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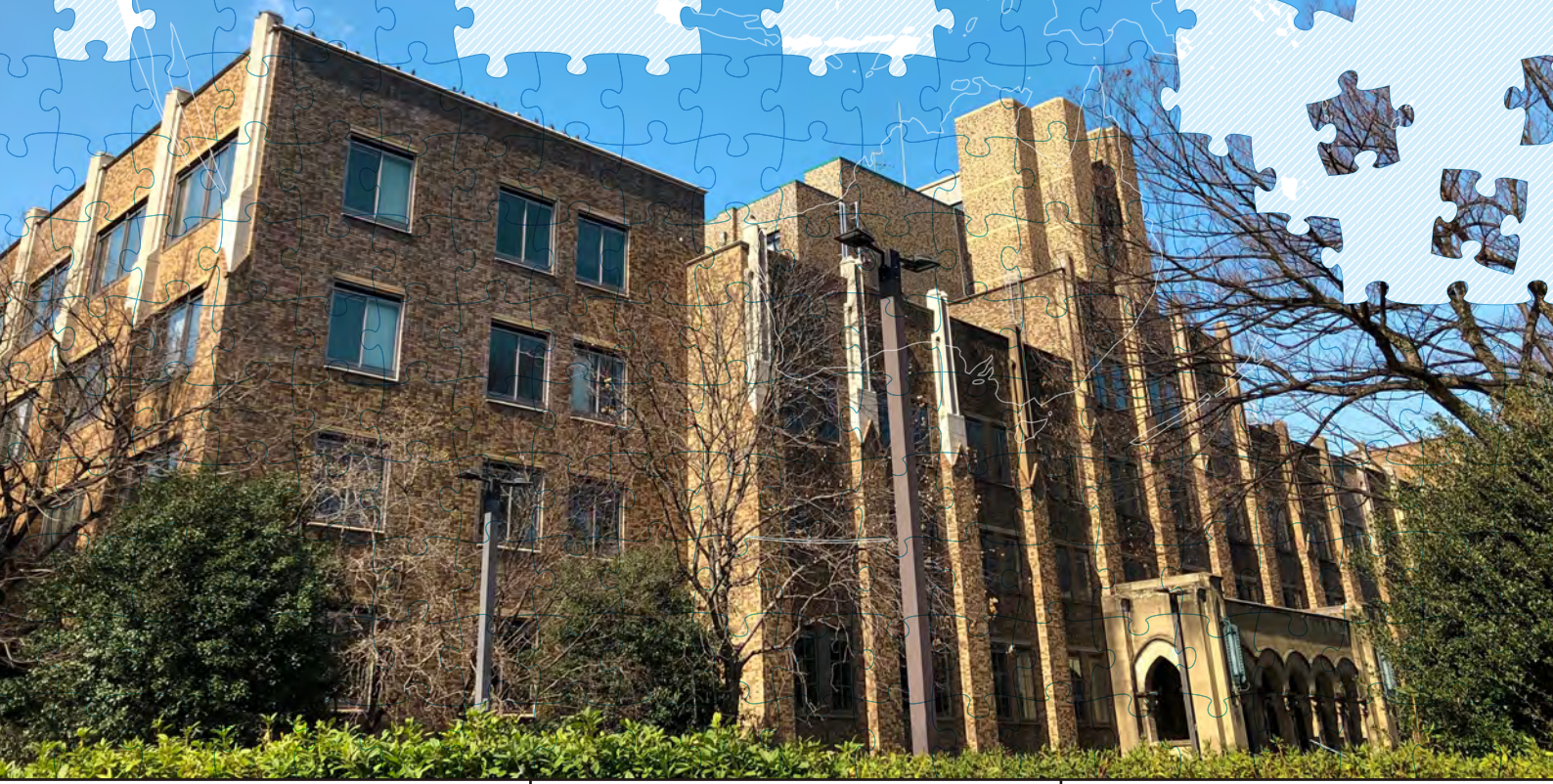

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Do Employees Grow during Challenging Periods?: An examination of the within-person effects of challenge stressors on learning

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Do Employees Grow During Challenging Periods?: An examination of the within-person effects of challenge stressors on learning

The challenge–hindrance stressor framework can be used to examine learning in the workplace. However, two issues exist regarding the association between challenge stressors and learning: (1) there are two hypotheses related to challenge stressors and learning: a linear association hypothesis based on action regulation theory and an inverted U-shaped hypothesis based on the comfort zone model, and (2) few studies have examined the association with learning using longitudinal data. This study examined the within-person effects of a challenge stressor on learning and strain using Japanese panel data obtained annually for eight years. The findings reveal that cognitive demands have a linear relationship with learning and that workload has an inverted U-shaped relationship with learning. Our findings suggest that within-person effects may be more likely to benefit from challenge stressors than between-person effects. Moreover, depending on the type of job demands, the assumptions of the challenge-hindrance stressor framework should be improved, and the assumption that there is a linear relationship between learning and workload may need to be revised.

Keywords: challenge-hindrance stress framework; workplace learning; strain; within-person effect; workload; job demands

Introduction

Workplace learning is crucial for both employees and organizations in the current rapidly changing knowledge society (Manuti, et al., 2015; Tannenbaum & Wolfson, 2022). Workplace learning is key for employees to grow and thrive throughout their careers, which in turn provides competitive advantages for organizations (Tannenbaum & Wolfson, 2022). Therefore, understanding the enablers and facilitators of workplace learning is helpful. Workplace learning occurs through informal means, such as work experience, reflection, and observational learning (Tannenbaum & Wolfson, 2022). Illeris (2010) noted two primary conditions for learning: an external interaction process between the learner and the social, cultural, and material environment and an internal

psychological elaboration and acquisition process in which new stimuli are linked to prior learning. In other words, learning involves the acquisition of knowledge through the learner's interaction with the work environment.

To explain the workplace factors that contribute to workplace learning, research has used the challenge-hindrance model as a theoretical basis (Hargrove et al., 2015). The challenge-hindrance stressor framework argues that job demands are not always negative and further categorizes job demands into those that contribute to employee growth, such as workplace learning, and those that do not (Cavanaugh et al., 2000; LePine, Podsakoff, & LePine, 2005). Stressors such as workload, cognitive demands, time pressure, and job responsibilities are considered challenge stressors and are thought to benefit personal growth (e.g., Cavanaugh et al., 2000; Kubicek et al., 2023; Podsakoff et al., 2023). In contrast, other stressors, including role ambiguity, organizational politics, interpersonal conflict, and job insecurity, are identified as hindrance stressors that impede potential gains such as workplace learning (e.g., Cavanaugh et al., 2000; Podsakoff et al., 2023).

Although empirical evidence has accumulated based on the challenge-hindrance stress framework, several questions remain about the relationships between challenge stressors and workplace learning. First, there are two contrasting hypotheses regarding the association between challenge stressors and learning: a linear association hypothesis based on behavioral regulation theory proposed by Kubicek et al. (2023) and the inverse U-shaped hypothesis based on the comfort zone model (Brown, 2008). However, studies have yet to examine which of these hypotheses is supported when challenge stressors are divided into workload and cognitive demand. Testing these two contrasting hypotheses helps us to better understand the challenge-hindrance stressor framework in terms of the underlying mechanisms through which specific challenge stressors affect

workplace learning in the long term. Second, although a few studies have used longitudinal data to examine the association between challenge stressors and learning (Kubicek et al., 2023), these studies have mostly investigated short-term effects with diary studies (e.g., Daniels et al. 2009; Prem et al., 2017). Prior research suggests that the benefits of challenge stressors may vary depending on the duration of exposure (Baethge et al., 2018). However, research on the long-term effects of challenge stressors on learning, especially within-person effects, is scarce. Practically, such research contributes to designing workplace interventions by explaining the extent to which these challenge stressors are beneficial for learning from a long-term perspective.

To fill this research gap, we used one-year interval 8-year panel data from Japanese employees and tested two hypotheses about challenge stressors (workload and cognitive demand) and learning: a linear hypothesis and the inverse U-shaped hypothesis. We also examined whether workload and cognitive demand were positively associated with strain even when considering within-person effects. Our study contributes to the literature in three ways. First, this study provides a deeper understanding of the challenge-hindrance stressor framework by examining the long-term within-person effects of the challenge stressor, which has been underresearched. Second, in line with previous research (Kubicek et al., 2023), this study suggests that the relationship between challenge stressors and learning differs depending on the type of demand. Third, this study provides evidence to partially support previous studies' suggestion that the challenge-hindrance stressor framework should be improved (Mazzola & Disselhorst, 2019; O'Brien & Beehr, 2019; Horan et al., 2020) by indicating the need to consider a nonlinear relationship.

The context in Japan

In Japan, a membership-based employment system is prevalent (Yonezawa, 2023), where companies do not (or cannot) consider matching a candidate's university major with a job at the time of hiring. In this circumstance, workplace learning is particularly important for employees to acquire the knowledge and skills needed for a job. Additionally, various meta-analyses have shown that both hindrance stressors and challenge stressors have positive relationships with strain (Lepine et al., 2005; Mazzola & Disselhorst, 2019). These findings are important for Japanese workplaces, where there is a prevailing belief that working hard for long hours is good and that there are many hard workers (Nishiyama & Johnson, 1997; Meek, 2004). However, studies with Japanese samples are limited and mainly examine the between-individual effects of challenge stressors (e.g., Inoue et al., 2014; Ikeda, 2023). Therefore, it is necessary to identify the positive and negative within-person effects of challenge stressors simultaneously to propose the extent to which challenge stressors should be experienced to promote employees' growth while also protecting their health.

Theoretical background and hypotheses

Relationship between Challenge Stressors and Learning

Based on the challenge-hindrance stressor framework, it has been argued that an increase in positive stressors is essential for human resource development (Hargrove et al., 2015). Prior research has demonstrated the relationship between challenge stressors and learning by focusing on the acquisition of knowledge and skills through workplace experiences (e.g., Ikeda, 2023; Kubicek et al., 2023).

However, as research on this topic has accumulated, some scholars have questioned the proposition that challenge stressors are related to positive outcomes (Mazzola & Disselhorst, 2019; Horan et al., 2020). For instance, meta-analyses show

that challenge stressors have no significant relationship with task performance, organizational citizenship behavior, job satisfaction, or engagement (Mazzola & Disselhorst, 2019). The inconsistency of the results indicates the need for more research in this area.

Accordingly, some researchers have suggested that the challenge-hindrance stressor framework should be improved by identifying differences in impact for each demand included in the challenge stressor and considering an inverted U-shape as a potential association between challenge stressors and learning. The first hypothesis was proposed by Kubicek et al. (2023), who stated that workload has a negative linear relationship with learning and that cognitive demand has a positive linear relationship with learning. Kubicek et al. (2023) explained these hypotheses based on behavioral control theory (Frese & Zapf 1994) and the task-related learning model (Wielenga-Meijer et al., 2010). According to these studies, learning processes include cognitive, motivational, and behavioral processes that lead to the acquisition of learning outcomes. Cognitive demand is believed to facilitate learning by initiating these processes. Specifically, in complex work environments that require multiple skills, employees acquire new skills by solving new problems and exploring and reflecting on them (Kubicek et al., 2023). On the other hand, workload hinders learning because it reduces opportunities for exploration and reflection, which are essential for learning (Kubicek et al., 2023). A cross-sectional meta-analysis supported this hypothesis (Kubicek et al., 2023). The authors found that workload was negatively associated with learning, while cognitive demand was positively associated with learning.

The second hypothesis suggests that the association between challenge stressors and positive outcomes might be an inverse U-shape (Mazzola & Disselhorst, 2019; O'Brien & Beehr, 2019; Horan et al., 2020). This hypothesis has been proposed for

positive outcomes in general, including task performance, engagement, and learning (Mazzola & Disselhorst, 2019; O'Brien & Beehr, 2019; Horan et al., 2020; Ikeda, 2023). Based on the comfort zone model, the hypothesis is also considered valid in the case of learning. The comfort zone model presents three zones and describes the conditions that are suitable for learning within them. It is often referenced in the context of adventure education (Brown, 2008). Influenced by Vygotsky's zone of proximal development (Vygotsky, 1978), this model explains that learning is more likely to occur in three zones: the comfort zone, growth zone, and panic zone (Brown, 2008; Taylor & Manning-Ouellette, 2022). Taylor and Manning-Ouellette (2022) described these three zones. According to these authors, in the comfort zone, the learner feels comfortable and can control things independently. In the growth zone, the learner does not know how to accomplish tasks or solve problems but prefers to discuss and think (Taylor & Manning-Ouellette, 2022). In the panic zone, the learner is faced with a task that cannot be completed without the help of others and feels a strong sense of urgency (Taylor & Manning-Ouellette, 2022). Based on this model, we propose that when workload and cognitive demand are low, the worker is in the comfort zone. In contrast, when demands are excessively high, the worker is in the panic zone, which does not promote learning. When there is moderate workload and cognitive demand, the worker is in the growth zone, which is thought to be the area that supports learning. Several empirical studies also support the inverted-U hypothesis (Van Ruysseveldt & Van Dijke, 2011; Ikeda, 2023). However, this proposition has not been examined at the within-person level.

Relationship between Challenge Stressors and Strain

The challenge-hindrance stress framework assumes that even challenge stressors are positively associated with strain due to the effort needed to encounter and manage

stressors (Cavanaugh et al., 2000). Several meta-analyses using cross-sectional data and experience sampling method data have shown that challenge stressors are positively associated with strain (Lepine et al., 2005; Mazzola & Disselhorst, 2019; Kubicek et al., 2023; Pindek et al., 2024). However, long-term within-person effects have not been studied. Examining the within-person effects of challenge stressors on strain is important from a practical perspective because certain stressors may simultaneously impact workplace learning and strain in opposite manners.

Within- and Between-Person Effects of Challenge Stressors

As discussed above, although a few studies have used longitudinal data to examine the association between challenge stressors and learning, these studies have mostly investigated short-term effects with diary studies (e.g., Daniels et al. 2009; Prem et al. 2017). There is a lack of studies on the long-term effects of challenge stressors on learning.

Differentiating the within- and between-person effects of challenge stressors is a critical aspect of re-examining the challenge-hindrance stressor framework from a long-term perspective. Although theories about learning are considered valid for explaining differences in learning between and within individuals (Brown, 2008; Wielenga-Meijer et al., 2010), the associations of challenge stressors such as workload and cognitive demands with learning may exhibit opposing effects. For example, while individuals who experience a challenge stressor do not necessarily experience more positive outcomes (i.e., between-person effects) (e.g., Mazzola & Disselhorst, 2019), an increase in challenge stressors may increase an individual's positive outcomes (i.e., within-person effects) (e.g., Pindek et al., 2024). Therefore, we examined which of the two

hypotheses (Hypothesis 1 and Hypothesis 2) about challenge stressors and learning is supported when within-person effects are considered.

Hypothesis 1a: Workload is negatively related to learning within individuals.

Hypothesis 1b: Cognitive demand is positively related to learning within individuals.

Hypothesis 2a: Workload has an inverse U-shaped relationship with learning within individuals.

Hypothesis 2b: Cognitive demand has an inverse U-shaped relationship with learning within individuals.

Studies of the effects of challenge stressors on strain have also investigated short-term effects with diary studies (e.g., Pindek et al., 2024), although studies on long-term effects are limited. It is essential to examine the within-person effects of challenge stressors on strain because these effects may vary within and between individuals. Therefore, we examine whether the following hypotheses are supported when considering within-person effects.

Hypothesis 3a: Workload is positively related to strain within individuals.

Hypothesis 3b: Cognitive demand is positively related to strain within individuals.

Materials and Methods

Data and Procedures

We conducted a secondary analysis using the Japanese Panel Study of Employment Dynamics (JPSED) by the Recruit Works Research Institute. The JPSED is a panel survey that examines employment and nonemployment status and its changes. The JPSED was distributed to 145,102 Japanese men and women aged 15 or older at T1 with a sample of 49,131 (response rate of 33.9%). The annual survey has been conducted online every January from 2016 to the present. New respondents are recruited every year, with an additional 9,512 to 30,690 respondents added annually since 2017 in addition to the continuing sample.

In the current study, we used eight years of data from 2016 to 2023 that were available from the Social Science Japan Data Archive by January 2024. For the analysis, we used data from respondents aged 15-65 who participated in the survey at two or more time points. The reason for targeting these ages is that age 65 is generally the retirement age in Japan. The final sample included 54,724 individuals with 231,956 responses. The characteristics of the sample are shown in Table 1. Of the valid responses, 57.7% were male, and 69.6% of the valid respondents were engaged in full-time work. The participants were employed in the following occupations: professional management, 32.4%; manual work (such as security, agriculture, forestry, transportation, and production processes), 18.5%; and nonmanual work (such as administrative, sales, and service), 49.2%.

Measures

Due to the secondary nature of the data, the items were original, and only single items were used to assess challenge stressors and learning. While longitudinal

surveys often face problems of participant exhaustion and attrition, the use of single items reduces participants' burden and hence maintains the quality of the data (Van Hootegem et al., 2023). Additionally, a single item is sufficient if the content referenced is clear. All surveys were conducted in Japanese.

Workload was measured with the item "I was overloaded with tasks that I couldn't handle." Responses were provided on a 5-point Likert scale ranging from 1 = disagree to 5 = agree.

Cognitive demand was measured with the item "I was responsible for a variety of tasks, not monotonous." Responses were provided on a 5-point Likert scale from 1 = disagree to 5 = agree.

Learning was measured with the item "I had a feeling of 'growing up' through my work." Responses were provided on a 5-point Likert scale ranging from 1 = disagree to 5 = agree.

Strain was measured using eight items that asked about strain. The items were "I feel depressed," "I feel tense," "I am terribly tired," "I have palpitations or shortness of breath," "I have headaches and dizziness," "My back, hips, and stomach ache," "I have no appetite," and "I don't sleep well." Responses were provided on a 5-point Likert scale from 1 = never to 5 = always. To consider whether the eight items could be treated as one concept, we performed an exploratory factor analysis using the time 1 data. The results showed that a one-factor model was considered reasonable based on the eigenvalue of 1 criterion, and the factor loadings were good, ranging from .56 to .83. The range of Cronbach's reliability coefficients for each wave was α = .87 to .88.

Control Variables We controlled for the effects of age, marital status, employment status, working hours, and occupation. The fixed-effect model we used in this study (described below) allowed us to examine only the effects of the time-variant variables; thus, we did not control for the effects of gender.

Statistical Analysis

We used a fixed-effects model to test our hypotheses. The model focuses on how changes in the dependent variable over time are affected by changes in the independent variable over time within the same unit (Woods et al., 2024). Fixed-effects models allow us to examine within-person effects. In addition, focusing on within-person changes over time allows us to control for unobserved individual heterogeneity (Zhou et al., 2017). Referring to Mitchell (2012), in cases where the analysis supported both linear and inverted-U hypotheses, we judged that the inverted-U hypothesis was supported because the association can be interpreted as positive up to the halfway point and negative from the halfway point. In creating the squared terms, workload and cognitive demand were centered by subtracting the within-individual mean from the scores at each time point and then squared. We also conducted a gender-stratified analysis because the mechanism by which challenge stressors affect learning may differ between men and women. In particular, women usually have limited access to informal learning, such as mentoring and networking, compared to men (Bancheva & Ivanova, 2015). Thus, the positive effects of challenge stressors may be weaker among women than men. The above analysis was performed using StataIC16.

Results

Descriptive Statistics

The descriptive statistics of the variables used in this study and the characteristics of the sample are presented in Table 1.

Insert Table 1 here

Hypothesis Testing

The results of hypothesis testing using the fixed effects models are shown in Table 2. First, the dependent variable in Models 1–3 was learning. In Model 1, workload and cognitive demand were predictors, and the model controlled for covariates. Model 2 added a squared term of workload to Model 1. Model 3 added a squared term of cognitive demand to Model 1. As shown in Model 1, workload and cognitive demand had significant positive effects on learning (.01, p <.01, .15, p <.001). Model 2 showed that the squared term of workload was significantly negatively related to learning (−.02, p <.001), while Model 3 showed that the confidence interval for the squared term of cognitive demand included zero, indicating no significant effect (−.01, n.s.) and suggesting that workload, but not cognitive demand, showed a nonlinear relationship with workplace learning. Therefore, we conducted a U-shaped test on the relationship between workload and learning to examine the extreme points (Lind & Mehlum, 2010). The results showed that the extreme point was .19, within the range of the centralized workload (−3.38 ≦ x ≦ 3.50). As shown in Figure 1, plotting the predicted values revealed an inverse U-shaped relationship. The slope below the extreme point was .16 (p <.001), and the slope above the extreme point was −.15 (p <.001). In sum, for the relationship between workload and learning, Hypothesis 1a was not supported and Hypothesis 2a was supported. For the relationship between cognitive demand and learning, Hypothesis 1b was supported and Hypothesis 2b was not supported.

Second, the dependent variable in Model 4 was strain. As shown in Model 4, workload and cognitive demand had a significant positive impact on strain (.10, p <.001, .01, p <.001). Thus, Hypotheses 3a and 3b were supported.

Insert Table 2 here

Insert Figure 1 here

Gender-stratified Analysis

Table 3 shows the results of a supplementary analysis to explore differences between men and women. The results showed that the separate analyses for men and women were similar to those for the combined analyses. Regarding workload, as shown in Model 2, the inverse U-shaped hypothesis (Hypothesis 2a) was supported. The extreme points were −.06 for men and .55 for women. Although the squared term was significant in the women's model for cognitive demand, the extreme point was outside the range. Therefore, Hypothesis 1b, a linear hypothesis, was supported for both men and women. Finally, for the association with strain, Hypotheses 3a and 3b were supported for both men and women (Model 4).

Insert Table 3 here

Discussion

In this study, we examined the long-term within-person effect of a challenging stressor on learning and strain among Japanese employees using panel data. The results showed that workload had an inverse U-shaped relationship with learning and a positive linear relationship with strain. In addition, cognitive demands had positive linear relationships with learning and strain.

Theoretical Contribution

First, this study contributes to a deeper understanding of the challenge-hindrance stressor framework by examining the long-term within-person effects of challenge stressors on learning. The analysis of the relationship between challenging stressors and learning was conducted primarily on cross-sectional data (Kubicek et al., 2023), and both linear and inverse U-shaped hypotheses were presented. Our results supported the inverse U-shaped hypothesis based on the comfort zone model for workload and the

linear hypothesis for cognitive demand. For the workload results, the extreme points were slightly higher than average. That is, individuals' learning is highest when their workload is slightly higher than usual. This result differs from the findings of a meta-analysis using cross-sectional data (Kubicek et al., 2023). Kubicek et al. (2023) showed that workload had a negative linear relationship with learning and suggested that workload inhibited learning because it reduced opportunities for actions essential to the acquisition of new knowledge, such as exploration and reflection; it is therefore impossible to commit to learning in the long term in the face of a heavy workload. Our results supported the inverse U-shaped hypotheses of workload, which may be because we examine the within-person effect in a Japanese work context. The within-person effect is the value compared to the average of the individuals in the workload (Baethge et al., 2018). Therefore, it does not simply indicate the amount of workload but rather the relative workload for the individual. Prior studies examining the association of challenge stressors with other positive outcomes suggest that within-person effects are more likely to be favorable than between-person effects (Baethge et al., 2018; Mazzola & Disselhorst, 2019; Pindek et al., 2024). Integrating previous research with the findings of this study, within-person and between-person effects of challenge stressors may be different, and more positive effects may be found for within-person effects. Furthermore, in Japan, reflection support (e.g., weekly one-on-one meetings with supervisors for reflection) is often provided in daily work (Matsuo, 2015). Hence, the inverse U-shaped hypothesis may have been supported by employees having time to reflect, which is essential for learning, even with a busy schedule. In addition, lifetime employment persists in Japan, and employees are more likely to commit to learning from a long-term perspective. Therefore, many people may explore and reflect even under high workloads. Additionally, in Japanese companies, contributing to the

company through long working hours is advantageous for promotion (Meek, 2004). Japanese culture also considers virtues such as patience and endurance (Meek, 2004). Therefore, people may believe that a large amount of work leads to learning. The results for cognitive demand indicate that learning often occurs when cognitive demand is high. The fact that the result was linear rather than inverted U-shaped is consistent with the work of Kubicek et al. (2023), who noted that cognitive demand promotes a cognitive learning process based on behavioral control theory (Frese & Zapf, 1994) and the task-related learning model (Wielenga-Meijer et al., 2010). Additionally, our results did not support the inverted-U association, possibly because there is support and precedent for solving complex tasks in the workplace, which did not lead to the panic zone in the comfort zone model.

Second, consistent with previous research (Webster et al., 2011; Kubicek et al., 2023), this study suggests that the impact of a challenge stressor on learning and strain depends on the type of demand. In this study, the within-person effects of workload and cognitive demand on learning were nonlinear and linear, respectively. Although workload and cognitive demand both had positive effects on strain, the effect size differed, with workload having a larger effect. This study provided additional evidence that the effects of challenge stressors are better considered separately based on the type of demand (e.g., Kubicek et al. 2023) rather than considering challenge stressors as a single factor (e.g., Cavanaugh et al., 2000). This perspective may provide a better understanding of the challenge-hindrance stressor framework.

Third, this study provides evidence that partially supports the suggestions in previous research that the challenge-hindrance stressor framework could be expanded to incorporate the nonlinear hypothesis (Mazzola & Disselhorst, 2019; O'Brien & Beehr, 2019; Horan et al. 2020). The need to improve the challenge-hindrance stressor

framework has been discussed, mainly because evidence does not support the assumption that challenge stressors and positive outcomes are positively associated (Mazzola & Disselhorst, 2019; Horan et al., 2020). Previous research has also noted that workload cannot be classified as a challenge stressor because of its negative effect on positive outcomes (Kubicek et al., 2023). The results of this study show that the link between challenge stressors and growth is valid, at least for the relationship between cognitive demands and learning. On the other hand, our findings on the relationship between workload and learning support the argument that the assumption may need to be changed to consider nonlinear relationships.

Practical Contribution

Our results provide two contributions to organizations and practitioners. First, imposing heavy workloads for employee development may not be worthwhile. The relationship between workload and learning has an inverted-U shape, and learning is maximized when it is slightly greater than the within-individual average. Additionally, a heavier workload produces more strain. Therefore, imposing excessive workloads on employees is not a good strategy for personal development.

Second, further research is needed to determine how employees should increase their cognitive demands to support their growth. Since cognitive demands are positively associated with learning and only slightly positively associated with strain, increasing cognitive demands may be an opportunity for growth if the negative effects on strain could be effectively mitigated. Human resource managers may encourage employees to grow by exposing them to various tasks while simultaneously imposing stress mitigating programs. Employees may also be able to grow by voluntarily performing multiple tasks through job crafting if they can effectively manage their stress levels.

Limitations

This study has several limitations. First, the sample for this study was limited to Japanese individuals. Whether similar results can be obtained in other cultures requires further study. Second, challenges remain in the measurement of challenge stressors and learning. To examine the within-person effect, this study conducted a secondary analysis using long-term panel data. Therefore, there are some limitations to the scale's validity, such as the measurement of workload, cognitive demand, and learning variables with a single item. In the future, it is necessary to examine whether similar results can be obtained using a scale with higher reliability and validity.

Conclusion

This study aimed to examine two contested hypotheses regarding the associations between challenge stressors (workload and cognitive demand) and learning using 8 years of panel data from the Japanese population. The results showed that workload had an inverse U-shaped relationship with learning and a positive linear relationship with strain. In addition, cognitive demands had positive linear relationships with learning and strain. These associations were retained in the gender-stratified analysis. These findings suggest that increasing cognitive demands may be an opportunity for growth if the negative effects on strain can be effectively mitigated. Future studies may benefit from using validated measurements for both predictors and outcomes.

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Table 1. Descriptive statistics and sample characteristics

	M	SD	Min	Max
Workload	2.71	1.13	1	5
Cognitive demand	3.10	1.14	1	5
Learning	2.92	1.04	1	5
Strain	2.63	.78	1	5
Age	42.3	11.7	15	65
Working hours (/week)	38.9	13.3	1	160
	Frequency	%		
Gender				
Male	133,836	57.7		
Female	98,120	42.3		
Employment status				
Full-time	161,455	69.6		
Others	70,501	30.4		
Occupation				
Professional management	74,847	32.3		
Nonmanual	114,110	49.2		
Manual	42,999	18.5		
Marriage status				
Married	128,423	55.4		
Unmarried	103,533	44.6		

N=231,956

Table 2. Within-person effects of challenge stressors on learning and strain

	Model1			Model2			Model3			Model4		
				DV=Learning						DV=Strain		
	Coef.	95% CI	SE	Coef.	95% CI	SE	Coef.	95% CI	SE	Coef.	95% CI	SE
Age	−.01	[−.01, −.01]	.00	−.01	[−.01, −.01]	.00	−.01	[−.01, −.01]	.00	−.01	[−.01, −.01]	.00
Full-time employment	−.06	[−.08, −.03]	.01	−.06	[−.05, .00]	.01	−.06	[−.08, −.04]	.01	.04	[.02, .05]	.01
Married	−.03	[−.05, .00]	.01	−.03	[−.05, .00]	.01	−.03	[−.05, .00]	.01	.01	[−.01, .02]	.01
Working hours	.00	[.00, .00]	.00	.00	[.00, .00]	.00	.00	[.00, .00]	.00	.00	[.00, .00]	.00
Professional management	.07	[.04,.09]	.01	.07	[.04, .09]	.01	.07	[.04, .09]	.01	.00	[−.01, .02]	.01
Nonmanual	.02	[.00, 05]	.01	.02	[.00, .05]	.01	.02	[.00, .05]	.01	−.01	[−.02, .01]	.01
Workload	.01	[.00, .01]	.00	.01	[.00, .01]	.00	.01	[.00, .01]	.00	.10	[.10, .10]	.00
Cognitive demand	.15	[.14, .15]	.00	.15	[.14, .15]	.00	.15	[.14, .15]	.00	.01	[.01, .01]	.00
Workload squared				−.02	[−.03, −.02]	.00						
Cognitive demand squared							−.01	[−.01, .00]	.00			
Intercept	2.92	[2.78, 3.07]	.07	2.96	[2.82, 3.11]	.07	3.40	[3.26, 3.54]	.07	2.52	[2.44, 2.60]	.04
R^2 (within)		.03			.03			.03			.05	
R^2 (between)		.12			.12			.02			.08	
R^2(over all)		.08			.08			.02			.07	
sigma_u		.79			.79			.83			.67	
sigma_e		.73			.73			.73			.41	
rho		.54			.54			.55			.73	
n/N						54,724/231,956						

*DV: Dependent variable

Figure 1. Within-person effect of workload on learning

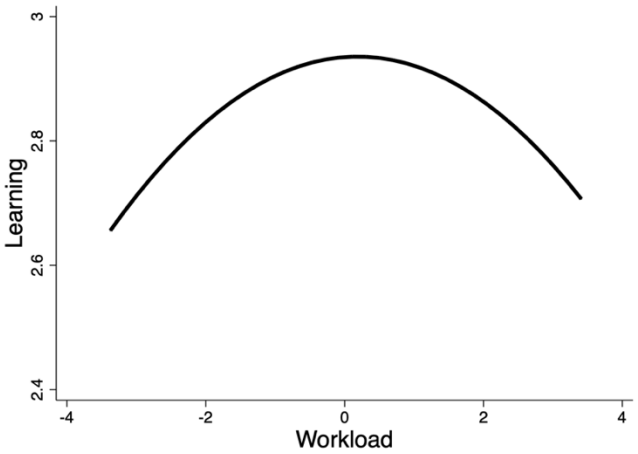

Table 3. Within-person effects of challenge stressors on learning and strain: stratified by gender

	Male								Female							
	Model1		Model2		Model3		Model4		Model1		Model2		Model3		Model4	
			DV=Learning				DV=Strain				DV=Learning				DV=Strain	
	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE	Coef. 95%CI	SE
Age	-.01 [-.01,-.01]	.00	-.01 [-.01,-.01]	.00	-.01 [-.01,-.01]	.00	-.01 [-.01,-.01]	.00	-.01 [-.01,-.01]		-.01 [-.01,-.01]	.00	-.01 [-.01,-.01]	.00	-.01 [-.01,00]	.00
Full-time employment	-.02 [-.06,-.01]	.02	-.03 [-.06,.01]	.02	-.02 [-.06,.01]	.02	.03 [.01,.05]	.01	-.10 [-.13,-.06]		-.10 [-.13,-.06]	.02	-.10 [-.13,-.06]	.02	.04 [.03,.06]	.01
Married	-.02 [-.06,.02]	.02	-.02 [-.06,.02]	.02	-.02 [-.06,.02]	.02	-.01 [-.03,.01]	.01	-.03 [-.07,00]		-.03 [-.07,00]	.02	-.03 [-.07,00]	.02	.02 [.00,.04]	.01
Working hours	.00 [.00,.00]	.00	.00 [.00,.00]	.00	.00 [.00,.00]	.00	.00 [.00,.00]	.00	.00 [.00,.00]		.00 [.00,.00]	.00	.00 [.00,.00]	.00	.00 [.00,.00]	.00
professional management	.05 [.02,.08]	.01	.05 [.02,.08]	.01	.05 [.02,.08]	.01	.00 [-.02,.01]	.01	.12 [.07,.18]		.12 [.07,.17]	.03	.12 [.07,.18]	.03	.03 .[00,.05]	.01
non-manual	.01 [-.02,04]	.01	.01 [-.02,.04]	.01	.01 [-.02,.04]	.01	-.01 [-.02,.01]	.01	.07 [.02,.11]		.07 [.02,.11]	.02	.07 [.02,.11]	.02	.00 [-.02,.03]	.01
Workload	.00 [.00,.00]	.00	.00 [-.01,.00]	.00	.00 [-.01,.00]	.00	.11 [.11,.12]	.00	.02 [.01,.03]		.02 [.01,.03]	.00	.02 [.01,.03]	.00	.09 [.08,.09]	.00
Cognitive demand	.15 [.14,.16]	.00	.15 [.14,.16]	.00	.15 [.14,.16]	.00	.01 [.01,.02]	.00	.15 [.14,.16]		.15 [.14,.16]	.00	.15 [.14,.15]	.00	.01 [.01,.01]	.00
Workloa2			-.02 [-.03,-.02]	.00							-.02 [-.03,-.01]	.00				
Cognitive demand2					.00 [-.01,.00]	.00							-.02 [-.02,-.01]	.00		
Intercept	2.94 [2.75,3.12]	.09	2.95 [2.77,3.13]	.09	3.41 [3.23,3.59]	.09	2.48 [2.38,2.58]	.05	2.88 [2.7,3.10]	.11	2.95 [2.73,3.17]	.11	3.35 [3.12,3.57]	.11	2.54 [2.41,2.67]	.07
R2 (within)	.03		.03		.03		.05		.04		.04		.04		.04	
R2 (between)	.14		.14		.02		.10		.10		.10		.02		.10	
R2(over all)	.09		.09		.03		.09		.07		.07		.02		.08	
sigma_u	.79		.79		.83		.66		.79		.79		.82		.63	
sigma_e	.72		.72		.72		.42		.75		.75		.75		.40	
rho	.54		.54		.57		.72		.53		.53		.55		.72	
n/N	30,772 / 133,836								23,952 / 98,120							