



**IMPACT OF INTRINSIC MOTIVATION
ON THE PSYCHOLOGICAL WELL-BEING OF
DOCTORAL STUDENTS – A MULTIVARIATE ANALYSIS**

Vrinda Acharya	Department of Commerce, Manipal Academy of Higher Education, Manipal, India	vrinda.doc@manipal.edu
Mathew Thomas Gil	Department of Commerce, Manipal Academy of Higher Education, Manipal, India	mathew.tg@manipal.edu
Aneesha Acharya K*	Department of Instrumentation and Control Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education (MAHE), Manipal, Karnataka, India	ak.acharya@manipal.edu

* Corresponding author

ABSTRACT

Aim/Purpose	This study investigates how personal resources act as moderators and mediators in the Job Demands-Resources (JD-R) model. The study introduced intrinsic motivation as a personal resource and explored the mediating and moderating role relating to job demands, job strain, and psychological well-being in a doctoral education setting.
Background	Future scholars and professionals are shaped by doctoral education, an essential phase in an academic career. Students' psychological well-being is negatively impacted by the stress associated with the rigorous demands of the program, such as long hours of study and academic research publications. Understanding the relationship between intrinsic motivation and doctorate students' mental health has attracted attention recently. Although fostering intrinsic motivation provides positive outcomes, the relationship with overall well-being is still multifaceted.

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Impact of Intrinsic Motivation on Psychological Well-Being of Doctoral Students

Methodology	The study collected cross-sectional data from 391 full-time PhD students in India's social science discipline. The investigation performed direct, moderation and mediation analysis of the study construct.
Contribution	The current findings offer validation for nurturing the psychological well-being of scholars in the stressful doctoral study environment through intrinsic motivation. Furthermore, by emphasizing the scholars' intrinsic motivation, the current study contributes to the body of literature on how scholars might prioritize their work-life balance and handle the demands of their programs.
Findings	Demands of the doctoral program increase job strain and negatively impact students' psychological well-being; however, this effect is conditional on the level of intrinsic motivation. This study highlights the significance of intrinsic motivation as a personal resource in the JD-R model that facilitates doctoral students' psychological well-being.
Recommendations for Practitioners	The study recommends that institutions, supervisors, and practitioners create a learning environment that fosters intrinsic motivation among scholars. The study result highlights interventions to enhance student motivation and psychological well-being to enhance the three psychological needs of scholars, i.e., autonomy, relatedness, and competence. Institutions can enhance the scholar's autonomy by providing a choice of courses during their coursework stage and by providing an opportunity for research grants and collaboration. Supervisors suggested providing constructive feedback, maintaining open communication, and conducting research writing, methodology and time management skills, and growth mindset workshops for students that foster scholars' competence. A sense of relatedness can be achieved through shared challenges and successes, peer mentorship programs, study groups, peer reviews, and social events.
Recommendations for Researchers	The researchers should consider other personal resources (for example, self-efficacy, grit, and resilience) that scholars can use to improve psychological well-being. Researchers should broaden their studies and interventions on resources rather than strategies to reduce the PhD program demands to tackle the job strain among scholars.
Impact on Society	Scholars with better mental health may be more productive and resilient and better able to support their communities. We can ensure they build their excellent research results, assist various fields in advance, and engage in social concerns.
Future Research	Researchers can investigate the present relationship using longitudinal studies by tracking students' well-being over time. Further studies can establish causal links, assess the efficacy of intrinsic motivation interventions, and uncover complex interactions between demands and resources influencing mental health among scholars.
Keywords	psychological well-being, personal resources, intrinsic motivation, job demands-resources, job strain

INTRODUCTION

The significant surge in mental health problems among doctoral students worldwide has alarmed higher education institutions. Studies over the past two decades have reported various mental health issues within the doctoral student population. For instance, 32% of doctoral students in Belgium exhibit at least two psychiatric problems, a rate higher than that of highly educated general adult employees (Levecque et al., 2017; Pervez et al., 2021). However, 41.9% of PhD candidates in France

(Marais et al., 2018) and 27.6% in India (LT et al., 2022) encounter anxiety and stress. Additionally, Milicev et al. (2023) found that 15.5% of PhD candidates in Australia experience suicidal thoughts. The rising prevalence of mental health problems negatively impacts doctoral students' psychological well-being (PWB). This has prompted supervisors, academicians, institutions, and policymakers to express interest in enhancing psychological well-being among scholars.

Researchers can understand individuals' PWB through various theoretical frameworks, such as Ryff's (1989) model. While Ryff proposes PWB as a comprehensive framework for understanding and measuring human well-being, it overlooks the impact of students' interactions with environmental demands on their PWB. The Job Demands-Resources (JD-R) model addresses this limitation by examining how environmental demands and resources influence individual well-being (Schaufeli & Bakker, 2004). According to this model, a highly demanding work environment with limited resources can cause stress, leading to mental health problems (Edú-Valsania et al., 2022). The JD-R model has demonstrated the association between job demands and resources on various outcomes, including performance, physical well-being, completion time, mental illness, service quality, job satisfaction, and turnover intentions (Ángelo & Chambel, 2012; Hoare & Vandenberghe, 2024; Kaiser et al., 2020; Lee, 2019; Milicev et al., 2023). This model has been widely applied across various occupations, including occupational health psychology, medicine, telecommunications, human resource management, and public sector enterprises (Adil & Baig, 2018; Akkermans et al., 2013). We extend this JD-R model to understand the PWB of the doctoral students.

It is evident that doctoral students have diverse assignments and responsibilities similar to regular employees. Given the shared psychological experiences of scholars and employees, understanding the demands and resources within PhD students' research environments is crucial (Levecque et al., 2017). To clarify, we will refer to these challenges as 'doctoral program demands,' encompassing the pressures students face in their research and study roles. Owing to the stressful environment of the doctoral program, studies have considered the JD-R model to understand how the resources (supervisor, social, and institution) are effective in enhancing well-being (Byrom et al., 2022; Caesens et al., 2014; Sufyan & Ali Ghouri, 2020; Ueno et al., 2024). However, these studies overlooked the doctoral program demands and its interaction with resources that impact doctoral students' PWB.

The doctoral program demands include interpersonal conflicts with supervisors, peer pressure, a heavy teaching workload, uncertain university PhD guidelines, coursework ambiguity, writing dissertation difficulties, a lack of institutional scholarship, uncertain career paths, ineffective advisory committees, work-family conflict, and publishing the research outcomes in high-quality academic journals (Ayres, 2022; Barry et al., 2018; Berry et al., 2021; Cornwall et al., 2019; Jones, 2013; Mackie & Bates, 2019; Pyhältö et al., 2012; Sin et al., 2021; van Rooij et al., 2021). In contrast, the job resources of the program involve offering frequent training in research, a vibrant research culture, full length of study scholarship, chances for career advancement, funding and journal publication incentives (Haven et al., 2019), peer support, networking, family emotional support, online resources, friends (Boone et al., 2020), emotional support, and supervisor mentorship (Nicholls et al., 2022).

The prior extended JD-R model incorporates personal and job resources for enhancing the well-being of the individual (Schaufeli & Taris, 2014). Personal resources effectively moderate the relationship between job demands and exhaustion, mediate the relationship between job resources and work engagement, and enhance individual well-being (Xanthopoulou et al., 2007). The most important personal resource a PhD student needs to finish their degree is intrinsic motivation (Litalien et al., 2015). Intrinsically motivated individuals find fulfillment and satisfaction in challenging situations that improve their well-being (R. M. Ryan & Deci, 2001). Previous research on doctoral education has focused solely on job resources, neglecting the role of personal resources in mitigating the impact of doctoral demands on scholars' well-being (Caesens et al., 2014; Sufyan & Ali Ghouri, 2020; Ueno et al., 2024). Therefore, grounded on the JD-R model, we presented the interaction effect of demands and personal resources on the PWB. Based on Xanthopoulou et al. (2007), we hypothesized the moderation and mediation role of personal resources between the PhD program demands and PWB. Our

findings have important implications for higher education institutions, practitioners, and supervisors who must meticulously plan their PhD programs to ensure that demands and resources are balanced.

LITERATURE REVIEW

THE RELATIONSHIP BETWEEN DEMANDS AND PSYCHOLOGICAL WELL-BEING

The PWB of the individuals is considered one of the major societal concerns by the Organisation for Economic Co-operation and Development (OECD) (Boarini, 2015; Durand, 2015; Sato, 2018). Each country's government is working harder to improve the mental health of its citizens. PWB encompasses individual well-being, effective daily functioning, positive peer relationships, and personal satisfaction (R. M. Ryan & Deci, 2001). Individuals with high PWB can recognize their strengths, manage their stress, and do well at work (Mendonça et al., 2022). Prior studies have measured the mental health problems of doctoral students in terms of exhaustion (McAlpine et al., 2020) and stressors (Pappa et al., 2020). However, the JD-R model is more suitable for measuring the positive aspects of scholars' mental health, such as PWB, as it considers the interaction effects of job demands and resources within the doctoral program.

The increasing demands of doctoral programs have been documented in earlier studies (Ayres, 2022; Horta & Li, 2023; Mackie & Bates, 2019; Sin et al., 2021; van Rooij et al., 2021). PhD program demands refer to the physical, psychological, social, and organizational aspects of the doctoral program that require effort. Prior studies have considered the impact of doctoral program demands on program satisfaction, performance, intentions to leave academia, students' completion, achievement, and well-being (Ayres, 2022; Berry et al., 2021; Cornwall et al., 2019; van Rooij et al., 2021). However, these studies overlooked the adverse impact of program demands on the PWB of the scholars using the JD-R model. As a result, we propose the following hypothesis:

H1: Doctoral program job demands can negatively predict the psychological well-being of doctoral students.

According to the JD-R model, job demands positively predict job strain (Schaufeli & Taris, 2014). Job strain occurs when job demands exceed job resources (Murtin et al., 2024). Workplace strain is common, impacting 30-40% of the labor force, and it can differ greatly between nations and professional specializations, resulting in negative psychological, physical, and behavioral effects (Steiber & Pichler, 2015). Work-related demands positively predict burnout among health service psychology doctoral students (Swords & Ellis, 2017). However, a PhD is deemed to be stressful (Pervez et al., 2021).

Hence, we hypothesized the impact of doctoral program demands on job strain among scholars. Job strain adversely affects employee health, leading to a higher chance of depression and organizational productivity and performance (Arji et al., 2023; Gómez Ortiz et al., 2020). A study on university professors found that emotional strain positively correlates with workload, disputes with coworkers, and program ambiguity and is inversely associated with well-being (Martini et al., 2019). In line with these findings, we propose two hypotheses:

H2: Doctoral program demands can positively predict the job strain of doctoral students.

H3: Job strain can negatively predict the psychological well-being of doctoral students.

Doctoral program demands, such as workload, role responsibility, and role complexity, adversely impact the scholars' motivation (Sverdlik & Hall, 2020). Program demands, specifically the pressure to complete the program on time, impact the motivation value for scholars (Kelley & Salisbury-Glenon, 2016). Recent studies have found that certain program demands, termed hindrance demands, stimulate scholars' motivation, while other program demands threaten their intrinsic motivation (Acharya et al., 2024; Bran et al., 2024; Kulikowski et al., 2019; Liu et al., 2023; McCauley & Hinojosa, 2020). These mixed arguments in the literature have created a space for additional discussion to

determine how PhD program demands affect students' intrinsic motivation. Direct evidence supporting the claim that demands negatively predict intrinsic motivation is lacking. As a result, we make the following hypothesis:

H4: Doctoral program demands can negatively predict the intrinsic motivation of doctoral students.

ROLE OF INTRINSIC MOTIVATION IN DEMANDS AND PWB

The extended JD-R model suggests that, besides job resources, personal resources are essential for handling job demands and achieving well-being (Bakker et al., 2023). Personal resources are positive-oriented self-perceptions and are linked to resilience. Quigley and Tymon (2006) argue that intrinsic motivation empowers individuals to shape their environments and achieve career goals. Notably, Xanthopoulou et al. (2013) found that intrinsic motivation can buffer the negative effects of job demands on well-being. Previous research has identified resilience, self-efficacy, fulfilling psychological needs, optimism, self-esteem, and organization-based self-esteem as crucial personal resources that can act as either moderators or mediators within the JD-R model (Bakker & Demerouti, 2017; Schaufeli & Taris, 2014; Xanthopoulou et al., 2007, 2013). Intrinsic motivation is a crucial personal resource for PhD students, as it reduces dropout intentions (Litalien et al., 2015). Intrinsically motivated scholars tend to achieve better results, experience higher job satisfaction, and demonstrate greater dedication in their work (Sverdlik & Hall, 2020; Zhou, 2015).

Work environments that foster learning, development, and personal improvement create feelings of challenge and competence, thereby stimulating intrinsic motivation (Putra et al., 2017). Self-determination theory (SDT) posits that intrinsically motivated individuals proactively seek job resources to fulfill their basic psychological needs of autonomy, relatedness, and competence (Leung et al., 2014; Shin et al., 2022). Intrinsically motivated doctoral students excel in their work, willingly take on complex tasks, persevere through challenges, and enjoy learning (Lynch et al., 2018). Faculty advisors highlight the critical importance of intrinsic motivation in research to nurture independent and self-sufficient scholars. They recognize its ability to mitigate the negative effects of complex demands (Viseu et al., 2022; Zhou, 2015). Intrinsic motivation and well-being are interconnected with supervisory practices that support doctoral students' basic psychological needs of autonomy, competence, and relatedness (Kumar & Kaur, 2019). By integrating these insights, we propose the following hypothesis:

H5: Intrinsic motivation can positively predict the psychological well-being of doctoral students.

MEDIATION ROLE OF JOB STRAIN AND INTRINSIC MOTIVATION

The JD-R model emphasizes that job strain mediates the relationship between job demands and health problems, while engagement mediates the link between job resources and turnover intention (Schaufeli & Bakker, 2004). However, Angelo and Chambel (2012) showed proactive coping as a personal resource partially mediates the association between job demands and burnout. Baka (2015) reported full mediation of job strain in the link between demand and performance. Mixed findings in the literature underscore the complex relationship between job demands and well-being, suggesting a need for further research on the mediating role of job strain. While previous studies have examined the mediating role of job strain between job demands and negative outcomes, further research is needed to fully comprehend the influence of job strain on the relationship between job demands and positive outcomes such as PWB.

H6: Job strain mediates the relationship between doctoral program demands and the psychological well-being of doctoral students.

The dual-path JD-R model demonstrates that engagement mediates the relationship between well-being and job resources (Schaufeli & Taris, 2014). Personal resources function as mediators and

predictors on the motivational axis of the JD-R model. Lynch et al. (2018) linked doctoral students' intrinsic motivation to increased creativity and PWB. Performance and self-concept are positively associated with the intrinsic motivation of the PhD student (Guo et al., 2024). Garn and Stenling (2024) determined that intrinsic motivation mediates the relationship between scholars' study time and extrinsic motivation. However, literature lacks research on the mediating role of intrinsic motivation in improving the psychological well-being of doctoral students. Based on these gaps, we hypothesized that intrinsic motivation would mediate increases in PWB and reduce the negative effects of PhD demands on job strain. This research provides an opportunity to investigate how personal resources, such as intrinsic motivation, act as buffers against the pressures of a PhD program within the extended JD-R model.

H7: Intrinsic motivation mediates the relationship between doctoral program demands and the psychological well-being of the doctoral students.

THE MODERATING EFFECT OF INTRINSIC MOTIVATION

Self-determination theory (SDT) explains the positive relationship between well-being and intrinsic motivation. According to SDT (Deci & Ryan, 2008), intrinsically motivated individuals prioritize activities that fulfill their fundamental needs for relatedness, autonomy, and competence. Autonomous motivation, a form of intrinsic motivation, can account for the positive correlations between job demands and well-being (Tadić Vujčić et al., 2017). Intrinsic motivation moderates the association between job demands and mental health problems, indicating that motivation effectively reduces the adverse effects of job demands on distress (Trepanier et al., 2013). Thus, intrinsic motivation acts as a catalyst to enhance well-being and buffer the impact of job demands on distress. However, the underlying psychological mechanisms by which intrinsic motivation mitigates demands on PWB remain unclear. Karazsia et al. (2014) explained that a single variable can function as both a mediator and a moderator. Thus, we integrated the mediating, and moderating roles of intrinsic motivation can deepen our understanding of the complex phenomena within the JD-R model, thereby enhancing both theory development and its implications (Hayes, 2018; Karazsia & Berlin, 2018; Karazsia et al., 2014). In light of these arguments, the proposed study investigates the moderating and mediating roles intrinsic motivation plays in the demands, job strain, and PWB. We suggest that intrinsic motivation is a vital personal resource, especially for doctorate students who encounter enormous program demands to complete the doctoral journey. The conceptual model of the study is shown in Figure 1.

H8: Intrinsic motivation moderates the relationship between doctoral program demands and the psychological well-being of the doctoral students.

H9: Intrinsic motivation moderates the relationship between doctoral program demands and the job strain of the doctoral students.

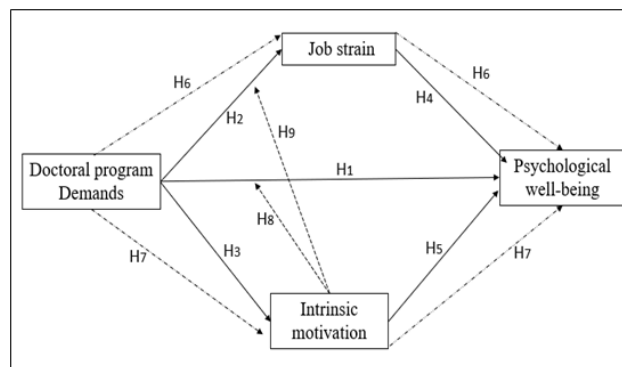


Figure 1. Proposed research model: multiple moderation and mediation between the JD-R model and psychological well-being

METHODS

DESIGN AND PARTICIPANTS

The study addressed research questions: (1) how do the doctoral program demands impact the job strain and PWB of the scholars? and (2) how does intrinsic motivation play a role in mediation and moderation in the conceptual model? We conducted a cross-sectional study using a multistage sampling technique to comprehensively assess doctoral students' perceptions of program demands and intrinsic motivation in India. This approach allowed us to systematically narrow down our sample from a broad population of social science disciplines. We propose that PhD students' unique challenges in social sciences – such as a strong emphasis on qualitative research, extensive fieldwork, and the expectation to produce publishable work – may lead to increased stress and burnout. We aim to contribute to a more comprehensive understanding of the factors impacting doctorate students' PWB by looking at this social science doctoral cohort. According to AISHE, the study population comprised 55,029 doctoral scholars enrolled in Social Science PhD programs between 2019–2020 and 2022–2023.

In the first stage, we selected institutions that demonstrated high academic standards, as indicated by the National Institutional Ranking Framework (NIRF) rankings and guided by National Assessment and Accreditation Council (NAAC) accreditation and data reported in the All-India Survey on Higher Education (AISHE). Here, we considered universities that were NAAC-accredited and among the top 100 by the NIRF as distinct strata. This stratification ensured that our sample represented a spectrum of educational experiences within top-tier academic environments, which is crucial for examining the nuanced impacts of doctoral program demands, job strain, and intrinsic motivation on PWB. In the second stage, the strata are subdivided into deemed universities, central universities, state-owned universities, and private institutions. The number of institutions offering doctoral programs in each category varies based on approvals from the All-India Council for Technical Education (AICTE), India. In the third stage, we considered only the full-time scholars. We distributed the online survey to all scholars whose email addresses were obtained from the websites of the top 100 ranked institutions. Employing simple random sampling, we invited all scholars to complete the questionnaire, ensuring equal probability of participation for each sample. Finally, respondents were PhD students from 28 Indian states.

We developed an online survey and rigorously pilot-tested it with a subset of the target population comprising 52 scholars from two Indian states. The pilot test ensured the questions' clarity, relevance, and readability in capturing the study's constructs. Feedback from the pilot phase necessitated minor wording adjustments for improved comprehensibility and response accuracy, primarily addressing spelling and layout issues. The main study questionnaire explained the research objectives and assured participants of privacy and confidentiality. It consisted of two sections: the first section gathered demographic information, including gender, university type, doctoral program registration year, and financial aid status, and the second section contained questionnaires on research constructs (doctoral program demands, personal resources, job strain, and PWB). The survey included 29 items related to the study constructs.

By the end of February 2024, we collected 423 responses, achieving a response rate of 53%. We excluded 21 respondents from non-social science disciplines and 11 part-time PhD students, resulting in a final sample of 391 for analysis. The data came from 391 full-time doctoral students in social sciences from central, private, state-owned, and deemed-to-be universities in India. We used this data to test the hypotheses derived from the conceptual framework.

INSTRUMENTS AND MEASURES

The study employed the 5-point Likert scale to measure the constructs of the hypothesized model except for PWB, which is a 4-point Likert scale.

Doctoral program demands state that “institutional, individual, job, and social characteristics of the job that need continued institutional and individual psychological skills and are, therefore, connected with certain tangible and intangible costs” (Acharya et al., 2024, p. 234). We adopted the challenges and hindrances demands scale developed and validated by Acharya et al. (2024), containing ten items across four dimensions: ambiguity of the PhD program, lack of resources, workload, and program complexity. An example of the demand for a doctoral program is, “There were often many uncertain rules to comply with my university norms.” The Cronbach’s alpha for challenge and hindrance demands is 0.841.

Job strain is the psychological imbalance perceived by the scholar due to the dynamic nature of the PhD program, contributed by external and internal stimuli, including factors related to self, social, and program structure and design. We measured job strain using the Maslach Burnout Inventory (MBI) (Maslach & Jackson, 1981). The Cronbach’s alpha for the 5-item scale was 0.882. A sample item is “I feel emotionally drained from my PhD.”

Psychological well-being is “that part of doctoral student’s overall well-being is primarily influenced by their PhD role and can be affected by university and/or institution-based interventions” (Juniper et al., 2012., p. 565). This definition applies to doctorate students. An 8-item scale with a 2-factor model of “social dysfunction” and “anxiety” was used in the General Health Questionnaire (GHQ) to measure the PWB of doctoral students (Kalliath et al., 2004, p.326). Levecque et al. (2017) have considered this GHQ scale to report mental health problems among PhD students. Here, we coded 3 as “better than usual” and 0 as “much worse than usual.” One of the statements was, “I am feeling unhappy or depressed.” The Cronbach’s alpha for the 8-item scale was 0.836.

Intrinsic motivation is the engagement of the students in PhD-related work to experience the pleasure and satisfaction inherent in the doctoral program and is the highest level of self-determination for scholars. We measured intrinsic motivation using Motivation for PhD studies developed by Litalien et al. (2015). The scale consists of six items and measures two aspects of motivation: controlled and autonomous. Cronbach’s alpha for the 6-item scale was 0.819.

CONTROL VARIABLES

Previous studies have demonstrated the significant impact of demographic characteristics on PWB (Rhee & Choi, 2017). Thus, we controlled the impact of the following factors on PWB: gender, kind of university, enrollment date (PhD stages), married status, and financial assistance (scholarship). We followed the instructions provided by Bernerth et al. (2018) for conducting our hypothesis testing both with and without the control variables. According to research by Bernerth et al. (2018), the parsimony of the regression model may be impacted by the inclusion of non-significant variables. Consequently, we finally incorporated the control variable that exhibited substantial correlations.

RESULTS

DATA SCREENING, MISSING VALUES, NORMALITY, COMMON METHOD BIAS

Our web-based survey design ensured complete responses from all participants, resulting in a dataset without missing value. We screened the responses for duplicate entries using MS Excel. To assess the presence of outliers, we employed z-scores for univariate analysis and the Mahalanobis distance for multivariate analysis, with all data points falling within acceptable ranges. The findings support the conclusion that the collected data exhibits a normal distribution. Harman’s single-factor test assessed common method bias, accounting for 21.14% of the total variance across all items, indicating no significant risk of common method bias, as a single factor does not explain more than 50% of the variance.

DESCRIPTIVE ANALYSIS

Table 1 presents the respondents' demographic characteristics. 47% of the participants were from state-owned universities, followed by 29.4% from central universities, 15.4% of respondents were from Deemed-to-be universities, and the remaining were from Private universities. The number of institutions affiliated with state-owned universities is higher. Hence, we received a maximum response from State-owned universities compared to other universities. Male respondents were 47.4%, and 52.6% were female scholars, representing an almost equal sample distribution. 57.8% of the respondents have scholarships for their doctoral program, and 42.2% have limited access to financial aid. 49.3% of the scholars were unmarried, 29.4% were married, without having kids' responsibility, and 21.3% had one or two kids at home to take care of. The mean, standard deviation, and values of the study construct are reported in Table 2. Doctoral program demands were positively correlated with job strain ($r=0.589$, $p<0.001$), negatively correlated with intrinsic motivation ($r=-0.073$; $p<0.05$), and PWB ($r=-0.198$; $p<0.01$). Similarly, job strain was negatively correlated with intrinsic motivation ($r=-0.139$; $p<0.01$) and PWB ($r=-0.281$; $p<0.001$). Likewise, intrinsic motivation was positively correlated with PWB ($r=0.136$; $p<0.001$).

Table 1. Participant demographical information

Respondent characteristics		Frequency	% of participants
Number of participants		391	
Type of University	Central	114	29.4
	Deemed	62	15.8
	Private	30	7.6
	State-owned	185	47
Gender	Female	206	52.6
	Male	185	47.4
Financial Assistant	Yes	226	57.8
	No	165	42.2
Marital status	Unmarried	193	49.3
	Married, no children	114	29.4
	Having one or two children at home	84	21.3

Table 2. Correlations, AVE, and CR values the variables

Variables	Mean	SD	1	2	3	4
DPD	3.36	0.978				
JS	2.81	1.08	0.589***	(0.773)		
IM	4.20	0.694	-0.073*	-0.139**	(0.560)	
PWB	0.86	0.674	-0.198***	-0.281***	0.136***	(0.482)
VIF			1.98	1.804	1.538	1.361
CR			0.871	0.842	0.848	0.835
AVE			0.634	0.660	0.735	0.629

DPD = doctoral program demands, JS = Job Strain, IM = Intrinsic Motivation, PWB = Psychology well-being. The reliability of scales is in parentheses along diagonals.

Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$

ASSESSMENT OF THE MEASUREMENT MODEL USING RELIABILITY AND VALIDITY

We performed internal consistency, convergent and discriminant validity, and hypothesis testing using SPSS AMOS 24.0 (Sarstedt et al., 2019). We assessed the reliability of the study constructs by calculating Cronbach's alpha coefficients and composite reliability (CR). Cronbach's alpha coefficients ranged between 0.819 and 0.882, with values above the threshold of 0.80. Similarly, the study confirms the CR range from 0.835 to 0.871. Hence, it confirms the reliability of the measurement model. Cronbach's alpha coefficient value and a CR indicate strong internal consistency among the items within each construct. Table 2 illustrates that the constructs' AVE greater than 0.5 and CR above 0.7 underscore convergent validity. To measure the discriminant validity of the study, we used the Fornell-Larcker criterion (Fornell & Larcker, 1981). As the square root of each AVE (Table 2) is greater than the corresponding correlations, our findings support the discriminant validity of the constructions. This suggests that the measures used effectively capture the unique variance of each construct and that they are distinct from each other in Table 2. We concluded that all constructs' psychometric qualities were established as the convergent and discriminant validity values were satisfactory.

MODEL FIT INDICES:

Confirmatory factor analysis evaluated the factor structure of the hypothesized model. The dimensions in our proposed conceptual model showed an excellent model fit ($\chi^2/57 = 202$, $p < 0.001$; CFI = 0.945; TLI = 0.934; SRMR = 0.049; and RMSEA = 0.044). The acceptable model cutoff for RMSEA and SRMR is less than 0.08 (Hair et al., 2017), while the threshold value for CFI, TLI, and GFI is larger than 0.9 (Hair et al., 2019). Our one model structure represents the values: $\chi^2(57) = 234$; $p < 0.001$; CFI = 0.921; TLI = 0.868; SRMR = 0.052; and RMSEA = 0.077. Fit indices indicated that the model had a good fit.

STRUCTURAL MODEL ASSESSMENT:

We established a structural model by adopting a multicollinearity test with the variance inflation factor (VIF) and the explanatory and predictive power of the model (R^2 and Q^2 statistics) (Henseler et al., 2015). Compared to other endogenous constructs, the highest inner VIF value, 1.98, corresponds to doctoral program demands; this value is below the threshold value, indicating the absence of multicollinearity. The coefficient of determination (R^2) gives explanatory power to every research concept. The R^2 value of PWB accounted for 40.5% of the variance, indicating the moderated to substantial explanatory power of the endogenous constructs, explained by the study's independent variables. Using the blindfolding method, the predictive power (Q^2) of PWB is obtained as 0.208, which is less than the threshold value of zero. The result validates the value of our hypothesis model in anticipating PWB based on doctoral program demands and personal resources.

HYPOTHESIS TESTING

The study utilized SPSS AMOS 24.0 software to analyze the direct paths within the conceptual model. Additionally, the PROCESS macro (Hayes, 2018) was employed to determine the effects of mediation and moderation on doctoral students' PWB.

Direct effect

The study assessed the impact of doctoral program demands on job strain, intrinsic motivation, and psychological well-being. We also examined the impact of job strain and intrinsic motivation on the PWB. The impact of DPD on PWB was negative and significant ($\beta = -0.355$, $t = -9.12$, $p < 0.001$) supporting H1. The impact of DPD on job strain was positive and significant ($\beta = 0.746$, $t = 13.1$, $p < 0.001$), hence H2 was supported. The impact of job strain on PWB was negative but significant ($\beta = -0.331$, $t = -12.46$, $p < 0.001$), hence H3 was supported. The impact of DPD on intrinsic motivation was negative and significant ($\beta = -0.0096$, $t = -0.219$, $p = 0.027$), hence H4 is supported. Finally,

the impact of intrinsic motivation on PWB was positive and significant ($\beta = 0.284, t = 6.03, p < 0.001$), hence H5 was supported. The study reported significant results only with gender and insignificant results with registration date, type of university, marital status, and financial assistance. Controlling gender revealed a significant positive effect of DPD on PWB ($\beta = 0.746, t = 2.49, p = 0.013$) and DPD on job strain ($\beta = 0.186, t = 2.03, p = 0.023$). The hypothesis findings are shown in Table 3, and Figure 2 provides a detailed structural model analysis.

Table 3. Hypothesis results (direct effect)

Hypothetical paths	Standardized coefficient (β)	SE	t-value	p-value	Decision
H1: DPD → PWB	-0.355	0.038	-9.12	<0.001	significant
Gender	0.154	0.061	2.49	0.013	significant
H2: DPD → JS	0.746	0.057	13	<0.001	significant
Gender	0.045	0.070	0.648	0.517	not significant
H3: JS→ PWB	-0.331	0.026	-12.46	<0.001	significant
Gender	0.186	0.091	2.03	0.023	significant
H4: DPD → IM	-0.009	0.044	-0.219	0.027	significant
Gender	0.081	0.056	1.41	0.159	not significant
H5: IM→ PWB	0.284	0.047	6.03	<0.001	significant
Gender	0.133	0.065	2.04	0.019	significant

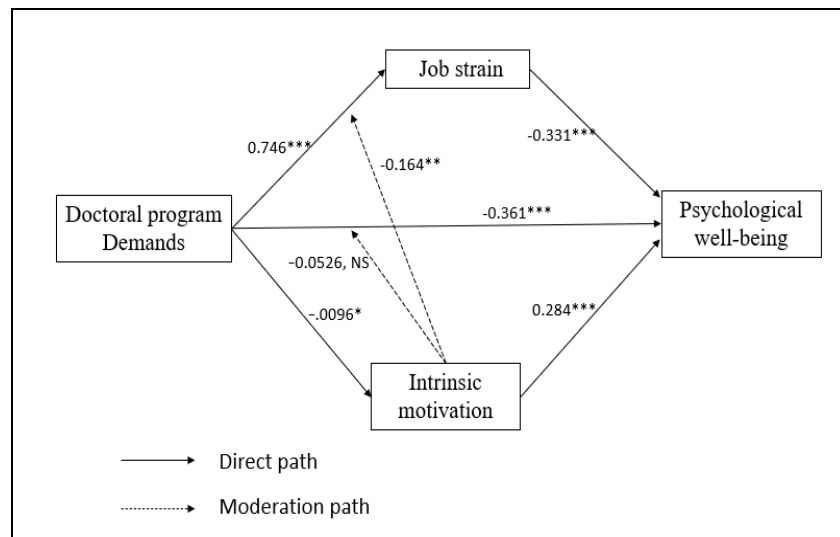


Figure 2. Structural model

Mediation analysis

The study evaluated the mediating function of intrinsic motivation (IM) and job strain on the associations between DPD and PWB. H6 was supported by data, which showed a substantial indirect effect of DPD on PWB through JS ($\beta = 0.202, t = 7.20, p < 0.001$). Additionally, H7 results showed a significant indirect impact of DPD on PWB through IM ($\beta = 0.0027, t = 9.571, p < 0.001$). Table 4 displays the mediation analysis results.

Table 4. Hypothesis results (mediation)

Relationship paths	Direct effect	Indirect effect	Total effects	Confidence interval	t-statistics	Boot SE	p-value	Decision
H6: DPD→JS → PWB	0.153	0.202	0.355	[0.2788, 0.0691]	7.20	0.0388	<0.001	significant
H7: DPD →IM → PWB	0.3521	0.0027	0.354	[0.026, 0.4242]	9.571	0.0318	<0.001	significant

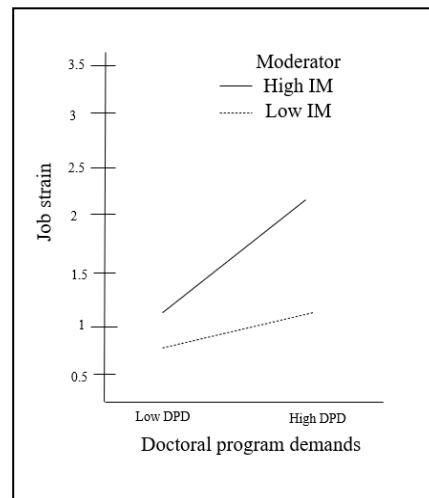
Moderation analysis

The study evaluated the moderating effect of intrinsic motivation on the link between job strain, DPD), and PWB. The findings did not support H8, which shows that IM had an insignificant moderating effect on the link between DPD and PWB ($\beta = -0.0526$, $t = -0.916$, $p = 0.360$). The findings supported H9 by showing that IM had a negative and significant moderating influence on the link between DPD and JS ($\beta = -0.164$, $t = -2.35$, $p = 0.019$). Table 5 displays the summary of the moderation analysis.

Table 5. Hypothesis results of moderation

Relationship	Beta	t-statistics	p-value	CI	Decision
H8: DPD *IM → PWB	-0.0526	-0.916	0.360	[-0.451, 0.0876]	not significant
H9: DPD *IM → JS	-0.164	-2.35	0.019	[-0.295, -0.0193]	significant

Simple slope analysis results were conducted to understand the moderating effects' nature better. Figure 3 illustrates how much steeper the line gets at higher intrinsic motivation (IM). This demonstrates that the impact of DPD on job strain is significantly less at high IM levels than at low IM levels. The strength of the link between DPD and job strain decreased as the level of IM increased, as Figure 3 illustrates. Here, we infer the outcome of the moderating effects of intrinsic motivation.

**Figure 3. The moderating effect of intrinsic motivation**

DISCUSSION

Within the framework of the JD-R model, this study investigates the effects of doctorate program demands on job strain, intrinsic motivation, and PWB of doctorate students, as well as the mediating role of job strain and intrinsic motivation on PWB. The results support H1 and H2 and show that

the demands of PhD programs hurt the PWB and have a considerably favorable impact on job strain. Similar findings were reported by Naidoo-Chetty and du Plessis (2021), who determined that excessive academic demands in higher education and limited resources can diminish the well-being and performance of the students using the JD-R model. In line with the above literature findings, our study also witnessed that doctoral program demands on scholars negatively affect PWB due to excessive exhaustion and distress. The findings of Bran et al. (2024) and Acharya et al. (2024) indicate that demands threaten the internal motivation of doctoral students; this result supports our hypothesis H4. Our findings of H3 are consistent with those reported by Park et al. (2021), that master's and doctoral students experience a high burnout rate and psychological distress, with stressors such as thesis, classwork, and financial support. The findings imply the need for systemic changes and integrative efforts to improve the well-being of PhD students.

Moreover, in H5, the study reveals that the intrinsic motivation of the scholars has substantial positive effects on PWB, consistent with the results of Kumar and Kaur (2019). This hypothesis suggests that intrinsically motivated individuals experience a sense of well-being and personal growth; fulfilling their inner desires and interests contributes to their overall happiness and satisfaction. In addition, the intrinsic motivation of the doctoral scholar is correlated with psychological needs, contributing to feelings of autonomy, competence, and relatedness, as supported by Kumar and Kaur (2019). Furthermore, prioritizing intrinsic motivation over extrinsic enhances learning, performance, creativity, optimal development, and PWB. Doctoral students with higher intrinsic motivation are less susceptible to burnout symptoms and engage in less dissent, indicating better PWB.

This study is the first to examine the dual mediating effects of intrinsic motivation and job strain in the links between the demands in PhD programs and PWB. H6 and H7 confirm the assumptions of dual mediation of the JD-R model as similar to Schaufeli and Taris (2014). Thus, it substantiates the health impairment process between high DPD and strain, whereas the motivational process is between personal resources and well-being. In H9, the study proves a strong moderating effect on the relationship between demands from doctoral programs and job strain. However, insignificant results are revealed when examining the moderating influence of intrinsic motivation between demands and PWB, indicating that H8 is not supported. However, in line with earlier research by Kohnen et al., (2023), Parker et al., (2017), and Trepanier et al., (2013), intrinsic motivation plays a role in diminishing the connections between demands and job strain. Higher levels of autonomy, competence, and relatedness among scholars reduce the effects of their demands on job strain, according to the moderating effect of intrinsic motivation. Conversely, a lower psychological need among scholars enhances the impact of demands on job strain. Therefore, the main conclusion from the findings is that intrinsic motivation, acting as stimuli, intrinsically motivated employees may cope better with job demands, leading to improved PWB. Echoing Schaufeli and Taris' (2014) report, intrinsic motivation emerges as an antecedent of PWB operating independent personal resources. Students with high intrinsic motivation experienced less job strain, even under demanding workloads, aligning with the SDT, which underscores the importance of a supportive environment in nurturing intrinsic motivation and PWB. A potential explanation is that, in a learning environment, students' own motivation and interest might play a more pivotal role in PWB than the resources provided by the university. This notion is in harmony with the SDT's principle that individuals thrive when their basic psychological needs for competence, autonomy, and relatedness are met.

IMPLICATIONS OF THE STUDY

This study is one of the first to apply the JD-R model to doctoral student PWB, extending the model's scope beyond traditional organizational outcomes like turnover intention, job satisfaction, and performance. The research provides empirically grounded recommendations for higher education practitioners, institutions, and supervisors grounded on SDT. To capitalize on doctoral student PWB and mitigate mental strain, institutions and supervisors should prioritize initiatives that foster autonomy, competence, and relatedness.

Institutions should provide opportunities for doctoral students to select courses relevant to their study area during the coursework stage that enhance their sense of autonomy (T. Ryan et al., 2022). Institutions can foster scholars' autonomy by providing individualized instruction, elective courses, and problem-solving activities aligned with students' chosen fields. Student participation in curriculum development and subject-related decisions boosts their sense of autonomy, ultimately empowering them. Developing relationships with supervisors, professionals, and fellow doctoral students strengthens the sense of relatedness among students. Educational institutions can foster this sense of relatedness by creating mentorship programs pairing students with experienced professionals or supervisors. Formal and informal peer collaborations, team-based learning, and group projects can facilitate networks among peers with similar interests. Encouraging participation in conferences, seminars, extracurricular activities, and social events further strengthens interpersonal bonds between students and supervisors. A comprehensive support network of institutions and supervisors enhances the competencies of PhD students. Here, the institution recommended prioritizing educating their scholars in research methodology, data analysis, interpretation of the study result, writing journal articles and thesis, classroom teaching strategies, and career planning. Engaging students with access to research equipment, licensed access to research databases, laboratory facilities, and relevant software for analysis indirectly bolsters scholars' competencies. Supervisor's constructive professional feedback on research proposals, journal articles, and grant applications further develops students' competence. Contingent to SDT, the holistic approach provided by institutions and supervisors enhances the PWB of the scholars.

Also, the institution's specific and attainable demands reduce the stress among doctoral students, while open and frequent meetings enable scholars to discuss challenges without apprehension. Institutions can enhance student's confidence by expressing empathy, recognizing their accomplishments, respecting their personal space, and promoting a healthy balance between their academic and personal lives. Open communication with supervisors enables the students to talk about their workload, challenges, and interests, and in response, supervisors can offer advice and assistance. A more successful PhD path may result from a supervisor who fosters a student's enthusiasm, curiosity about their subject, growth mindset, self-discovery activities, and love of learning. Supervisors can talk about how their students' research affects society, how it ties into the larger context, and how to give their studies a deeper feeling of responsibility.

Institutions can create a nurturing environment by offering interactive sessions with demonstrations, hands-on exercises, and insights into artificial intelligence (AI) tools that help doctoral students flourish. Furthermore, granting access to relevant research AI tools through library subscriptions or university licenses is key. Institutions and supervisors stay updated on the latest research AI tools, including access to powerful academic search engines, text summarization tools that condense lengthy papers, concept generation tools, data analysis, writing assistance, and citation management with AI integration. Institutions may develop clear ethical guidelines on using AI tools in research, which is crucial to address potential issues like bias, plagiarism, and proper attribution.

LIMITATIONS AND DIRECTION FOR FUTURE RESEARCH

The research presented here points out a few limitations and provides ideas for more investigation. First, there are concerns over the generalizability of the findings to other doctorate students' disciplines because the sample was limited to full-time social science PhD students in India. Subsequent research endeavors could explore the model's generalizability to disciplines like medical, STEM, and full-time scholars. Second, a self-administered survey method was used in key Indian cities to gather cross-sectional data for the study. The study's depth could be increased by extending the investigation to a more extensive and heterogeneous sample. Third, while correlations were found between PWB, doctoral program demands, job strain, and intrinsic motivation, the study could not determine how other job resources affected PWB. The study ultimately concentrated on how the SDT framework's autonomy, relatedness, and competence elements affect the doctorate student's intrinsic motivation and PWB. Additional personal resource characteristics, like grit, self-efficacy, and optimization in

different samples, may be the subject of future study. Furthermore, integrating variables such as job crafting, transformational leadership, and work engagement relationships may augment future comprehension of the JD-R and SDT framework.

CONCLUSION

This study is among the first to empirically examine the significance of intrinsic motivation as a personal resource in a high-demand setting that influences student PWB, adding to the JD-R model literature. These results support the idea that competence, autonomy, and relatedness are essential to moderate job strain among students, which aligns with the assumptions of SDT theory. The current cross-sectional study results further revealed that job strain and intrinsic motivation mediate the relationship between doctoral program demands and PWB, which support the health impairment and motivation process of the JD-R model in the doctoral education context. By utilizing personal resources, this study clarifies the mechanisms underlying the association between job demands and intrinsic motivation to lessen job strain. Future research should focus on developing and evaluating different interventions to enhance intrinsic motivation and well-being among doctoral students.

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AUTHORS



Dr. Vrinda Acharya graduated with a Ph.D. in Psychological well-being of doctoral students in social science from Manipal Academy of Higher Education, Manipal. She is an assistant professor at the Department of Commerce, Manipal Academy of Higher Education, Manipal. Her teaching and research interests include Human Resource Development, Statistics, business analytics, and human psychology. She has over 13 years of experience in education, teaching Bachelor of Business administer students. Email: vrinda.doc@manipal.edu



Dr. Mathew Thomas Gil is an Assistant Professor Sr. Scale at the Department of Commerce, MAHE, Manipal. With an engineering background, he earned an MBA in Marketing and Human Resources and a doctorate in Management from Anna University, India. Dr. Gil has a combined experience of one year in industry and seven years in academia. His research interests encompass marketing, consumer behavior, green marketing, gender-based studies, entrepreneurship, quality management, and bibliometric studies. He has delivered guest speeches, facilitated workshops, and published in international journals, also serving as a reviewer for respected publications like Sage Open, Sustainability, Cogent Business & Management, AJSTID, AWMH, IJERPH, Simulation, FIIB Business Review (FIB) SAGE, and WORK: A Journal of Prevention

Assessment & Rehabilitation.



Dr. Aneesha Acharya K is currently working as an Assistant Professor (Sr. Scale) in the Department of Instrumentation and Control Engineering, MIT, Manipal Academy of Higher Education, Manipal, Karnataka, India. He has around 13 years of experience in the field of teaching and research. He holds a PhD in Hand Rehabilitation from Manipal Academy of Higher Education, Manipal, Karnataka, India. He has ten publications in peer-reviewed journals. His area of interest is Biomedical Instrumentation and qualitative research. Email: ak.acharya@manipal.edu