The Mediating Role of Basic Psychological Needs Satisfaction Between Transformational Leadership and Work Motivation of Predoctoral Researchers at German Professorships

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This study examines the relationship between predoctoral researchers' perceptions of transformational leadership and their autonomous work motivation, with basic psychological need satisfaction (autonomy, relatedness, and competence) as a mediator. Based on the full range leadership model and self-determination theory, hypotheses are tested using an online survey (n=1,969) conducted from March to May 2022 among professors and their academic staff at German research universities in the fields of business administration, biology, mechanical engineering, and sociology. For the subsample of predoctoral researchers (n=1,005), the structural equation model reveals that transformational leadership increases autonomous work motivation through perceived autonomy and competence, whereas perceived relatedness has a negative effect. In addition, academic career aspirations positively influence autonomous work motivation, while gender has no significant effect. These findings highlight the role of transformational leadership in promoting basic psychological needs satisfaction among emerging scientists.

Keywords: self-determination theory, work motivation, predoctoral researchers, transformational leadership, basic psychological needs, professorships, Germany

INTRODUCTION

Transformational leadership, the core of the full range leadership model (FRLM), has been extensively studied in various organizational contexts. It is characterized by the ability to inspire and motivate followers to achieve higher performance and personal development. This leadership style has been linked to many positive outcomes across different sectors, including increased employee engagement, job satisfaction, and organizational commitment (Bass & Riggio, 2006; Avolio & Bass, 1995). However, its impact on the academic sector, particularly concerning predoctoral researchers at German universities, remains underexplored. Predoctoral researchers, who are at a critical juncture in their academic and professional development, require a conducive environment that fosters intellectual growth and supports their intrinsic motivational needs (Cornér et al., 2017). Deci and Ryan's self-determination theory (SDT) posits that fulfilling three basic psychological needs—autonomy, competence, and relatedness (basic psychological needs satisfaction; BPNS)—is crucial for enhancing autonomous motivation (Deci & Ryan, 2000). In

higher education research, using motivation theories to explain the micro-macro link has proven fruitful in understanding the relationship between different forms of work-related motivation and the perception of the working environment (Wilkesmann, 2023). Therefore, this study examines the role of transformational leadership in fulfilling these basic psychological needs and how this fulfillment influences the autonomous work motivation of predoctoral researchers. By focusing on this relationship within the context of German universities, the research aims to contribute new insights to the academic field.

Unlike the structured doctoral programs and graduate schools that are common in Anglo-American universities, such frameworks are rare in the German higher education system (Bloch, 2018; De Vogel, 2020). As a result, most German doctoral students are employed as research assistants at universities. A distinctive feature of the German higher education system for doctoral candidates is their dual role as students and employees. Unlike many other higher education systems, they typically enter into an employment contract with the university, specifically with a professor who not only supervises their dissertation but also becomes their boss (Douglas, 2022; Schneiderberg & Teichler, 2018). Thus, this dual relationship places significant emphasis on the supervisor's leadership style, profoundly influencing the doctoral student's perception of their work environment and affecting work-related outcomes.

In 2021, the workforce at public research universities in Germany comprised 25,643 professors, 2,171 lecturers and assistants, and 191,196 scientific staff, plus a significant number of scientific staff working on externally funded projects that are not covered by official statistics (Destatis, 2022a). For 2021, the number of predoctoral researchers financed directly by the university budget (i.e., excluding the number of predoctoral researchers financed by third-party funds) totals 54,439 (Destatis, 2022b).

The organizational structure of German research universities is characterized by the prevalence of professorships (Wilkesmann & Wagner, 2024; Brechelmacher et al., 2015; Fumasoli et al., 2015; Enders, 2001), which serve as basic units of academic administration and research (Clark, 1983; Neave & Rhoades, 1987; Hüther & Krücken, 2018). As such, professorships operate as semiautonomous units within universities and exert considerable influence on research agendas, academic culture, and the professional development of predoctoral researchers: Professors are thus at the head of a research team, which can be small or very large, depending on the discipline, and are tenured civil servants (Höhle, 2015; Teichler & Höhle, 2013). However, academic staff below the rank of professor are—including, with a few exceptions all doctoral students—employed in the public sector on fixed-term contracts. According to the German Academic Fixed-Term Contract Act (Wissenschaftszeitvertragsgesetz), academic staff can be employed at a university with university funding for a maximum of six years before obtaining a doctorate and six years after the doctorate, whereby the contractually agreed weekly working hours can range from 20 hours to 40 hours. If they do not secure one of the few permanent positions by then, they can only be financed by third-party funds after the six-year period has expired.

While the structural working conditions of early career researchers and leadership styles of German professors have already been addressed in national studies (Schmidt & Richter, 2009; Gassmann, 2018; Moll & Kretschmar, 2017), research on the interplay between the organization and leadership of professorships and the individual level has been scarce. Braun et al. (2013) explored the link between leadership of academic research teams and how it affects team-level performance and individual job satisfaction. Wilkesmann and Wagner (2024) applied a mixed-methods approach to work out the particularities of the internal organization and division of labor at German professorships along Ahrne and Brunson's (2011) five criteria that define organization (membership, hierarchy, rules, monitoring, and sanction). At the international level, the research groups led by Jensen et al. (2021) and Aboagye et al. (2021) provide more recent findings on the organization of departments. However, the transferability of these findings is limited because universities in German-speaking countries are generally not organized along departmental structures. Thus, this article combines SDT and the FRLM in the specific case of German professorships and analyzes two aspects that have received little attention in higher education research:

(1) How does transformational leadership affect basic psychological needs satisfaction (autonomy, competence, and relatedness) of predoctoral researchers?

(2) How does the leadership behavior of professors affect the work motivation of predoctoral researchers, mediated by the three basic psychological needs?

The structure of this article is as follows. First, the theoretical framework is presented, from which three hypotheses are derived. This is followed by a brief description of the sample and a more in-depth exploration of the conditions faced by predoctoral researchers. Subsequent sections describe the measurement instruments used in the study. The statistical analysis section includes descriptive, bivariate, and multivariate results. This article concludes with a discussion that synthesizes key findings, compares them to existing literature, and identifies limitations as well as potential directions for future research.

THEORETICAL FRAMEWORK

Self-Determination Theory

SDT is a widely used framework for understanding work motivation that links perceptions of workplace dynamics to different types of motivation and has been adapted to academic settings (Deci et al., 2017; Ryan & Deci, 2020; Wilkesmann, 2023). According to Ryan and Deci (2000a, 2000b), motivation spans a continuum from extrinsic, where actions are reward-driven, to intrinsic, characterized by self-determination and enjoyment. Intermediate levels of motivation involve varying degrees of internalization and self-regulation. The most extreme form of extrinsic motivation is external regulation, and examples in the academic context include the allocation of research funds or decisions on permanent positions based on publications. This form of motivation is usually linked to specific, measurable outcomes, such as the number of publications in high-ranking journals or obtaining competitive grants. Introjected regulation involves self-reward or punishment, with recent studies finding an increase in guilt among German professors for poorly prepared courses, highlighting internal pressures even in the absence of direct supervision (Wilkesmann & Lauer, 2020). Identified regulation aligns behavior with social norms and professional ethics, essential in research and teaching (Freidson, 2001; Jaffe, 2017). Integrated regulation reflects actions consistent with one's self-concept, promoting engagement in their work-related tasks for those who identify as committed scholars. Intrinsic motivation, free of external influences, drives actions for the intrinsic satisfaction they provide (Wilkesmann & Schmid, 2014). Autonomous motivation includes integrated and intrinsic forms and reflects a self-directed, fulfilling engagement with one's work (Eyal & Roth, 2011; Kanat-Maymon et al., 2020).

SDT highlights the fulfillment of three BPNSs–autonomy, competence, and relatedness–as central to self-motivation and internalization processes (Ryan & Deci 2000a, 2000b, 2020).

(1) Autonomy involves individuals feeling self-organized and free to act according to their own will, which fosters a sense of responsibility for their actions (Ryan & Deci, 2013; Tang et al., 2020). In academia, autonomy allows professors to choose and manage their research topics, suggesting that extending similar autonomy to junior academics could enhance their engagement and development.

(2) Competence (i.e., the belief in one's ability to manage and engage successfully with a situation) is crucial for internalizing external goals (Ryan & Deci 2000a, 2000b, 2013). Professors are often perceived as competent within their domains, raising questions about their role in nurturing this perception among their staff.

(3) Relatedness (i.e., the need for belonging and connection) is a vital component of motivation, particularly in academic settings where individuals align with the social norms of their groups (Ryan & Deci, 2000a, 2000b, 2020; Wilkesmann & Schmid, 2014). This need underscores the importance of internalizing social norms, such as the order of authorship in collaborative publications, to foster autonomous work motivation.

Together, these basic psychological needs highlight the importance of creating an environment that supports autonomy, competence, and relatedness to promote self-directed learning and development within academic contexts (Yasué et al., 2019; Autin et al., 2022).

Research relevance to science or society fosters researchers' intrinsic motivation by emphasizing the impact of their work (Daumiller et al., 2020). Organizational support for autonomy, competence, and

relatedness significantly enhances autonomous work motivation. Autonomy allows for self-directed choices, competence prevents feeling overwhelmed, and relatedness supports the adoption of peer group norms. Meta-analyses confirmed that BPNS enhance autonomous motivation across organizations (Van Den Broeck et al., 2016), highlighting the importance of an environment that fosters these basic psychological needs. This leads to the first hypothesis:

H1: *Perceived autonomy, competence, and relatedness are positively related to autonomous work motivation.*

Full Range Leadership Model

German professors' leadership significantly influences team dynamics, which affects members' work perceptions and motivation. Autonomy granted by professors increases autonomous motivation while promoting competence and fostering relatedness through inclusive leadership increases internalized motivation. The FRLM, which is effective in academic settings (Braun et al., 2013), supports this analysis by emphasizing the role of leadership in motivating team members by addressing their autonomy, competence, and relatedness needs. Bass and Avolio's (1994) FRLM identifies transformational leadership as key to meeting basic psychological needs. As defined by Bass and Riggio (2006), it fosters a purposeful, family team atmosphere that emphasizes long-term goals and shared values. Transformational leaders act as mentors and role models, focusing on the group's well-being rather than individual performance (Bass & Riggio, 2006, pp. 103–104). They motivate team members to exceed standard organizational expectations (Podsakoff et al. 1990, p. 109). The FRLM categorizes transformational leadership into four main components (Bass & Riggio 2006, pp. 6–7):

(1) Idealized influence (providing an appropriate role model; PAM): Transformational leaders exemplify desired behaviors rather than merely dictating them. Professors serve as role models in academia, guiding junior academics through their work ethic and professionalism. In this sense, professors have a socializing function for junior academics into academia.

(2) Articulating a vision (AV): Transformational leaders inspire their teams with a compelling vision for the future. Professors articulate their vision for research and academic development, igniting enthusiasm and optimism among their team members.

(3) Intellectual stimulation (ISN): Transformational leaders encourage creativity and innovation among team members, valuing diverse perspectives. Professors foster independent thinking and encourage staff to approach scientific problems in novel ways.

(4) Individualized support (IS): Transformational leaders provide personalized guidance and support, acting as coaches and mentors. Professors create a supportive environment for staff development, addressing personal concerns and nurturing emotional well-being.

Additional components, as suggested by Podsakoff (1996), include:

(5) Promoting the acceptance of group goals (FAG): Related to the academic context, professors may encourage collaboration among staff by creating a sense of belonging within the research team.

(6) High-performance expectations (HPEs): This facet emphasizes the general high-quality standards in academia and thus professors should also uphold these high-performance standards and drive their team members to excellence, refusing to accept mediocrity.

Research in various contexts showed that transformational leadership significantly increases autonomous work motivation and job satisfaction, in contrast to transactional leadership's tendency toward controlled motivation. Studies by Gagné and Deci (2005), Bono and Judge (2003), Eyal and Roth (2011), Chua and Oluremi (2021), and Kanat-Maymon et al. (2020) confirmed transformational leadership's ability to promote group identification, increase self-efficacy, and support basic psychological needs, resulting in autonomous work motivation among employees.

Furthermore, Hetland et al. (2011, 2015) highlighted the direct correlation between transformational leadership, BPNS, and positive work attitudes, showing BPNS as a mediator in this relationship. Studies

by Messmann, Evers and Kreijns (2022) on Dutch secondary school teachers and Kovjanic et al. (2012, 2013) on organizations in Germany and Switzerland, and Jensen and Bro (2018) on the public sector consistently validated the mediating role of BPNS in fostering innovative work behaviors, job satisfaction, work engagement, intrinsic motivation, and public service motivation under transformational leadership. To sum up, these findings highlight the importance of transformational leadership in fostering a work environment conducive to meeting employees' basic psychological needs and enhancing their motivational outcomes. Accordingly, the last two hypotheses state the following:

H2: *Transformational leadership is positively related to autonomy, competence, and relatedness.*

H3: *A positive relationship between transformational leadership and autonomous work motivation is partially mediated by perceived autonomy, competence, and relatedness.*

EMPIRICAL EVIDENCE

Survey Design and Methods

The data is based on a nationwide online survey of all professors and their academic staff in the fields of business administration, biology, mechanical engineering, and sociology, conducted between March and May 2022. Contacts were made by email, with the email addresses retrieved from the public accessible home pages of the respective professorships between April and September 2021.

A total of 2,280 professors were contacted and 233 completed questionnaires were received. Of these, 27.0% are female and 73.0% are male. The average age is 52.3 years. In addition, 19,520 email addresses of academic staff were contacted. In both cases, a complete survey of the population was conducted. The response rate was 10% (n = 1,969). In the sample, 58.3% are male, 41.3% are female, and 0.4% are diverse. The average age is 35.1 years. 59.3% are working on their doctorate, 37.1% have completed their doctorate, and 3.7% are not pursuing a doctorate. For 33.5% of the respondents, the university's budget funded the position. Meanwhile, 43.0% were funded by external sources, and 19.1% of all respondents had both budget and external funding. In 2.4% of cases, there were other sources of funding.

For the preceding analyses, only the subsample of predoctoral researchers is considered (n=1,005). The average age is 30.1 years, with 21.6% in business administration, 17.3% in biology, 51.4% in mechanical engineering and 9.7% in sociology. Respondents have been employed in academia for an average of 3.7 years. The predoctoral researchers' average contractually agreed working time is 35 hours per week. When asked how much they work per week, the average is 44.2 hours. 83.6% indicate a teaching load of an average of 2 hours per week.

As Table 1 shows, 56.6% in sociology are most likely to write a monograph, followed by 44.3% in mechanical engineering. Here, 44.3% of respondents indicated that they must also write peer-reviewed journal articles as part of their monograph. The cumulative dissertation is most common in business administration (75.6%). Depending on the doctoral regulations, 3-5 peer-reviewed journal articles must be published (of which a certain number must be first or sole authorship), linked and theoretically discussed in a comprehensive framework when the dissertation is submitted.

TABLE 1
PREDOCTORAL RESEARCHERS' DESIRED FORM OF DISSERTATION

	Overall (n=1005)	Business administration (n=217)	Biology (n=714)	Mechanical engineering (N=517)	Sociology (n=97)
Monograph	32.3%	13.8%	23.0%	39.1%	56.6%
Monograph + additional journal articles	27.7%	6.0%	16.7%	44.3%	7.2%
Cumulative dissertation	29.9%	75.6%	41.4%	6.6%	30.9%
Not determined yet	10.1%	4.6%	19.0%	10.1%	7.2%

As for the allocation of working time, Table 2 shows that the most time spent on research is reported in biology, with 61.3% of working time. The least amount of time devoted to research is among predoctoral mechanical engineering researchers. The highest teaching load is found in business administration (25.5%) and sociology (21.3%), and the lowest in biology (8.7%).

TABLE 2
ALLOCATION OF WORKING TIME OF PREDOCTORAL RESEARCHERS IN GERMANY

	Business administration (n=217)	Biology (n=714)	Mechanical engineering (N=517)	Sociology (n=97)
Research (incl. publications and talks)	38.1%	61.3%	33.6%	48.4%
Teaching (incl. examinations and course preparation)	25.6%	8.7%	14.4%	21.3%
Reviewing (journal manuscripts, funding applications)	3.9%	5.3%	5.7%	2.8%
Supervision of students	14.4%	16.2%	13.4%	8.3%
Acquisition of third-party funding	2.7%	1.3%	12.1%	3.6%
Management/administration	10.4%	7.0%	12.1%	10.5%
Other	4.0%	2.6%	8.3%	6.0%

Regarding career aspirations, the goal of obtaining a professorship is highest in business administration (25.3%) and sociology (29.9%). It is least attractive for predoctoral researchers in mechanical engineering (7.2%), where the goal of obtaining a management position outside of academia is most attractive (69.5%) (Table 3). Taken together, 35.1% or the predoctoral researchers in the sample wish for a career inside academia, whereas 74.9% strive for a career outside academia.

TABLE 3
CAREER ASPIRATIONS OF PREDOCTORAL RESEARCHERS IN GERMANY

	Business administration (n=217)	Biology (n=714)	Mechanical engineering (N=517)	Sociology (n=97)
Professorship	25.3%	13.2%	7.2%	29.9%
Other position in academia	11.5%	28.2%	14.2%	33.0%
Position in science management	4.1%	5.2%	1.2%	5.2%
Management position outside of academia	52.1%	48.3%	69.5%	22.7%
Other position outside academia (e.g., no management responsibility, self-employed) or not decided yet	6.9%	5.2%	8.0%	9.3%

MEASUREMENTS

The Dependent Variable: Autonomous Work Motivation

To measure work motivation (Likert-scale: 1 = "totally disagree", 5 = "totally agree"), items related to the six regulatory types of SDT were formulated and subjected to confirmatory factor analysis with unweighted least squares (ULS) estimator. Six items measuring intrinsic (e.g., "because I get pleasure from being completely absorbed in a scientific subject"), integrated (e.g., "because this work is part of my life"), and identified (e.g., "because I make a meaningful contribution to gaining new knowledge through my work") work motivation were combined to autonomous work motivation. The fit indices indicate that the proposed measurement model provides a good fit to the data ($\chi 2$=598.605, df=71, GFI=.99, AGFI=0.98, SRMR=.05). Taken together, except for the poor reliability of external motivation (α=.50), the remaining indices show satisfactory Cronbach's alpha values ranging from α=.66 for amotivation, α=.73 for introjected motivation to α=.82 for autonomous motivation.

As seen in Table 4, a comparison of means with a one-factorial analysis of variance (ANOVA) shows that the average values within the four disciplines differ significantly in autonomous work motivation (F=6.975, df=3, $p < .01$), external motivation (F=7.830, df=3, $p < .01$) and amotivation (F=3.054, df=3, $p < .05$). No differences can be found for introjected motivation (F=.830, df=3, p=.48)

TABLE 4
ANOVA: WORK MOTIVATION

	Autonomous motivation M(SD)	Introjected motivation M(SD)	External motivation M(SD)	Amotivation M(SD)
Business administration	3.13 (.97)	3.78 (.82)	2.28 (.98)	2.08 (.94)
Biology	3.31 (.80)	3.65 (.79)	1.88 (.85)	2.26 (.93)
Mechanical engineering	3.06 (.76)	3.71 (.81)	2.30 (.92)	2.17 (.98)
Sociology	3.39 (.73)	3.70 (.66)	2.11 (.88)	2.43 (.97)

The Independent Variables

BPNS

As shown in Table 5, a further confirmatory factor analysis with ULS estimator was conducted for BPNS (Likert-scale: 1 = "totally disagree", 5 = "totally agree"). Again, a good model fit was obtained (χ^2=378.859, df=51, GFI=.99, AGFI=.98, SRMR=.05). The respective Cronbach's alpha values ranged from .74 to .79.

TABLE 5
CONFIRMATORY FACTOR ANALYSIS FOR BPNS

Standardized regression weights	Items (R=reversed coding)
Autonomy (α=.753)	
0.474	At work, I feel forced to do things I don't want to do. (R)
0.683	The tasks I perform at work are in line with what I really want to do.
0.854	I feel that I can be myself at my work.
0.613	I can do my work the way I think is best.
Competence (α=.790)	
0.609	I have doubts about whether I am doing my job properly. (R)
0.779	I am good at the things I do in my work.
0.803	I feel competent in my work.
0.701	I feel that I can handle even difficult tasks at work.
Relatedness (α=.740)	
0.624	I often feel alone when I am with my colleagues. (R)
0.540	Some people I work with are good friends of mine.
0.685	At work, I can talk to people about private and official things that really concern me.
0.730	At work, I feel like I'm part of a group.

FRLM

To test the FRLM, instead of the Multifactor Leadership Questionnaire (MLQ; Bass & Avolio, 1994), we used the Transformational Leadership Inventory (TLI), developed by Podsakoff et al. (1990) and translated into German by Heinitz and Rowold (2007), Diebig and Rowold (2015), and Krüger et al. (2011). The items were again measured on a Likert-Scale ranging from 1 = "totally disagree" to 5 = "totally agree".

The TLI is preferred to the MLQ due to its significantly shorter length and the strong intercorrelations reported among the transformational subscales (Avolio et al., 1999; Krüger et al., 2011). The TLI uses 26 items to assess six subscales of transformational leadership: articulating a vision (AV; "My supervisor inspires others with his/her plans for the future of the professorship."), providing an appropriate role model (PAM; "My supervisor leads by 'doing', rather than simply by 'telling'."), fostering the acceptance of group goals (FAG; "My supervisor encourages staff members to be 'team players'.") , high-performance expectations (HPEs; "My supervisor insists on only the best performance.") , individualized support (IS; "My supervisor shows respect for my personal feelings.") , and intellectual stimulation (ISN; "My supervisor challenges me to think about well-known scientific problems in new ways."). Another confirmatory factor analysis with the ULS estimator was performed on the TLI leadership inventory, yielding a good model fit (χ2=2799.426, df=278, GFI=.99, AGFI=.99, SRMR=.05). The Cronbach's Alpha values indicate a good reliability for all computed indices ranging from .87 to .92.

Control Variables

Additionally, we included two control variables. Career aspirations was measured as a dummy variable to indicate whether a career was planned within or outside of academia (1="yes", 0="no") and gender (1="female", 0="male").

ANALYSES

Descriptions and Correlations

As shown in Table 6, the mean value of autonomous work motivation is M=3.15 (SD=.83), with significant differences in whether or not a career in academia is aspired to. No significant differences are found for gender. The mean scores for autonomy, competence, and relatedness range from M=3.54 (SD=.74) to M=3.64 (SD=.91). The mean scores for perceptions of the supervisor's leadership style are generally not high: Perceptions of transformational leadership are highest for the dimension high-performance expectations with M=3.33 (SD=1.07) and lowest for the dimension role modeling with M=2.62 (SD=1.08).

TABLE 6
CORRELATION ANALYSES (N=950)

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. AWM	3.15	.83	(.82)									
2. AUT	3.54	.74	.33**	(.75)								
3. COMP	3.69	.74	.32**	.38**	(.79)							
4. RELATED	3.65	.91	.14**	.30**	.31**	(.74)						
5. AV	3.03	1.09	.20**	.25**	.04	.11**	(.91)					
6. FAG	2.85	1.18	.21**	.32**	.10**	.32**	.59**	(.92)				
7. HPEs	3.33	1.07	.05	-.17**	.04	.01	.26**	.08**	(.84)			
8. IS	3.25	1.13	.17**	.48**	.09**	.17**	.38**	.50**	-.29**	(.92)		
9. ISN	2.76	1.00	.28**	.18**	.09**	.15**	.48**	.42**	.23**	.26**	(.92)	
10. PAM	2.62	1.08	.27**	.38**	.07	.12**	.64**	.60**	.04	.64**	.49**	(.87)

AWM=autonomous work motivation, *AUT*=autonomy, *COMP*=competence, *RELATED*=relatedness, *M*=mean, *SD*=standard deviation, Cronbach Alpha's are shown in parentheses along the diagonal, ** $p < 0.05$, * $p<0.01$

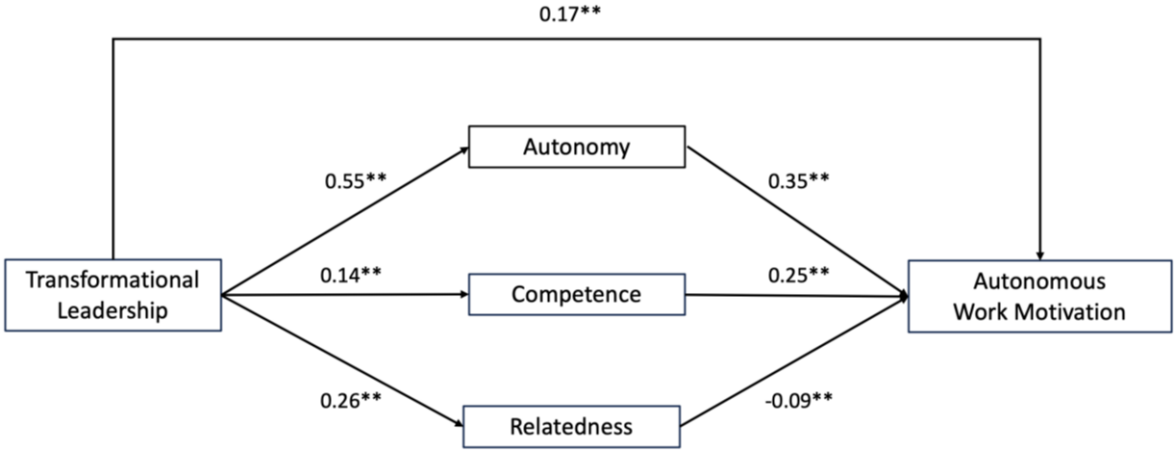
The bivariate correlations show that, as theoretically expected, perceived autonomy, perceived competence and perceived relatedness are positively related to autonomous work motivation. The facets of transformational leadership are also positively related to autonomous work motivation, except high-performance expectations. In the case of high-performance expectations, it is negatively related to perceived autonomy. Perceived competence is positively related to promoting group goals, individualized support, and intellectual stimulation. Finally, perceived relatedness is positively related to shared vision, promotion of group goals, individualized support, and role modeling.

Hypotheses Testing

Structural equation modeling was chosen to test our hypotheses using the R-package lavaan. Since the data are ordinal, diagonal weighted least squares (DWLS) estimation was used as suggested by Mîndrilă (2010). For the structural equation model (Figure 1), in which we had specified our hypothesized direct and indirect effects, a good model fit was determined ($\chi 2$=1854.61, df=579; CFI=95.9; RMSEA=.05; SRMR=.06). We examined the following: first, if the components of BPNS—namely, perceived autonomy, perceived competence, and perceived relatedness—have a predictive relationship with autonomous work motivation (Hypothesis 1); second, if transformational leadership is a predictor of the dimensions of BPNS (Hypothesis 2); and third, if transformational leadership indirectly influences autonomous work motivation through its impact on the dimensions of BPNS (Hypothesis 3).

Regarding our proposed hypotheses, our findings indicate that not all dimensions of BPNS positively predict autonomous work motivation. While there is a positive effect of the perception of autonomy (β = .35, p < .01) and competence (β = .25, p < .01), the effect of the perception of relatedness is negative (β = –.09, p < .01). Therefore, Hypothesis 1 can only partly confirmed. In terms of the relationship between transformational leadership and BPNS, our analysis shows that transformational leadership has a significant positive impact on perceived autonomy (β = .55, p < .01), perceived competence (β = .14, p < .01) and perceived relatedness (β = .26, p < .01). Thus, there is full support for Hypothesis 2. When examining the link between transformational leadership and autonomous work motivation, the coefficients indicate an indirect positive effect of transformational leadership on autonomous work motivation through perceived autonomy (β = .19, p < .01), perceived competence (β = .04, p < .01) and a negative indirect effect through perceived relatedness (β = –.02, p < .01). Additionally, there is a direct positive effect of transformational leadership on autonomous work motivation (β = .17, p < .01). Because the effect of perceived relatedness is negative, Hypothesis 3 can only be partially confirmed (i.e., the influence of transformational leadership on autonomous work motivation is partially mediated by perceived autonomy and perceived competence). Among the control variables, career aspiration positively affects autonomous motivation (β = .37, p < .01), while gender has no effect. (β = .03, p = –.29).

FIGURE 1
STANDARDIZED ESTIMATES FOR EFFECTS ON AUTONOMOUS WORK MOTIVATION



DISCUSSION

This study investigated the effect of the mediating role of BPNS in the relationship between transformational leadership and the autonomous work motivation of predoctoral researchers at German professorships. By examining how fulfilling basic psychological needs such as autonomy, competence, and relatedness influences this dynamic, the research provides insights into the mechanisms through which transformational leadership behaviors positively impact autonomous work motivation.

Our first hypothesis (H1) posited that autonomy, relatedness, and competence would directly predict autonomous work motivation, which was largely confirmed. This is consistent with prior research in other occupational settings highlighting the connection between the satisfaction of these basic psychological needs and autonomous work motivation (Deci et al., 2017; Gagné et al., 2015; Van Den Broeck et al., 2016; Tang et al., 2020; Roth et al., 2007; Yasué et al., 2019). However, contrary to existing studies and the theoretical model proposed by Deci et al. (2017), we found a negative relationship between perceived relatedness and autonomous work motivation. This unexpected result diverges from the established understanding of how BPNS influences autonomous work motivation, leaving the reasons for this discrepancy unexplained in our findings.

Therefore, we can only speculate about possible explanations that need to be considered in further studies, as the perception of relatedness was related to the immediate work environment and not to the scientific community, as examined in a recent national study by Meuleners et al. (2023). One reason for this could be an overemphasis on collaboration in academic work: Predoctoral researchers often work in highly collaborative environments (Wuchty et al., 2007). While collaboration is beneficial, an overemphasis on it could lead to a sense of dependence on others for success, undermining their sense of autonomy and self-determination, key components of autonomous motivation. Another reason might be competition: Academic environments can be competitive, and predoctoral researchers may experience conflict or competition with peers, which could strain relationships and diminish the positive aspects of relatedness, negatively affecting their intrinsic motivation. A final possible explanation could be goal misalignment. When a predoctoral researcher's goals are misaligned with those of his or her colleagues or supervisors, it can lead to isolation or alienation despite being in a relatedness-satisfying environment. This misalignment can dampen their intrinsic motivation to work autonomously.

Furthermore, our study supported the second hypothesis (H2) that transformational leadership is positively related to predoctoral researchers' perceptions of autonomy, competence, and relatedness. The association is strongest for perceived autonomy and weakest for perceived competence. This finding is consistent with the large body of research in different contexts (e.g., Gagné & Deci, 2005; Bono & Judge, 2003; Eyal & Roth, 2011; Kanat-Maymon et al., 2020) that demonstrates the profound impact of transformational leadership in fostering an environment that promotes autonomous work motivation. It supports the premise that transformational leaders inherently promote intellectual stimulation and individualized consideration, empowering their followers to take initiative and make independent decisions. This empowerment fosters personal growth and cultivates a work environment in which creativity and innovation can flourish, essential components in the academic environment. Similarly, the positive relationship between transformational leadership and competence underscores the critical role of constructive feedback, mentorship, and the setting of challenging yet achievable goals by leaders. Perhaps most compelling is the clear link between transformational leadership and team members' perceptions of relatedness. Transformational leaders are adept at fostering a sense of belonging and community, which is critical in academic settings where collaboration and sharing ideas are paramount. Such leaders facilitate strong interpersonal bonds and a cohesive team environment by promoting open communication and mutual respect. This finding is particularly relevant in the German academic context, where the hierarchical nature of professorships could potentially inhibit relatedness.

Finally, the third hypothesis (H3), which states a positive relationship between transformational leadership and autonomous work motivation, partially mediated by perceived autonomy, competence, and relatedness, can also be confirmed for the most part. The mediation effect is highest for autonomy, which is not surprising given the strong effect of transformational leadership examined in H1. The positive mediation effect underscores the importance of leadership that inspires and motivates and actively supports the fulfillment of autonomy, competence, and relatedness among predoctoral researchers. This is particularly relevant in the academic domain, where the pursuit of knowledge and the drive for innovation require a deep sense of autonomous motivation. Thus, our findings are consistent with and extend the broader body of research (Hetland et al., 2011, 2015; Kovjanic et al., 2012, 2013; Messmann et al., 2022; Jenson & Bro, 2018) that has examined the direct relationship between transformational leadership and both basic psychological need satisfaction and positive work-related outcomes.

CONCLUSION

In conclusion, our results show that in the German higher education system, professors and their leadership behavior, mediated by perceptions of the work situation, significantly affect the autonomous work motivation of predoctoral researchers. Professors in the German higher education system must be aware of their leadership responsibility toward their doctoral researchers in two respects: first, as their supervisors under employment contracts, and second, as supervisors of their doctoral students (Wilkesmann & Wagner, 2024). Their leadership behavior influences the perception of their employees' basic

psychological needs and, thus, their motivation to work. In this way, they impact the work environment at universities, socialize young academics, and shape their future careers. Consequently, our results suggest that professors need to become even more aware of their leadership responsibilities and behaviors to foster a motivating and supportive environment for their predoctoral researchers.

However, none of these studies, including ours, have analyzed the relative effects of the various facets of transformational leadership on job-related outcomes. Instead, most use single composite indices that measure transformational leadership. This may be appropriate for work environments outside academia. The question of how relevant the individual aspects are to the academic context remains a matter for future research. The correlation analyses can provide some indication of the importance of transformational leadership in the context of German professorships. Here, individual support is most strongly correlated with perceived autonomy, followed by role modeling and the promotion of group goals. The correlations with autonomous work motivation and the individual aspects of transformational leadership are weaker; here the correlations are highest with the role model function and intellectual stimulation. Qualitative studies, such as those already conducted by Evans (2015) and Machovcova et al. (2023), could also be instrumental in further exploring these dynamics.

LIMITATIONS

As with all empirical studies, our results are subject to limitations. First, the data is cross-sectional and relates only to the German university context. Second, our analysis only includes autonomous work motivation as a dependent variable and is restricted to transformational leadership. Future studies should encompass a broader range of disciplines and investigate additional positive job-related outcomes such as research activity, creativity, and independence. They should also examine the impact of various leadership styles, including laissez-faire, transactional, and instrumental leadership (Rowold, 2014). Ideally, a targeted longitudinal study should be conducted to track prospective academics' career progression and work motivation over time, though this may be challenging to implement in practice.

ACKNOWLEDGEMENT

This study was supported by the German Federal Ministry for Research and Education under Grant 01PH20005.

REFERENCES

Aboagye, E., Jensen, I., Bergström, G., Brämberg, E.B., Pico-Espinosa, O.J., & Björklund, C. (2021). Investigating the association between publication performance and the work environment of university research academics: A systematic review. *Scientometrics*, *126*(4), 3283–3301. https://doi.org/10.1007/s11192-020-03820-y

Ahrne, G., & Brunsson, N. (2011). Organization outside organizations: The significance of partial organization. *Organization*, *18*(1), 83–104. https://doi.org/10.1177/1350508410376256

Autin, K.L., Herdt, M.E., Garcia, R.G., & Ezema, G.N. (2022). Basic psychological need satisfaction, autonomous motivation, and meaningful work: a self-determination theory perspective. *Journal of Career Assessment*, *30*(1), 78–93. https://doi.org/10.1177/10690727211018647

Avolio, B.J., Walumbwa, F.O., & Weber, T.J. (2009). Leadership: Current theories, research, and future directions. *Annual Review of Psychology*, *60*(1), 421–449. https://doi.org/10.1146/annurev.psych.60.110707.163621

Bass, B.M., & Avolio, B.J. (1994). transformational leadership and organizational culture. *International Journal of Public Administration*, *17*(3–4), 541–554. https://doi.org/10.1080/01900699408524907

Bass, B.M., & Riggio, R.E. (2006). *Transformational Leadership*. Psychology Press. https://doi.org/10.4324/9781410617095

Bloch, R. (2018). Stratification without producing elites? The emergence of a new field of doctoral education in Germany. In R. Bloch, A. Mitterle, C. Paradeise, & T. Peter (Eds.), *Universities and the Production of Elites* (pp. 299–324). Springer International Publishing. https://doi.org/10.1007/978-3-319-53970-6_13

Bono, J.E., & Judge, T.A. (2003). Self-Concordance at work: Toward Understanding the Motivational Effects of Transformational Leaders. *Academy of Management Journal*, *46*(5), 554–571. https://doi.org/10.2307/30040649

Braun, S., Peus, C., Weisweiler, S., & Frey, D. (2013). Transformational leadership, job satisfaction, and team performance: A multilevel mediation model of trust. *The Leadership Quarterly*, *24*(1), 270–283. https://doi.org/10.1016/j.leaqua.2012.11.006

Brechelmacher, A., Park, E., Ates, G., & Campbell, D.F.J. (2015). The rocky road to tenure–career paths in Academia. In T. Fumasoli, G. Goastellec, & B.M. Kehm (Eds.), *Academic Work and Careers in Europe: Trends, Challenges, Perspectives* (pp. 13–40). Springer International Publishing. https://doi.org/10.1007/978-3-319-10720-2_2

Chua, J., & Ayoko, O.B. (2021). Employees' self-determined motivation, transformational leadership and work engagement. *Journal of Management & Organization*, *27*(3), 523–543. https://doi.org/10.1017/jmo.2018.74

Clark, B.R. (1983). *The higher education system: Academic organization in cross-national perspective*. University of California Press.

Cornér, S., Löfström, E., & Pyhältö, K. (2017). The relationships between doctoral students' perceptions of supervision and burnout. *International Journal of Doctoral Studies*, *12*, 091–106. https://doi.org/10.28945/3754

Daumiller, M., Stupnisky, R., & Janke, S. (2020). Motivation of higher education faculty: Theoretical approaches, empirical evidence, and future directions. *International Journal of Educational Research*, *99*, 101502. https://doi.org/10.1016/j.ijer.2019.101502

De Vogel, S. (2020). *Individuelle und strukturierte Formen der Promotion: Zugang, Lernumweltbedingungen und beruflicher Übergang* [Individual and structured forms of doctoral studies: Access, learning environment conditions and professional transition]. Springer. https://doi.org/10.1007/978-3-658-29508-0

Deci, E.L., Olafsen, A.H., & Ryan, R.M. (2017b). Self-Determination Theory in work organizations: The State of a Science. *Annual Review of Organizational Psychology and Organizational Behavior*, *4*(1), 19–43. https://doi.org/10.1146/annurev-orgpsych-032516-113108

Destatis. (2022a). *Personal an Hochschulen* [Staff at universities]. Retrieved from https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Hochschulen/Publikationen/Downloads-Hochschulen/personal-hochschulen-2110440217004.pdf?__blob=publicationFile

Destatis. (2022b). *Statistik der Promovierenden* [Statistics on doctoral students]. Retrieved from https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Hochschulen/Publikationen/Downloads-Hochschulen/promovierendenstatistik-5213501217004.pdf?__blob=publicationFile

Diebig, M., & Rowold, J. (2015). *Aktuelle Gütekriterien und Normen der Selbst- und Fremdversion des Transformational Leadership Inventories (TLI)* [Current quality criteria and norms of the self- and third-party version of the Transformational Leadership Inventory]. Retrieved from https://pvm.zhb.tu-dortmund.de/storages/pvm-zhb/r/Formulare/Informationsseite_TLI_Neu.pdf

Douglas, A.S. (2022). Dimensions of fit for doctoral candidates: Supporting an academic identity. *Research Papers in Education*, *37*(6), 954–974. https://doi.org/10.1080/02671522.2021.1905704

Enders, J. (2001). A chair system in transition: Appointments, promotions, and gate-keeping in German higher education. *Higher Education*, *41*(1–2), 3–25. https://doi.org/10.1023/A:1026790026117

Evans, L. (2015). A changing role for university professors? Professorial academic leadership as it is perceived by 'the led'. *British Educational Research Journal*, *41*(4), 666–685. https://doi.org/10.1002/berj.3163

Eyal, O., & Roth, G. (2011). Principals' leadership and teachers' motivation: Self-determination theory analysis. *Journal of Educational Administration, 49*(3), 256–275. https://doi.org/10.1108/09578231111129055

Freidson, E. (2011). *Professionalism: The third logic*. Polity Press.

Fumasoli, T., Goastellec, G., & Kehm, B.M. (2015). Academic careers and work in Europe: Trends, challenges, perspectives. In T. Fumasoli, G. Goastellec, & B.M. Kehm (Eds.), *Academic work and careers in Europe: Trends, challenges, perspectives* (pp. 201–214). Springer. https://doi.org/10.1007/978-3-319-10720-2

Gagné, M., & Deci, E.L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior, 26*(4), 331–362. https://doi.org/10.1002/job.322

Gassmann, F. (2018). *Wissenschaft als Leidenschaft? Über die Arbeits- und Beschäftigungsbedingungen wissenschaftlicher Mitarbeiter* [Science as a passion? On the working and employment conditions of scientific staff]. Campus Verlag.

Heinitz, K., & Rowold, J. (2007). Gütekriterien einer deutschen Adaptation des Transformational Leadership Inventory (TLI) von Podsakoff [Quality criteria for a German adaptation of Podsakoff's Transformational Leadership Inventory (TLI)]. *Zeitschrift für Arbeits- und Organisationspsychologie A&O, 51*(1), 1–15. https://doi.org/10.1026/0932-4089.51.1.1

Hetland, H., Hetland, J., Schou Andreassen, C., Pallesen, S., & Notelaers, G. (2011). Leadership and fulfillment of the three basic psychological needs at work. *Career Development International, 16*(5), 507–523. https://doi.org/10.1108/13620431111168903

Hetland, J., Hetland, H., Bakker, A.B., Demerouti, E., Andreassen, C.S., & Pallesen, S. (2015). Psychological need fulfillment as a mediator of the relationship between transformational leadership and positive job attitudes. *Career Development International*, *20*(5), 464–481. https://doi.org/10.1108/CDI-10-2014-0136

Höhle, E.A. (2015). Hierarchie in Lehrstuhl und Department: Ein empirischer Vergleich in Europa. In U. Banscherus, O. Engel, A. Mindt, A. Spexard, & A. Wolter (Eds.), *Differenzierung des Hochschulsystems in Deutschland und im internationalen Vergleich* (pp. 199–220). Waxmann.

Hüther, O., & Krücken, G. (2018). *Higher Education in Germany–Recent Developments in an International Perspective* (Vol. 49). Springer International Publishing. https://doi.org/10.1007/978-3-319-61479-3

Jaffe, A. (2017). Differentiated eliteness: Socialization for academic leadership. *Social Semiotics, 27*(3), 370–381. https://doi.org/10.1080/10350330.2017.1301801

Jensen, I., Bjorklund, C., Hagberg, J., Aboagye, E., & Bodin, L. (2021). An overlooked key to excellence in research: A longitudinal cohort study on the association between the psycho-social work environment and research performance. *Studies in Higher Education*, *46*(12), 2610–2628. https://doi.org/10.1080/03075079.2020.1744127

Jensen, U.T., & Bro, L.L. (2018). How transformational leadership supports intrinsic motivation and public service motivation: The mediating role of basic need satisfaction. *The American Review of Public Administration*, *48*(6), 535–549. https://doi.org/10.1177/0275074017699470

Kanat-Maymon, Y., Elimelech, M., & Roth, G. (2020). Work motivations as antecedents and outcomes of leadership: Integrating self-determination theory and the full range leadership theory. *European Management Journal*, *38*(4), 555–564. https://doi.org/10.1016/j.emj.2020.01.003

Kovjanic, S., Schuh, S.C., & Jonas, K. (2013). Transformational leadership and performance: An experimental investigation of the mediating effects of basic needs satisfaction and work engagement. *Journal of Occupational and Organizational Psychology*, *86*(4), 543–555. https://doi.org/10.1111/joop.12022

Kovjanic, S., Schuh, S.C., Jonas, K., Quaquebeke, N.V., & Van Dick, R. (2012). How do transformational leaders foster positive employee outcomes? A self-determination-based analysis of employees' needs as mediating links: TFL and Basic Need Satisfaction. *Journal of Organizational Behavior*, *33*(8), 1031–1052. https://doi.org/10.1002/job.1771

Krüger, C., Rowold, J., Borgmann, L., Staufenbiel, K., & Heinitz, K. (2011). the discriminant validity of transformational and transactional leadership: A multitrait-multimethod analysis of and norms for the German Transformational Leadership Inventory (TLI). *Journal of Personnel Psychology*, *10*(2), 49–60. https://doi.org/10.1027/1866-5888/a000032

Machovcova, K., Mudrak, J., Cidlinska, K., & Zabrodska, K. (2023). Early career researchers as active followers: Perceived demands of supervisory interventions in academic workplaces. *Higher Education Research & Development*, *42*(1), 171–185. https://doi.org/10.1080/07294360.2022.2040447

Messmann, G., Evers, A., & Kreijns, K. (2022). The role of basic psychological needs satisfaction in the relationship between transformational leadership and innovative work behavior. *Human Resource Development Quarterly*, *33*(1), 29–45. https://doi.org/10.1002/hrdq.21451

Meuleners, J.S., Neuhaus, B.J., & Eberle, J. (2023). The role of scholarly identity and basic needs support during doctoral studies on career aspirations of early career scientists. *Studies in Higher Education*, *48*(12), 1952–1965. https://doi.org/10.1080/03075079.2023.2217726

Mîndrilă, D. (2010). Maximum Likelihood (ML) and Diagonally Weighted Least Squares (DWLS) Estimation Procedures: A Comparison of Estimation Bias with Ordinal and Multivariate Non-Normal Data. *International Journal for Digital Society*, *1*(1), 60–66. https://doi.org/10.20533/ijds.2040.2570.2010.0010

Moll, J., & Kretzschmar, L. (2017). An investigation of the suitability of a Servant Leadership model for academic Group Leaders at German universities. *Journal of Leadership Education*, *16*(2), 166–182. https://doi.org/10.12806/V16/I2/T1

Neave, G., & Rhoades, G. (1987). The academic estate in Western Europe. In B.R. Clark (Ed.), *The Academic Profession: National, Disciplinary, and Institutional Settings* (pp. 211–270). University of California Press.

Podsakoff, P. (1996). Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship. *Journal of Management*, *22*(2), 259–298. https://doi.org/10.1016/S0149-2063(96)90049-5

Podsakoff, P.M., MacKenzie, S.B., Moorman, R.H., & Fetter, R. (1990). Transformational leader behaviors and their effects on followers' trust in leader, satisfaction, and organizational citizenship behaviors. *The Leadership Quarterly*, *1*(2), 107–142. https://doi.org/10.1016/1048-9843(90)90009-7

Roth, G., Assor, A., Kanat-Maymon, Y., & Kaplan, H. (2007). Autonomous motivation for teaching: How self-determined teaching may lead to self-determined learning. *Journal of Educational Psychology*, *99*(4), 761–774. https://doi.org/10.1037/0022-0663.99.4.761

Rowold, J. (2014). Instrumental leadership: Extending the transformational-transactional leadership paradigm. *German Journal of Human Resource Management: Zeitschrift Für Personalforschung*, *28*(3), 367–390. https://doi.org/10.1177/239700221402800304

Ryan, R.M., & Deci, E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R.M., & Deci, E.L. (2013). Toward a social psychology of assimilation: Self-determination theory in cognitive development and education. In B.W. Sokol, F.M.E. Grouzet, & U. Müller (Eds.), *Self-Regulation and Autonomy* (pp. 191–207). Cambridge University Press. https://doi.org/10.1017/CBO9781139152198.014

Ryan, R.M., & Deci, E.L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, *61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Schmidt, B., & Richter, A. (2009). Zwischen laissez-faire, Autokratie und Kooperation: Führungsstile von Professorinnen und Professoren [Between laissez-faire, autocracy and cooperation: Professors' leadership styles]. *Beiträge zur Hochschulforschung*, *31*(4), 8–35.

Schneijderberg, C., & Teichler, U. (2018). Doctoral education, training and work in Germany. In J.C. Shin, B.M. Kehm, & G.A. Jones (Eds.), *Doctoral Education for the Knowledge Society* (pp. 13–34). Springer International Publishing. https://doi.org/10.1007/978-3-319-89713-4_2

Tang, M., Wang, D., & Guerrien, A. (2020). A systematic review and meta-analysis on basic psychological need satisfaction, motivation, and well-being in later life: Contributions of self-determination theory. *PsyCh Journal*, *9*(1), 5–33. https://doi.org/10.1002/pchj.293

Teichler, U., & Höhle, E.A. (Eds.). (2013). *The Work Situation of the Academic Profession in Europe: Findings of a Survey in Twelve Countries*. Netherlands: Springer. https://doi.org/10.1007/978-94-007-5977-0

Van Den Broeck, A., Ferris, D.L., Chang, C.-H., & Rosen, C.C. (2016). A Review of Self-Determination Theory's Basic Psychological Needs at Work. *Journal of Management*, *42*(5), 1195–1229. https://doi.org/10.1177/0149206316632058

Wilkesmann, U. (2023). The organizational transformation of universities: Using motivation theories to explain the micro–macro link. In L. Leišytė, J.R. Dee, & B.J.R. Van Der Meulen (Eds.), *Research Handbook on the Transformation of Higher Education* (pp. 317–332). Edward Elgar Publishing. https://doi.org/10.4337/9781800378216.00031

Wilkesmann, U., & Lauer, S. (2020). The influence of teaching motivation and New Public Management on academic teaching. *Studies in Higher Education*, *45*(2), 434–451. https://doi.org/10.1080/03075079.2018.1539960

Wilkesmann, U., & Schmid, C.J. (2014). Intrinsic and internalized modes of teaching motivation. *Evidence-Based HRM: A Global Forum for Empirical Scholarship*, *2*(1), 6–27. https://doi.org/10.1108/EBHRM-07-2013-0022

Wilkesmann, U., & Wagner, O. (2024). Theoretical and empirical approach to how a professorship is organized in the German higher education system and how the organizational process works. *Higher Education*. Advance online publication. https://doi.org/10.1007/s10734-023-01178-7

Wuchty, S., Jones, B.F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *Science*, *316*(5827), 1036–1039. https://doi.org/10.1126/science.1136099

Yasué, M., Jeno, L., & Langdon, J. (2019). Are autonomously motivated university instructors more autonomy-supportive teachers? *International Journal for the Scholarship of Teaching and Learning*, *13*(2). https://doi.org/10.20429/ijsotl.2019.130205