., X^2, Y^2) when studying interactions (i.e., XY) in order to obtain a reliable estimate of the interaction terms (Edwards, 2008). Second, including quadratic terms would allow us to use subsequent response surface methodology (Edwards, 1994) to test Hypothesis 4 and 5.

At step 1 in the analysis, we entered the control variables gender (0 = female, 1 = male), age, and educational level, together with the main effects of workload and autonomy and the workload x autonomy interaction term, as such allowing for direct tests of Karasek's active learning hypothesis. At step 2, we added the squared terms of workload and autonomy[i]. Following procedures outlined by Aiken and West (1991), all squared effects and interaction terms were based on mean-centered versions of the variables.

To test Hypothesis 1 through 3, we subsequently performed simple slopes analyses (at 1 *SD* above and 1 *SD* below the mean) to determine (1) whether the effect of workload on learning opportunities was contingent upon the level of autonomy (i.e., whether at low levels of autonomy the effect of workload is negative and at high levels positive); and (2) whether the effect of workload on learning opportunities was contingent upon the level of workload (i.e., whether at low levels of workload the effect of workload is positive and at high levels negative). Furthermore, in a curvilinear pattern, there is an inflection point, which is a maximum or a minimum depending on the shape of the curve. Following from the curvilinear equation:

$$\in (y) = ax^2 + bx + c$$

the inflection point (maximum or a minimum) of the graph can be calculated (*x*) as follows:

$$x = \frac{-b}{2a}$$

INSERT TABLE 2 ABOUT HERE

Table 2 presents an overview of the regression analyses for the 2004 and 2007 data. All three control variables were significantly related to learning opportunities such that learning opportunities decreased with age and increased with educational level, and males experienced higher learning opportunities than females.

At step 1, the analyses revealed a significant positive relationship between autonomy and learning opportunities in both samples. Workload and learning opportunities were not significantly related in the FWM 2007, and only very weakly in the FMW 2004. Further, the results showed that autonomy significantly moderated the relationship between workload and learning opportunities in both samples. Simple slope analyses for low (i.e. 1 *SD* below the mean) and high (i.e. 1 *SD* above the mean) autonomy gave insight into the nature of this interaction. In the 2004 sample, when autonomy was low, workload was significantly and negatively related to learning opportunities ($\beta = -0.07$, $t = -5.41$, $p < 0.001$). When autonomy was high, however, this relationship was significantly positive ($\beta = 0.10$, $t = 7.23$, $p < 0.001$). The same pattern was observed in the 2007 sample. When autonomy was low, workload was significantly negatively related to learning opportunities ($\beta = -0.08$, $t = -5.62$, $p < 0.001$). When autonomy was high, workload had a significant positive relationship with learning opportunities ($\beta = 0.07$, $t = 5.02$, $p < 0.001$).

At step 2, the analyses showed that the squared workload variable was significantly related to learning opportunities in both the 2004 and 2007 samples. Subsequent simple slopes analyses for low (i.e. 1 *SD* below the mean) and high (i.e. 1 *SD* above the mean) workload gave insight into the shape of this relationship. In the 2004 sample, when workload was low, workload was significantly and positively related to learning opportunities ($\beta = 0.07$, $t = 4.83$, $p < 0.001$). When workload was high, however, this relationship was significantly negative (β

= -0.03, t = -3.15, p = 0.03). In the 2007 sample, similar results were found. At low levels, workload was significantly and positively related to learning opportunities (β = 0.07, t = 4.89, $p < 0.001$). At high levels, workload was significantly negatively related to learning opportunities (β = -0.04, t = -3.60, $p < 0.001$). These findings support an inverted u-shape curve: At lower levels of workload, a rise in workload is associated with increased learning opportunities. At higher levels of workload, a rise in workload is associated with a decline in learning opportunities. The maximum of this curve was calculated as 39.0 (*SD* = 0.06) for the FWM 2004 sample, and as 39.8 (*SD* = 0.07) for the FWM 2007 sample.

To test Hypothesis 4 and 5, which refer to congruence and incongruence between autonomy and workload, respectively, we further analyzed surfaces corresponding to the quadratic regression equation using response surface methodology (Edwards & Parry, 1993; Edwards & Rothbard, 1999). Table 3 presents the results pertinent to these analyses (i.e., *b* values instead of the β values in Table 2, and relevant combinations of *b* values). The corresponding surfaces are illustrated in figures 3 and 4. Workload is indexed on the *X*-axis; autonomy on the *Y*-axis; experienced learning opportunities are indicated on the *Z* axis.

INSERT TABLE 3 ABOUT HERE

To test hypothesis 4 regarding the level of learning opportunities as a function of congruence between the levels of workload and autonomy, we explored the shape of the surface along the $X = Y$ line (from the nearest to the furthest corner of the *X, Y* plane; see figures 3 and 4). Along this line of congruence, levels of workload and autonomy are congruent. Testing the shape of the surface along this line implies setting *X* equal to *Y* in the polynomial equation and solving for *X* and X^2. The curve of the surface along the $X = Y$ line is represented by ($b3 + b4 + b5$), and the slope of the surface at $X = 0$ by ($b1 + b2$). If learning opportunities increase linearly moving from low workload and autonomy towards high workload and autonomy, the surface would be positively sloped along the *X* = *Y* line at the point *X* = 0 and would have no curve, such that (*b1* + *b2*) would be positive and (*b3* + *b4* + *b5*) would not differ from zero (Edwards & Rothbard, 1999).

Values for the combinations of *b* coefficients were calculated from the polynomial regression coefficients reported in Table 3. This table shows that both conditions were met for both FWM 2004 and FWM 2007, (*b1* + *b2*) was significantly positive and (*b3* + *b4* + *b5*) was not significantly different from 0. This supports Hypothesis 4: employees' experiences of learning opportunities increased when workload and autonomy *both* increased.

INSERT FIGURE 3 ABOUT HERE

INSERT FIGURE 4 ABOUT HERE

To test Hypothesis 5, regarding the effect of *mis*match or *in*congruence between workload and autonomy on employees' experiences of learning opportunities, we explored the shape of the surface along the *X* = -*Y* line. This line extends from the left to the right corner of the *X*, *Y* plane (see figures 3 and 4). Along this line, levels of workload and autonomy are incongruent. On the right side of the plane, workload exceeds autonomy. On the left side of the plane, autonomy exceeds workload. Hypothesis 5 predicted that employees' experiences of learning opportunities decrease as the level of workload exceeds that of autonomy, while employees' experiences of learning opportunities increase as the level of autonomy exceeds that of workload. Moreover, we expected this last effect to level off as autonomy reaches its highest level, and workload its lowest level. Hypothesis 5 thus implies an upward slope starting at the point representing the combination of the highest level of workload and the lowest level of autonomy (*X* > *Y*; right corner of the *X*, *Y* plane) and continuing into the field where autonomy gradually exceeds the level of workload (*Y* > *X*; left side of the *X*, *Y* plane). At the same time, a downward curve might be observed when the line of incongruence approaches the point representing the combination of the highest level of autonomy and the lowest level of workload, i.e. the left corner of the plane.

Support for hypothesis 5 requires that two conditions are met (Edwards & Rothbard, 1999). First, because employees' experiences of learning opportunities decrease as incongruence between workload and autonomy increases, particularly when levels of workload exceed those of autonomy (right side of the X, Y plane), the surface along the $X = -Y$ line must be dome-shaped, which implies a negative value for ($b3 - b4 + b5$). As indicated by the significant values for ($b3 - b4 + b5$) in the final column of table 3, this was the case for both the FWM 2004 sample and for the FWM 2007 sample.

The second condition to be met is that the slope of the surface along the $X = -Y$ line must be downward from the left to the right side of the X, Y plane, indicating that employees' experiences of learning opportunities decrease as the level of workload exceeds that of autonomy (and steeper as the slope reaches the highest levels of workload). This implies that the slope of the surface needs to be negative as it crosses the $X = Y$ line. This condition holds, as indicated by the significant and negative values for $(b1 – b2)$ reported in table 3, for both the FWM 2004 sample and for the FWM 2007 sample.

Discussion

We studied how workload affects employees' experiences of opportunities for workplace learning, i.e. under which conditions workload is positively and negatively related to workplace learning opportunities. We predicted, first of all, that the relationship between workload and workplace learning opportunities is generally of an inverted u-shaped nature. We found support for this idea in two large and heterogeneous samples. In both samples, workload was on average positively related to learning opportunities at lower levels of workload but negatively to learning opportunities at higher levels of workload.

Further, we identified task autonomy as a moderator of the relationship between workload and learning opportunities. We predicted that at low levels of autonomy, the positive effects of workload on learning opportunities (i.e., at low levels of workload) would not materialize.

Conversely, high levels of autonomy were predicted to prevent the negative effects of workload on workplace learning opportunities (that is, at high levels of workload) from occurring. In line with our ideas, the results showed that the inverted u-shaped relationship between workload and workplace learning opportunities is restricted to moderate levels of autonomy. At low levels of autonomy, workload was always negatively related to workplace learning opportunities and this negative relationship became progressively stronger at higher levels of workload. When, on the other hand, autonomy was high, workload was always positively related to workplace learning opportunities but this relationship became progressively weaker at higher levels of workload (see figure 1).

Finally, we explicitly examined two specific combinations of workload and autonomy, i.e. *matches* and *mismatches* between levels of workload and autonomy. We predicted that workplace learning is promoted the most when workload and autonomy *both* increase. Furthermore, we predicted that workplace learning is obstructed the most when the mismatch between (high) workload and (low) autonomy increases. In line with our expectations, our results showed that employees' experiences of learning opportunities increased when workload and autonomy *both* increased towards a match between high workload and high autonomy (the active job type; Karasek & Theorell, 1990). Moreover, the results indicated that employees' experiences of learning opportunities decreased as the level of workload exceeded that of autonomy, while they increased as the level of autonomy exceeded that of workload. Learning opportunities reached the lowest level when the discrepancy between high workload and low autonomy was largest.

In sum, our results showed that the relationship between workload and workplace learning opportunities is not unconditionally straightforward. As we assumed, this relationship is influenced by two conditions: First, the level of workload itself, in the sense that too high levels of workload obstruct its challenging potential. And second, the level of autonomy, as insufficient autonomy leaves the employee with too little opportunities for flexible adjustment and active engagement in work problem solving. In the following sections, we will discuss the implications and limitations of these findings.

Theoretical Implications

Prior empirical work investigating the relationship between workload and learning-related outcomes resulted in conflicting findings (for an overview, see Taris & Kompier, 2005). Higher workload leads to more workplace learning in some studies (e.g. Rau, 2006; De Witte et al., 2007; Wielenga-Meijer et al., 2010). In other studies, workload was found to be unrelated to workplace learning (e.g. De Jonge et al., 1996; Houkes et al., 2001; Morrison et al., 2005; Van Ruysseveldt & Taverniers, 2010). Still other studies found that higher workload decreases workplace learning (e.g. Parker & Sprigg, 1999; Taris et al., 2003). The present research provides one way to connect these disparate findings by showing that workload and learning are, in fact, related in an inverted u-shaped manner (at moderate levels of autonomy).

In their review, Wielenga-Meijer et al. (2010) attributed the moderately strong evidence for a positive relationship between job demands such as workload and learning related constructs to the possibility of nonlinearity in this relationship. Our argument and findings take this idea a step further, by giving strong indications that high levels of workload are not just overwhelming (Karasek, 1998), but that higher workload also becomes gradually more detrimental to employees' experience of learning opportunities beyond the point of overwhelmingly high demands. Indeed, the present research clearly shows that workload and learning opportunities are, in fact, related in an inverted u-shaped manner (at moderate levels of autonomy). Our results are thus the first to empirically support suggestions by Karasek (1998) who noted that high, *but not overwhelmingly high*, job demands should stimulate active learning, as well as suggestions that workload and learning are related in a curvilinear way (e.g. de Jonge & Kompier, 1997; Taris & Kompier, 2005; Wielenga-Meijer et al., 2010).

Moreover, our results support the idea that the level at which demands such as workload become overwhelming depends on the level of autonomy offered in a job (see Wielenga-Meijer et al., 2010). Previous research has not unequivocally supported this claim: high autonomy indeed seems to be a precursor for learning to take place (see Wielenga-Meijer et al., 2010, for an overview), but it seemed to matter less whether workload was high or low (de Jonge & Kompier, 1997; Parker & Sprigg, 1999; Holman & Wall, 2002; Taris & Kompier, 2005). In fact, we know of only one prior study that found support for an interaction effect of workload and autonomy on learning related outcomes: De Witte et al. (2007) found that autonomy increased the positive impact of workload on the perceived acquisition of new skills. Our findings replicate this effect in the sense that workload was found to be related to improved workplace learning opportunities when autonomy was high. More interestingly, our findings show that this positive effect of increasing workload (when autonomy is high) becomes gradually weaker at higher levels of workload. Hence, given a high level of autonomy, increasing workload from moderate to high levels does not add much in terms of increasing perceived learning opportunities.

When we consider our study results within the framework of the JDC model (Karasek, 1979; Karasek & Theorell, 1990), we found empirical evidence for most of the assumptions underlying the active learning hypothesis. In particular, our findings supported the core assumption of this hypothesis: Workplace learning opportunities increased when workload and autonomy *both* increased towards a match between high workload and high autonomy (the active job type; Karasek & Theorell, 1990). As Karasek (1979) argued, the combination of high workload and high autonomy promotes active learning, because employees in these active jobs both feel enabled and experience a need or urgency to display exploratory behavior, which in turn helps them to develop new, more effective work strategies.

At the same time, our research enables us to refine and even extend some of the assumptions underpinning the active learning hypothesis. As noted previously, our results support the idea that high, *but not overwhelmingly high*, job demands stimulate active learning. But it extends this idea by adding the observation that at too high levels, workload becomes an hindering task characteristic, as it becomes gradually detrimental to workplace learning. Our findings support this extension because, even at high levels of autonomy, increasing workload from moderate to high levels does not add much in terms of increasing workplace learning opportunities.

Furthermore, the active learning hypothesis predicts the lowest levels of workplace learning when both autonomy and workload are low (i.e. in passive jobs). Low workload has been argued to “squeeze the challenge out of work” and, in combination with low autonomy, to even entail the risk of a gradual loss of previously acquired skills (Karasek, 1998; Taris & Kompier, 2005). Our findings contradict this idea. When autonomy is low, workload decreases workplace learning opportunities but this effect becomes gradually *stronger* at higher levels of workload. In fact, we observed the worst employees’ experiences of workplace learning opportunities when workload was high and autonomy was low (see figures 3 and 4). Our research thus contradicts this part of the active learning hypothesis, but it connects with some prior research showing that, at low levels of autonomy, levels of perceived mastery were lower in jobs with high workload, rather than low workload (Parker & Sprigg, 1999; Taris et al., 2003).

Building on this last observation, it was instructive to shift the focus from the activation diagonal in the JDC model, i.e. the line of congruence between workload and autonomy obtain, to the examination of *mismatches* between levels of workload and autonomy along the line of incongruence. Indeed, central to the active learning hypothesis is the idea that high levels of active learning are promoted when two conditions are simultaneously present: high workload – as a challenger to learning – and high autonomy – as a necessary enabling or facilitating task characteristic. Consequently, it is interesting to examine closer what happens to workplace learning when one of these two conditions are not satisfactorily met. Our analysis of the influence of mismatches between levels of workload and autonomy on employees’ workplace learning experiences permit us to refine the active learning hypothesis from this perspective. Specifically, our results showed that from the lowest level of workplace learning opportunities which was reached where the discrepancy between high workload and low autonomy was largest, these opportunities advanced remarkably as levels of autonomy increased and levels of workload decreased. This observation reinforces the idea that a lack of autonomy is more detrimental to workplace learning than a lack of workload. Moreover, as the discrepancy between high autonomy and low workload became largest, the advancement of workplace learning opportunities started to level off. But this curbing trend, due to the gradual disappearance of the sense of urgency to change work strategies and behaviors, is rather modest compared to the strong downward trend resulting from rising workload (see figures 3 and 4). In sum, from a theoretical point of view, our findings suggest that the JDC model could pay more attention to the energy-depleting properties of high levels of workload, which disturb the effectiveness of cognitive processes (Eysinck & Calvo, 1992; Warr & Downing, 2000; Holman & Wall, 2002; LePine et al., 2004) and urge employees to fall back on automated work behavior (Frese & Zapf, 1994; Taris et al., 2006), as such undermining or eroding the experience of learning opportunities.

As Wielenga-Meijer et al. (2010) noted, job demands should be considered as multifaceted, comprising different types of concepts such as cognitive load, task complexity, emotional and physical demands, and workload. In this respect, an interesting question is to what extent our conclusions with regard to the relationship between workload and workplace learning also applies to other job demands. Indeed, in research that conceptualized demands as cognitive demands, relatively consistent evidence was found in favor of a positive relationship between cognitive demands and workplace learning (see for instance: Holman & Wall, 2002; Wielenga-Meijer et al., 2010; Van Ruysseveldt & Taverniers, 2010). In contrast, research that conceptualized demands also or dominantly as workload or time pressure (Parker & Sprigg, 1999; Rau, 2006; De Witte et al., 2007), resulted in conflicting findings (for an overview, see Taris & Kompier, 2005). Hence, future research could investigate more closely the idea that cognitive demands such as task complexity contain more 'challenging' or 'motivating' properties, while 'quantitative' demands such as workload contain more energy-depleting properties, and these differential characteristics of demands evoke different mechanisms influencing their relationship with workplace learning.

As an alternative to distinguishing between specific demands, another approach, distinguishing between *types* or *classes* of demands could be considered. An example of such a differential approach is found in the work of LePine, Podsakoff and colleagues (e.g. Podsakoff, LePine & LePine, 2007). These researchers developed a two-dimensional work stressor framework, distinguishing between challenge and hindrance stressors. Hindrance stressors (e.g. role ambiguity, role conflict) refer to those aspects of the job that place a burden on employees' capacities and wear out their personal resources, whereas challenge stressors (e.g. cognitive demands, task complexity) are characterized as demanding obstacles that can be overcome and that provide opportunities for growth and learning. According to Podsakoff et al. (2007), both stressors require energy to cope with them and they therefore cause stress. However, hindrance stressors are negatively related to employees' well-being and learning, while challenge stressors enhance employees' well-being by promoting personal growth and development (LePine et al., 2004; Podsakoff et al., 2007; Van den Broeck, Vansteenkiste & De Witte, 2009).

However, contrary to Podsakoff et al. (2007) (see also Van den Broeck et al, 2009), in our research, workload appeared to act both as an hindrance (i.e. at high levels) and as a challenger (i.e. at low levels) to workplace learning. This observation highlights the fact that affective-motivational processes underlying the relationships under investigation should not be ignored: A specific demand is not a challenger or hindrance per se, but its effects are dependent on the degree to which this demand is being *appraised* by employees as a challenger or a hindrance. If, up to some point, workload is (generally) appraised as being challenging in character, the positive affective-motivational forces are stronger than the associated energy-depleting potential, and, as a result, a positive experience of workplace learning opportunities develops. However, workload may reach a point beyond which employees no longer think they can cope with aversive workplace conditions, workload gradually becomes appraised as a hindrance, and, as a result, workload becomes gradually detrimental to employees' experience of workplace learning opportunities. Following this line of reasoning, specific demands, such as workload or time pressure, might function both as a challenger and as a hindrance, depending on its level. Moreover, our results seem to suggest that the tipping point for the change in appraisal is also influenced by the level of autonomy.

In sum, the relationship between job demands and workplace learning needs further theoretical elaboration and empirical testing. Possibly, a more sophisticated approach that distinguishes between the workplace learning potential of specific (types of) demands, might provide a more refined and fruitful understanding of the complex relations between demands and learning at work.

Practical Implications.

Workplace learning is considered beneficial to long-term corporate competitiveness as well as employment and employability (Desjardins & Tuijnman, 2005). In fact, the ability to learn faster than competitors may well be the only sustainable competitive advantage left in today's knowledge based economy (Coetzer, 2007). We recognize that managers and team leaders may often be driven by more short-term considerations and, for instance, be tempted to increase employee workload to meet ambitious targets. However, organizations cannot have sustained, long-term success when focusing solely on short term objectives. Organizations can thus benefit from our findings by designing jobs such that optimal combinations of autonomy and workload will lead to the most optimal employee learning experiences, while at the same time not disregarding more short-term objectives; knowledge that is currently lacking (cf., Marsick & Volpe, 1999; Skule, 2004; Coetzer, 2007; Mayer & Solga, 2008).

Our findings suggest, first of all, that increasing workload triggers workplace learning only in specific circumstances. More specifically, increasing workload provides employees with learning opportunities most clearly at relatively low levels of workload (that is, when autonomy is moderate or high). When workload is high already, a further increase can be expected to result in marginally improved learning opportunities at best (when autonomy is high) and more often in decreased learning opportunities (when autonomy is moderate or low). From the perspective of enhancing learning opportunities it thus appears beneficial for management to focus on jobs that are low or moderate in autonomy and to develop ways in which autonomy can be increased, rather than further stimulating autonomy in jobs that are already high in autonomy.

Second, our findings suggest that short-term (productivity) goals and long-term (employee learning and organizational sustainability) goals are not necessary in conflict with each other. However, management should recognize that increased productivity can be achieved without cost for (and actually in benefit of) the learning processes by increasing workload only when task autonomy is high. Hence, managers should ensure that employees can to some extent freely experiment with different ways of meeting the demands of their jobs, giving them the opportunity to actively engage in the way the job is done, and giving them the necessary resources to adjust the working conditions and job content to the intended change in work practices.

Strengths and Limitations

The majority of research on the relationship between workload and workplace learning has been conducted on relatively small and homogeneous samples. This might explain the mixed findings of these studies. Researchers (e.g., Taris & Kompier, 2005; De Witte et al., 2007) have thus advised to rely on large and heterogeneous samples to identify the true nature of the relationship between workload and workplace learning. Hence, a clear strength of the present research is that, due to our reliance on two large and heterogeneous data sets, we are the first to consistently show a curvilinear relationship between workload and workplace learning opportunities, and to identify task autonomy as a moderator to this effect.

We tested our predictions in two samples that are representative of the Flemish working population. However, we believe that our samples are also largely representative of the European workforce because on most relevant labor market characteristics, the Flemish and European working populations are very comparable: Employees work, on average, for 36.7 hours per week in Flanders and for 37 hours per week in Europe; full- versus part-time employment numbers are equal in Flanders and in Europe (79%); the same holds for educational level (68% completed upper secondary education); and the diffusion of permanent contracts is largely comparable (92% in Flanders and 86% in Europe). Interestingly, data from the European Survey on Working Conditions (Merllié & Paoli, 2001) show the same average levels of task autonomy and learning opportunities for the Flemish and European workforce (see also: Malfait, 2002; Bourdeaud'hui & Vanderhaeghe, 2007) although European employees report slightly higher levels of workload compared to Flemish employees (Malfait, 2002). In sum, these similarities in relevant labour characteristics between the Flemish and European working population suggest that our findings are likely to generalize to the population of European employees.

Nevertheless, we acknowledge that our research is not without limitations: The necessity of addressing our research questions using large and heterogeneous samples implied certain trade-offs in terms of the quality of the data that were available. First of all, we had to rely on cross-sectional data, which does not allow drawing conclusions regarding the direction of causality in the assumed relationships between the study variables. However, prior studies using longitudinal data support the proposed causality in the relationships between job demands and autonomy on the one hand and learning related outcomes on the other hand, such as motivation to learn (Taris et al., 2003), feedback seeking behavior (Taris & Feij, 2004), effective problem solving at work (Cunningham, Woodward, Shannon, MacIntosh, Lendrum, Rosenboom & Brown, 2002), and feelings of mastery

(Holman & Wall, 2002). Moreover, the experimental studies included in the review of Wielenga-Meijer et al. (2010) showed consistent evidence for a positive relationship between demands and learning outcomes, suggesting that the idea of causality in this relationship is well grounded. Hence, although this prior work did not test our specific (interactive and curvilinear) hypotheses, it does increase our confidence in how the constructs of interest in the present study causally relate to one another.

A second limitation that is inherent to our samples is that we had to rely on employee self-reports. Such self-reports may lead to an overestimation of the associations between the study variables owing to common method variance. However, it should be noted that common method variance cannot account for interaction effects (including squared effects, which refer to independent variables interacting with themselves; Evans, 1985). In fact, interaction effects are suppressed in regression analyses and field data making such effects difficult to detect (McClelland & Judd, 1993). Furthermore, the confirmatory factor analyses gave us little reason to worry about common method variance being an important factor in our data.

A final potential limitation to the generalizability of our findings is that our dependent variable in both samples consisted of employees' experiences of learning opportunities, rather than actual employee learning. This is in line with previous research in this domain (e.g. Parker & Sprigg, 1999; Holman & Wall, 2002, Morrison et al., 2005; Rau, 2006). Central to workplace learning is the presence of adequate learning opportunities at work (Morrison et al., 2005; Rau, 2006, Wielenga-Meijer et al., 2006). However, as Rau (2006) pointed out, the fact that employees have learning opportunities, does not automatically imply that they use these opportunities for learning (see also Wielenga-Meijer et al., 2006). Yet, recent research (Van Ruysseveldt & Taverniers, 2010) shows that learning opportunities do lead to an increase in new, work-related competencies, thus suggesting that learning opportunities are not only an important outcome variable in their own right, but that they can also function as a proxy for workplace learning.

Concluding Remarks

Our research shows that workload and employee learning opportunities can be (i.e., at moderate levels of autonomy) related in an inverted u-shaped manner: Progressively higher levels of workload will first improve opportunities for workplace learning but gradually start hampering workplace learning. However, task autonomy plays an important moderating role in this process. Low autonomy prevents the potential benefits of (low to moderate) workload on learning opportunities from materializing whereas high autonomy can prevent the negative impact of (high) workload on learning opportunities from occurring. Moreover, a work situation which combines (very) high levels of workload and (very) low levels of autonomy is most detrimental to workplace learning. These results have important implications for the active learning hypothesis, and more generally, for our understanding of workplace learning, because they highlight the need to study additional processes of energy depletion when investigating informal workplace learning in organizations. Our results also have relevant practical implications because they highlight the need for managers to recognize that specific aspects of jobs should not be looked at in isolation, but rather in concert as one type of job factor (i.e., autonomy) affects the effectiveness of another factor (i.e., workload) in stimulating workplace learning.

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Table 1

Descriptives and Intercorrelations for the Study Variables

	FWM 2004		FWM 2007				
	M	*SD*	*M*	*SD*	1	2	3
1. Workload	44.61	17.21	44.98	16.69	(.89)	-.22**	-.06**
2. Autonomy	54.23	22.19	54.04	22.01	-.21**	(.91)	.43**
3. Learning opportunities	47.45	23.87	48.46	23.41	-.04**	.43**	(.85)

Notes: Correlations between the FWM 2004 scales are below the main diagonal; correlations between the FWM 2007 scales are above the main diagonal. Cronbach's α are on the main diagonal.

* $p < .01$; ** $p < .001$

Table 2

Regression Results for Learning Opportunities (FWM 2004 and FWM 2007)

	FWM 2004[a]				FWM 2007[b]			
	Model 1		Model 2		Model 1		Model 2	
Gender	.05	***	.05	***	.05	***	.05	***
Age	-.08	***	-.08	***	-.08	***	-.08	***
Educational level	.20	***	.19	***	.20	***	.20	***
Workload	.02	*	.03	**	.00		.02	
Autonomy	.40	***	.40	***	.39	***	.39	***
Workload x autonomy	.09	***	.07	***	.08	***	.05	***
Workload squared			-.04	***			-.05	***
Autonomy squared			-.04	***			-.05	***
F	514.50	***	391.41	***	438.99	***	336.35	***
F change			16.71	***			21.61	***
R^2	.25	***	.26	***	.25	***	.26	***
R^2 change			.01	***			.01	***

Note. Columns reflect standardized regression coefficients
[a] N = 11099
[b] N = 9738
* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3

Polynomial Regression Results of Learning Opportunities on Workload and Autonomy.

Learning opportunities	Results from the quadratic regression						Shape along the $X = Y$ line		Shape along the $X = -Y$ line	
	X	Y	X^2	XY	Y^2	R^2	$b_1 + b_2$	$b_3+b_4+b_5$	$b_1 - b_2$	$b_3-b_4+b_5$
FWM 2004 [a]	.042**	.433**	-.070**	.131**	-.057**	.26**	.48**	.00	-.39**	-.26**
FWM 2007 [b]	.020	.416**	-.097**	.099**	-.061**	.26**	.40**	-.03	-.42**	-.25**

Note. Following Edwards and Rothbard (1999) columns labeled X, Y, X^2, XY, Y^2 reflect unstandardized regression coefficients with all predictors entered simultaneously. X, workload, Y, autonomy. The column labeled R^2 indicates the variance explained by the five quadratic terms, controlling for age, gender and education. Columns labeled $b_1 + b_2$ and $b_3+b_4+b_5$ represent the slope of the surface along the $X = Y$ line, and columns labeled $b_1 - b_2$ and $b_3-b_4+b_5$ represent the slope of the surface along the $X = -Y$ line (b_1, b_2, b_3, b_4, and b_5 are the coefficients on X, Y, X^2, XY, and Y^2, respectively).

[a] $N = 11099$

[b] $N = 9738$

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

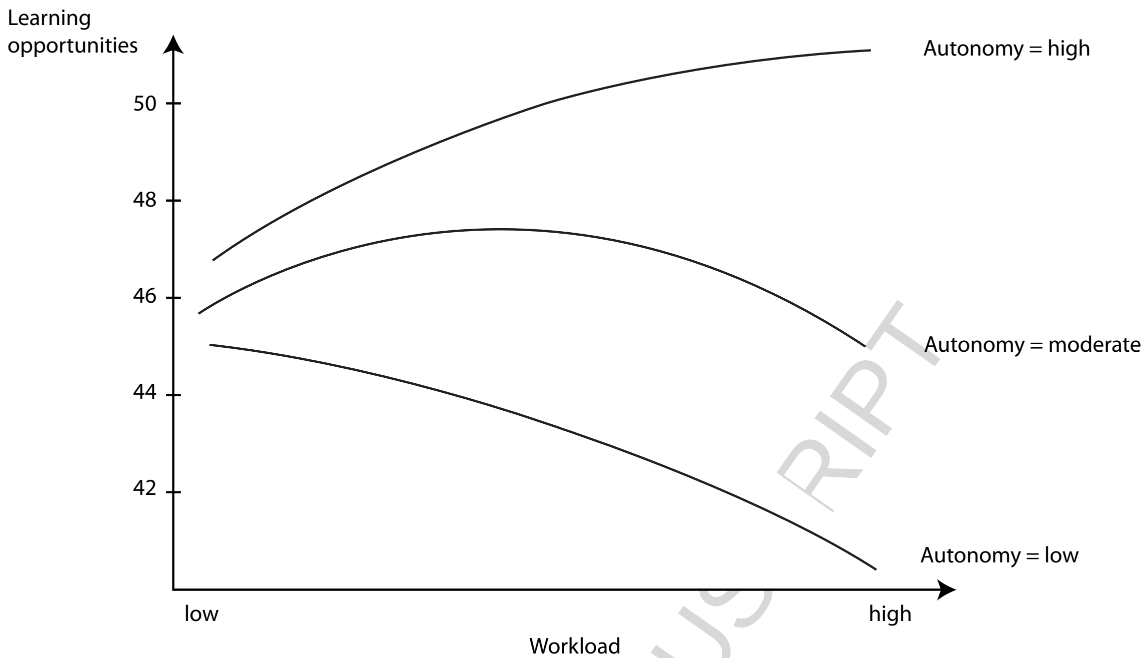
Learning
opportunities
50
48
46
44
42
Autonomy = high
Autonomy = moderate
Autonomy = low
low
high
Workload

Figure 1

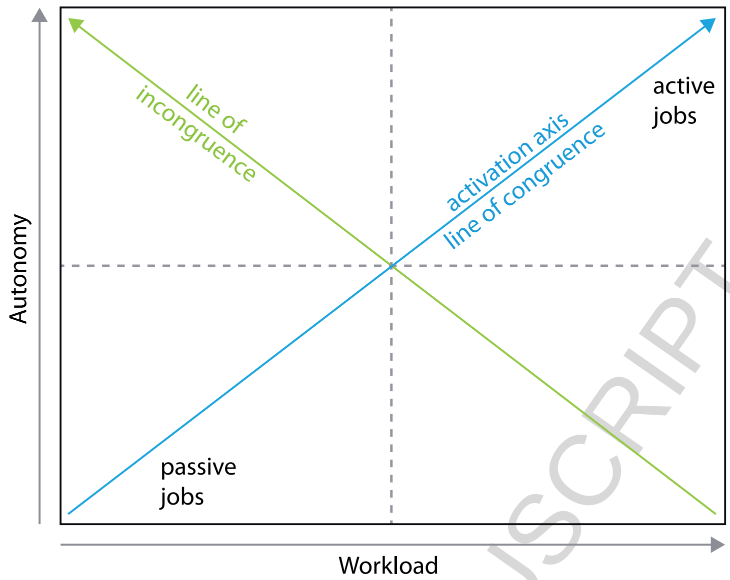
line of
incongruence
activation axis
line of congruence
active
jobs
passive
jobs
Autonomy
Workload

Figure 2

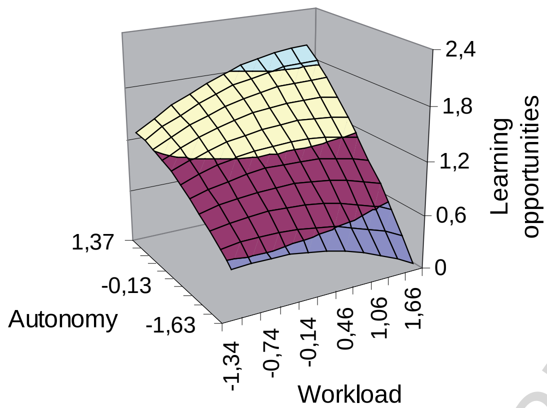
2,4
1,8
1,2
0,6
0
Learning opportunities
1,37
-0,13
-1,63
Autonomy
-1,34
-0,74
-0,14
0,46
1,06
1,66
Workload

Figure 3

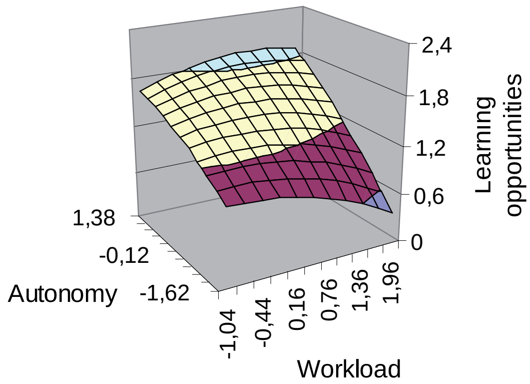

Figure 4

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[i] In order to verify for the presence of significant higher order interaction effects, at step 3, we entered the interaction between the squared workload term and autonomy, as well as the interaction between the squared autonomy term and workload. In the FWM 2004, only one of these higher order interaction terms proved to be significant, the squared autonomy term and workload, but its effect size was very small ($\Delta R^2 = .001$; Fchange = 3.27; $p = .038$). In the FWM 2007, none of these higher order interaction terms proved to be significant. As a consequence, we decided not to include these higher order effects into our final model.