Validation of the German work-related basic need satisfaction scale (W-BNS-G)

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Abstract

Currently, there is no validated German tool that captures the basic needs as outlined in Self-Determination Theory (SDT) in the organizational context. To be able to collect reliable and valid data for research and use the results of German research on SDT to derive and implement empirically grounded practical implications that foster employee well-being, performance, and companies' growth, a validated measurement tool is a compulsory requirement. Therefore, this study aimed to develop and validate a German version of the Work-related Basic Need Satisfaction scale. (W-BNS). We replicated the three-factor structure, as well as the reliability of the three subscales and could extensively confirm the construct- and the criterion-related validity of the original W-BNS for the German version (W-BNS-G, $N = 648$). Additionally, multi-group comparisons were conducted to investigate cultural measurement invariance with the Dutch and the Italian version of the W-BNS. In summary, the present study provides a tool with high reliability and validity assessing the basic needin the organizational context in German language. We address the potential comparability of German, Italian, and Dutch findings using the different versions of the W-BNS and conclude by discussing the limitations of the present study and deriving suggestions for future research.

Keywords Self-determination theory · Work-related basic need satisfaction · Validation study · Cultural measurement invariance · Confirmatory factor analysis

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Introduction

Self-determination theory (SDT; Deci & Ryan, 1985) is a well-established psychological theory describing human motivation. The overall aim of SDT is to foster well-being and personal growth (Deci & Ryan, 2000). The assumed principles, constructs and explanations were successfully proven in psychological research and effectively adapted for multiple applied contexts, such as physical education (Vasconcellos et al., 2020), the learning context (Ryan & Deci, 2020), health behavior changes (Gillison et al., 2019; Ng et al., 2012), or the organizational context (Ryan & Deci, 2017).

SDT conceptualizes the complexity of human motivation and expands the dichotomy of intrinsic versus extrinsic regulation by proposing a more nuanced differentiation of motivation (Deci & Ryan, 1985, 2000). These different types of motivation can be arranged on a continuum by their degree of self-determination (see Fig. 1). The more self-determined an action is, i.e., the more autonomous, the more it is characterized by being driven by one's intrinsic
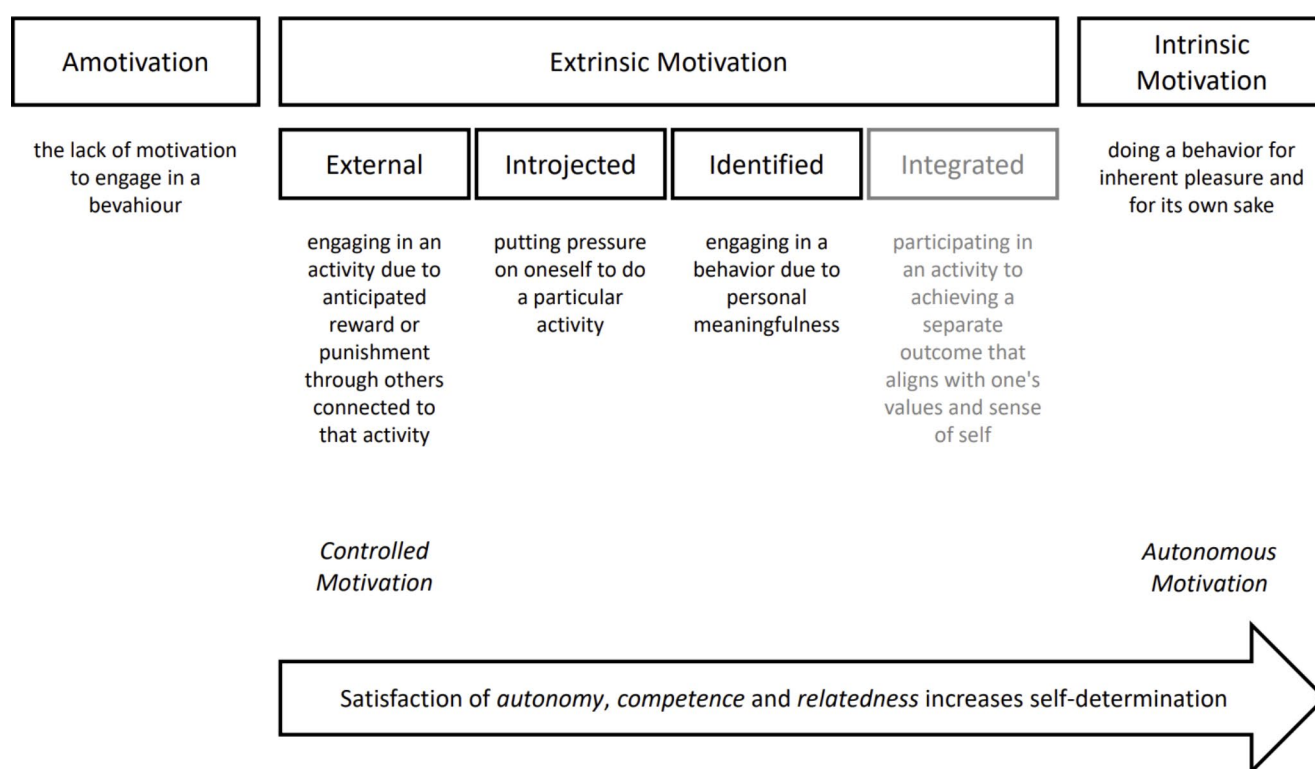
Fig. 1 Illustration of motivational regulation according to Self-Determination Theory (SDT). *Note.* Integrated regulation is put in grey as it was shown to be empirically difficult to distinguish integrated regulation to neighboring motives (Gagné et al., 2015; Howard et al., 2017)

will, conscious choice, and deliberate intention. The fully self-determined type of motivation is *intrinsic motivation*, i.e., doing a particular behavior for inherent pleasure and for its own sake (Deci & Ryan, 1985). Intrinsic motivation is associated with numerous positive outcomes such as general well-being (Ryan & Deci, 2020; Van den Broeck et al., 2016; Van den Broeck et al., 2021), mental health (Ng et al., 2012), and the overall aim of personal growth (Ryan & Deci, 2017; Van den Broeck et al., 2016). Within this continuum of self-determination, SDT further differentiates four different types of *extrinsic motivation* by their degree of self-determination, i.e. *external regulation* (i.e., to obtain rewards and avoid punishments under the control of others), *introjected regulation* (i.e., to safeguard one's self-esteem, to feel positive about oneself and avoid negative feelings), *identified regulation* (i.e., because the activity is seen as valuable), and *integrated regulation* (i.e., because the activity is aligned with one's values). While external and introjected are types of controlled motivation, identified, integrated and intrinsic regulation are types of autonomous motivation. (Deci & Ryan, 2000).To reach a higher quality of motivation, i.e. a more self-determined type of motivation, SDT proposes a mechanism and theoretical explanation: The satisfaction of three basic psychological needs autonomy, competence, and relatedness (Gagné, 2003).

Basic psychological needs and self-determined motivation

The core of SDT is the definition of three universal basic psychological needs, namely *autonomy*, *competence*, and *relatedness* (Deci & Ryan, 2000). Autonomy refers to the need to feel like having the control and choice over one's actions (Slemp et al., 2020). The need for competence describes feeling capable in achieving desired outcomes (Vansteenkiste et al., 2020). Last, relatedness pertains to the need for social connections, belongingness, and meaningful relationships (Gagné, 2003). When these basic needs are met, i.e., when people authentically and volitionally engage in a behavior (autonomy), that they feel capable at doing as they use and extend their skills and experiences (competence) while they feel connected and supported by important others (relatedness), these basic needs become fulfilled, what is called *basic need satisfaction* (BNS). When individuals' basic needs are satisfied, they are more likely to experience a higher quality of motivation, i.e., a more self-determined type of motivation like intrinsic motivation (Deci & Ryan, 2000; Gagné, 2003; Ryan et al., 2022; Slemp et al., 2018; Van Wingerden et al., 2018). These central principles of SDT, how to achieve a higher quality of motivation, and the associations with numerous positive outcomes

in various domains were recently summarized in a meta-review of meta-analytic findings evaluating SDT (Ryan et al., 2022).

Relevance of basic need satisfaction

First, BNS is positively associated with greater well-being and life satisfaction in general (Deci & Ryan, 2000). Additionally, BNS fosters positive affect (Stanley et al., 2021) and desirable mental health outcomes such as vitality ($r=.35$ to $r=.43$; Ng et al., 2012). Ng and colleagues (Ng et al., 2012) conducted a meta-analysis investigating indicators of mental and physical health. They found positive associations between BNS and smoking abstinence ($r=.11$ to $r=.30$), physical activity ($r=.14$ to $r=.36$), and weight loss ($r=.22$) as well as a negative association with depression ($r=-.20$ to $r=-.50$), anxiety $r=-.23$ to $r=-.32$), and negative affect ($r=-.28$ to $r=-.33$). A meta-analysis focusing on elderly persons (Tang et al., 2020) aggregating across 17 studies confirmed a negative relation between BNS and depression ($r=-.17$ to $r=-.37$) as well as a positive relation between autonomy satisfaction and subjective health ($r=.21$).

Second, the relevance of BNS was specifically investigated and confirmed in various applied domains as the organizational context (Cerasoli et al., 2016; Van den Broeck et al., 2021), the educational context (Bureau et al., 2022; Slemp et al., 2020), or physical activity (Chatzisarantis et al., 2003; Teixeira et al., 2018). Regarding the organizational context particularly, BNS is associated with numerous positive outcomes commonly referred to as employee optimal functioning (Van den Broeck et al., 2016) like employee well-being (Vansteenkiste et al., 2007), engagement (Ryan et al., 2022), or performance (Van Wingerden et al., 2018). A review assembling 99 studies investigated the antecedents and consequences of BNS at work in general (Van den Broeck et al., 2016). This study extensively confirmed the positive relationships between BNS and job satisfaction ($r=.40$ to $r=.54$), affective commitment ($r=.21$ to $r=.48$), performance ($r=.21$ to $r=.33$), and effort ($r=.17$ to $r=.30$). Moreover, BNS was negatively associated with turnover intentions ($r=-.05$ to $r=-.31$) and deviance ($r=-.16$ to $r=-.19$). Autonomy and relatedness satisfaction were further negatively associated to absenteeism ($r=-.05$ to $r=-.10$). Aligning with the assumed principles of SDT, BNS was negatively related to amotivation ($r=-.20$ to $r=-.29$) and positively associated with more self-determined types of motivation ($r=.24$ to $r=.54$). To foster employees' BNS, one focus of research relies on the relationship between different leadership styles and BNS. For example, BNS was found to mediate the positive effects of servant leadership (Chiniara & Bentein, 2016; Hudecek

et al., 2024) and transformational leadership (Jensen & Bro, 2018; Kovjanic et al., 2013) on outcomes such as work engagement, performance, or organizational citizenship behaviors. These findings suggest that different leadership styles can foster employees' BNS, which in turn is associated with favorable attitudes and behavioral outcomes.

These results provide exemplary insights into the applied value of SDT's principles and assumptions, for example, within the organizational context. Meanwhile, the importance to consider and evaluate BNS in the workplace was proven extensively (Ryan et al., 2022; Van den Broeck et al., 2021). In addition to the well-established positive effects of BNS in previous research and applied settings, more relevance of SDT in today's workplace arises from the increasing power shift from institutions to individuals, as employees are increasingly able to make their own decisions and seek jobs that align with their values and lifestyles (Rigby & Ryan, 2018). Given these changes, organizations must develop a deeper understanding of building motivating and engaging cultures that benefit both employees and organizations (Rigby & Ryan, 2018). Here, applications of self-determination theory in the organizational context successfully address how to promote well-being and productivity (Ryan & Deci, 2017).

Present research

As an essential requirement for reliable and valid research and as the foundation for organizational implications of SDT, Van den Broeck et al. (2010) developed and validated the Work-related Basic Need Satisfaction scale (W-BNS) to assess BNS in the organizational context. The W-BNS is a well-established tool that has been cited in over 1800 publications. Meanwhile, there is a Turkish (Cumali, 2018), a Finnish (Karkkola et al., 2019), and an Italian version (Colledani et al., 2018). Despite the huge body of research investigating SDT in German-speaking countries (e.g., Grüttner, 2024; Keller et al., 2024; Renninger et al., 2023; Schwinger et al., 2020; Volodina et al., 2019), there are currently only two scales to assess BNS in German language, namely for the context of mental health (Heissel et al., 2018) and in exercise (Rackow et al., 2013). Yet, there is no validated German tool to capture valid and reliable data on BNS in the organizational context. Thus, the results of German studies are limited in interpretation, which narrows the possibility of comparing findings from German studies with results from other studies. In addition, researchers are forced to develop and utilize their own non-validated instruments (e.g., Janke et al., 2015; Schwab et al., 2022), further impeding the interpretation and comparability of results. Moreover, the lack of a valid instrument imposes restrictions on the extent to which practical implications can be

derived– especially for German samples and organizations using German as their main company language. In 2022, approximately 130 million people spoke German as either their first or second language, including 45 million U.S. citizens (Statista, 2022). In addition, Germany had the fourth-largest Gross Domestic Product (GDP) in 2022, following the United States, China, and Japan (Statista, 2023), demonstrating Germany's economic strength and relevance in the international comparison.

Therefore, a validated measurement tool is a compulsory requirement for interpreting and using the results of German research on SDT and deriving and implementing empirically grounded practical implications that foster employee well-being, performance, and companies' growth. To address this lack of an existing validated measure, the present study aimed to develop and validate a German version (W-BNS-G) of the W-BNS (Van den Broeck et al., 2010). Additionally, we add further empirical evidence for the associations between BNS and employee-related outcomes.

The original W-BNS

Van den Broeck et al. (2010) developed the scale by generating a large item pool based on SDT literature and available measurement tools assessing employees' perception of BNS rather than antecedent conditions or potential consequences of BNS– a limitation of the available measurements at that time. Furthermore, the authors specifically included negative items. These items are supposed to capture the *absence* of need satisfaction alongside the *presence* of need satisfaction to address the limitation of previous research and measurement scales focusing on positive items. Lastly, the scale was designed to be applicable to all work contexts, rather than focusing on specific work domains.

Four samples (total $N = 1.185$) were assessed to select the final set of items and validate the W-BNS. Specifically, one convenience sample and three organization-specific samples were used. After calculating exploratory factor analysis, item analysis, and item intercorrelations of the initial item pool, a final set of 18 items was selected. This final set contains six items for each basic need. More specifically, the scales capturing autonomy and relatedness include three positive items assessing the presence of need satisfaction and three negative items assessing the absence of need satisfaction. The scale measuring competence contains four positive items and two negative items (see Appendix 1 Table 5).

For their final set of 18 items, the authors confirmed the three-factor structure of the scale for all four samples by calculating confirmatory factor analyses. Additionally, items intercorrelations, the internal consistence reliability and impression management were investigated and verified before examining the discriminant, criterion-related, and

predictive validity of the scale. To investigate the discriminant validity of the scale, the authors assessed different job resources matching the needs, i.e., task autonomy, skill utilization, and social support. To examine the criterion-related validity Van den Broeck et al. (2010) investigated employees´ well-being, i.e., job satisfaction, engagement, and burnout, as well as employees' organizational commitment, performance, and motivation. Lastly, to test for predictive validity, turnover intentions were assessed.

The authors report good psychometric proper in of the W-BNS and a clear three-factor structure across all samples. The W-BNS shows good values for reliability and evidence for the criterion-related as well as the discriminant and the predictive validity.

The German work-related basic need satisfaction scale

We intended to replicate the confirmed three-factor structure, the reliability, and the discriminant, as well as the criterion-related validity of the original W-BNS for our German version. This served the purpose of creating an equivalent German version of the original. W-BNS. In addition, we intended to gain more information about the validity of our scale by comparing it to the well-established original W-BNS and by replicating previously proven associations of SDT using our study's data.

First, confirmatory factor analysis was conducted to test the factor structure of the German version. Furthermore, the scales´ internal consistencies were investigated. In order to avoid potential bias due to self-report measures, we assessed impression management, as previous research has shown that this aspect should not be underestimated when evaluating self-rated reports (Ferris et al., 2008). For discriminant validity and criterion-related validity, we proceeded very closely to the original W-BNS validation study by Van den Broeck and colleagues (Van den Broeck et al., 2010) and used constructs in line with SDT itself and previous SDT-based studies on BNS in the organizational context (Van den Broeck et al., 2008, 2021). To do so, we assessed different job resources for discriminant validity analysis, namely *task autonomy*, *skill utilization* and *social support*. Based on conceptual ground and according to previous research (Van den Broeck et al., 2010; Broeck et al., 2016), we expected the highest correlation between task autonomy and autonomy satisfaction, skill utilization and competence satisfaction, and between social support and relatedness satisfaction. For criterion-related validity analysis we assessed various employee-related outcomes. In line with previous research (e.g., Howard et al., 2020; Ng et al., 2012; Van den Broeck et al., 2016, 2021), we also expected positive correlations between BNS and job satisfaction, work engagement, affective organizational commitment,

life satisfaction, performance, and more autonomous forms of motivation, as well as a negative association between BNS and burnout, amotivation, and controlled forms of motivation. With regard to our study design and the number of variables assessed, we also statistically controlled for common method bias following the procedure of Kock et al. (2021) and included a marker variable in our correlation analysis.

Additionally, we tested for cultural measurement invariance (CMI) between the German sample and the original Dutch sample (Van den Broeck et al., 2010) as well as the sample of the validation of the Italian version (Colledani et al., 2018). This also served to assess the credibility of our scale by comparing the different versions of the W-BNS and provided an incremental scientific value in terms of the potential comparability of German, Italian, and Dutch findings regarding BNS in the organizational context.

Methods

Procedure

Participants of the pre-registered study (https://osf.io/4agrd) were recruited via social networks and German universities. Participants completed all questionnaires independently at one measurement point using an online survey tool. In return, they could choose to be informed about the results. All items of every measurement tool were randomized to avoid biases related to item order. Employed students received credit points for participation or for recruiting employed relatives and friends. Current employment of at least 10 h per week was required for participation. Further, we included two attention check items (e.g., "For this question, the answer `completely´ must be chosen") to ensure conscientious participation. There was no missing data, as we used an online survey tool, where all questions had to be answered mandatorily. Only participants who completed the questionnaire were considered for the analyses.

Sample

German sample

The final sample comprises 648 participants (71% female, 29% male) that finished the survey and passed the attention check items correctly (74 participants were excluded from the analyses). Participants' age ranged from 18 to 66 ($M = 28.08$, $SD = 9.07$). The amount of hours worked per week ranged from 10 to 65 ($M = 33.56$, $SD = 9.94$) and is thus representative of the German average of $M = 34.70$ (Statistisches Bundesamt, 2023). Regarding the educational background of the sample, most participants stated that their highest level of education was the university entrance qualification, i.e., German Abitur (36%) or completed vocational training (31%), followed by university of applied sciences entrance qualification, i.e., German Fachhochschulreife (14%) and academic degree, i.e., bachelor, master or higher (13%). Thus, our sample is comparable to the German population in terms of individuals with an Abitur or equivalent qualification (Statista, 2024a) and the proportion of university degrees (Bachelor, Master, Diploma; Statista, 2024b), but underrepresents those with apprenticeships (Statista, 2024b).

Dutch and Italian Sample

To test for CMI, the German sample was compared to two Dutch samples (Van den Broeck et al., 2010: $N_1 = 166$, 50% women, 25% men, 25% NA, average age of 37 years; $N_2 = 261$, $M_{age} = 28.23$, $SD_{age} = 9.0$, 54% women) and two Italian samples (Colledani et al., 2018: $N_1 = 600$, 51% women, $M_{age} = 39.10$, $SD_{age} = 13.21$; $N_2 = 159$, 79% men, 29% <30 years, 17% 31–40 years, 53% >40 years).

Measurements

The W-BNS-G was developed using two loops of the translation/back-translation procedure (Brislin, 1970; Hambleton, 1994) until a semantically and contextually accurate German version had been developed. The German version thus is equivalent to the original W-BNS in terms of number of items, i.e., six items per need, and the valence of the items, i.e., three positive and three negative items for autonomy and relatedness as well as four positive and two negative items for competence. Inconsistencies were discussed and modified after the first loop. No inconsistencies occurred after the second loop. The items of the original W-BNS and the final German version are provided in Appendix 1 Table 5.

We checked for impression management using the German questionnaire "Soziale Erwünschtheit– Gamma" (Social desirability– Gamma; Kemper et al., 2014). Participants indicated agreement with three items assessing the exaggeration of positive qualities (e.g., "In an argument, I always remain objective and stick to the facts") and three items assessing the understatement of negative qualities (e.g., "I have occasionally thrown litter away in the countryside or on to the road") on a five-point Likert scale (1 = not at all to 5 = completely). Internal consistency of the German scale is acceptable ($\alpha = 0.71$– 0.78; Kemper et al., 2014).

To analyze construct validity, more specifically discriminant validity, we examined the associations between work-related basic need satisfaction and job resources. These job

resources are operationalized by measuring *task autonomy*, *skill utilization*, and *social support* using a German version of the Work Design Questionnaire (Stegmann et al., 2010). The German version is based on the Work Design Questionnaire (WDQ) by Morgeson and Humphrey (2006) and developed to analyze workplaces by assessing objective task, knowledge, social, and contextual work characteristics with 21 scales in total.

We operationalize task autonomy, using the three sub-scales Work Scheduling Autonomy (e.g., "The job allows me to make my own decisions about how to schedule my work"), Decision-Making Autonomy (e.g., "The job gives me a chance to use my personal initiative or judgement in carrying out the work"), and Work Methods Autonomy (e.g., "The job allows me to make decisions about what methods I use to complete my work") with three items each. Skill utilization was assessed with the subscales Skill Variety (e.g., "The job requires me to utilize a variety of different skills in order to complete the work") and Specialization (e.g., "The job is highly specialized in terms of purpose, tasks, or activities") with four items each. Social support was measured with the subscale social support of the WDQ with six Items such as "I have the opportunity to develop close friendships in my job". Participants had to indicate their agreement with all items of the WDQ on a five-point Likert scale (1 = not at all to 5 = completely). According to Stegmann and colleagues (Stegmann et al., 2010), the internal consistencies of the German scales have proven to be good for task autonomy ($\alpha = 0.84$–0.96) and varying from acceptable to excellent for the different subscales and samples on skill utilization ($\alpha = 0.67$–0.91) and social support ($\alpha = 0.62$–0.82).

To examine the criterion-related validity of the W-BNS-G, we assessed employees´ functioning, i.e., work engagement, burnout, performance, job satisfaction, affective organizational commitment, life satisfaction, and motivation: Work engagement was measured using the German version of the Utrecht Work Engagement Scale 9 (UWES 9; Sautier et al., 2015). The UWES 9 consists of nine items that measure academic engagement (e.g., "I am enthusiastic about my job"). Participants answered on a seven-point Likert scale (1 = never to 7 = always). Internal consistency of the German UWES-9 has an excellent value of $\alpha = .94$ (Sautier et al., 2015).

Burnout was assessed using the German version of the Maslach-Burnout Inventory (Wörfel et al., 2015) which is based on the Maslach-Burnout-Inventory-Student Survey (MBI-SS KV; Schaufeli et al., 2002). For our study, we adapted these items from the university context to the work context by changing single nouns. Participants indicated their agreement to the nine items referring to their current employment (e.g., "I doubt the significance of my work") on a seven-point Likert scale (1 = not at all to 5 = completely). The internal consistency of the German scale was reported to be acceptable with $\alpha = .73$–$.85$ (Wörfel et al., 2015).

Performance was measured using the German questionnaire "Skala zur Beurteilung beruflicher Leistung" (Work performance evaluation scale; Danner, 2014). The Scale consists of five items such as "The employee will achieve agreed upon or specified goals". The items were adapted for self-assessment (e.g., "I will achieve agreed upon or specified goals"). Participants rated their subjective performance on a six-point Likert Scale with anchor points whose wording depended on the question (1 = not at all to 6 = completely; 1 = very bad to 6 = very good). Internal consistency of the German Scale has an excellent value of $\alpha = 0.91$ (Danner, 2014).

Further, we assessed Job satisfaction using a short version of the German questionnaire "Allgemeine Arbeitszufriedenheit" (General job satisfaction; Fischer & Lück, 2014). Participants rated eight statements about their workplaces depending on "how they personally find these opinions right or wrong when thinking about their own work". Items such as "I really enjoy my work" were rated on a five-point Likert scale (1 = wrong to 5 = right). Anchor points of the scales varied depending on the wording of the items (e.g., "are you satisfied with your opportunities for advancement", 1 = very dissatisfied to 5 = very satisfied.) Split half reliability was reported to be very good ($r = .95$; Fischer & Lück, 2014).

The subscale affective organizational commitment of the German Questionnaire "Commitment Organisation, Beruf und Beschäftigungsform" (Commitment to Organization, Occupation, and Employment Form; COBB, Felfe et al., 2002) was used to examine affective organizational commitment. The COBB consists of five items (e.g., "I would be very happy to spend the rest of my working life in this organization"). Participants indicated their agreement on a 5-point Likert scale (1 = not at all to 5 = completely). Internal consistency of the subscale was reported to be good ($\alpha = 0.86$; Felfe et al., 2002).

Life satisfaction was assessed with the German version of the Satisfaction with Life Scale (SWLS; Janke & Glöckner-Rist, 2012). Five Items (e.g., "So far, I have achieved the essential things I want for my life") assess the cognitive component of subjective well-being. Participants reported their agreement on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree). Internal consistency was reported to be excellent with $\alpha = 0.92$ (Glaesmer et al., 2011).

The different types of motivation according to SDT were measured using the German version of the Multidimensional Work Motivation Scale (Gagné et al., 2015) with 19 items such as "I make an effort at work because others reward me financially only when I make an effort (e.g., employer,

supervisor)". Participants indicated "how much each of the following reasons applies to them to make an effort in their current work" on a 7-point Likert scale (1 = not at all to 7 = completely). Internal consistency was reported to be $\alpha = 0.55$– 0.93.

A summary of all measurement tools with number of items, range, Cronbach's alpha, and example item can be found in Appendix 2 Table 6.

Statistical analyses

First, we used confirmatory factor analysis (CFA) to test the three-factor structure of the W-BNS-G. Fit indices were based on well-established criteria: Due to our sample size $N > 250$, values of χ^2/df smaller than 3 indicate a good fit (Kline, 1998). Further, RMSEA < 0.05 indicates a good model fit (Browne & Cudeck, 1992) and should not be > 0.08. CFI and NFI should be greater than 0.95 for a good model fit (Schermelleh-Engel et al., 2003).

Second, we tested reliability and examined the item-total-correlations. Cronbach's alpha should be above 0.70 (Schermelleh-Engel & Werner, 2012) and item-total-correlations should be above 0.30 (Bühner, 2011). Additionally, we checked for normal distribution using the Shapiro-Wilk test. Further, the construct and the criterion-related validity were investigated using correlation and regression analyses.

Table 1 Correlations between W-BNS-G factors and construct-related scales

Variable	1	2	3
1. W-BNS-G: Autonomy			
2. W-BNS-G: Competence	.32**		
	[.25,.39]		
3. W-BNS-G: Relatedness	.40**	.26**	
	[.34,.47]	[.19,.33]	
4. Task autonomy: Work Scheduling Autonomy	.43**	.07	.11**
	[.36,.49]	[-.01,.14]	[.04,.19]
5. Task autonomy: Decision-Making Autonomy	.60**	.19**	.26**
	[.55,.65]	[.12,.27]	[.18,.33]
6. Task autonomy: Work Methods Autonomy	.53**	.13**	.23**
	[.47,.59]	[.06,.21]	[.16,.31]
7. Skill utilization: Specialization	.20**	.09*	.14**
	[.13,.27]	[.01,.17]	[.06,.21]
8. Skill utilization: Skill Variety	.44**	.13**	.25**
	[.37,.50]	[.06,.21]	[.18,.32]
9. Social support	.41**	.13**	.71**
	[.35,.47]	[.06,.21]	[.67,.75]

Note. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Last, we conducted multi group comparisons to test for CMI with the Dutch and the Italian sample, respectively (Hudecek et al., 2020; Vandenberg & Lance, 2000). Thus, we followed the procedure proposed by Fischer and Karl (2019): First, the baseline model is being compared to the configural model to analyze whether the overall structure is similar for both samples (configural invariance). Next, the factor loadings in both samples are being compared (metric invariance). The last step is comparing the item intercepts in both samples (scalar invariance). As χ^2 is sensitive to sample size, we used the CFI (Little, 1997) and RMSEA (Little et al., 2007) to report the results of the multi-group comparisons following the suggestions of Putnick and Bornstein (2016). The differences of both indices should be smaller than 0.01 for each level of invariance (Cheung & Rensvold, 2002). If full measurement invariance was not established, partial measurement invariance was tested, releasing items stepwise based on their modification indices until the global fit indices indicated a good fit without releasing more than half of the items for every factor (Vandenberg & Lance, 2000).

Data were analyzed using R Studio and the lavaan package (Rosseel, 2012) for CFA and multigroup comparisons. The level of significance for all analyses was $\alpha = 5\%$.

Results

Factor structure of W-BNS-G

First, we intended to replicate the three-factor structure of the original W-BNS. As the significant Shapiro-Wilk test ($p < .05$) indicated that the three basic needs were not normally distributed, χ^2 was Satorra-Bentler corrected. Results revealed a good model fit, $\chi^2(132) = 359.84$, $p < .001$; CFI = 0.92, NFI = 0.89; RMSEA = 0.052; SRMR = 0.05. Further, all items had significant loadings on their intended latent factor (see Appendix 3 Table 7).

Intercorrelations and reliability

Shapiro-Wilk test further indicated that the three scales of the W-BNS-G are not normally distributed (*Skewness* = −0.84 to -0.14, *Kurtosis* = 2.50–3.87). Cronbach's alpha for autonomy, relatedness, and competence was 0.77, 0.83, and 0.78, respectively. Autonomy, competence, and relatedness satisfaction were significantly correlated (see Table 1). Analysis for impression management revealed that our sample (M = 2.78, SD = 0.66) was comparable to the reference sample of the original scale (M = 2.61, SD = 0.76; Kemper et al., 2014) in the exaggeration of positive qualities. Further, for

the understatement of negative qualities, our sample showed similar agreement (M = 2.73, SD = 0.93) as the reference sample (M = 2.83, SD = 0.89).

Criterion-related and construct validity

The correlations between BNS and job resources can be found in Table 1. Task autonomy was more strongly correlated with autonomy than competence and relatedness satisfaction. Further, skill utilization was also more correlated with autonomy than competence and relatedness satisfaction. Last, social support was highest correlated to relatedness compared to autonomy and competence satisfaction.

All correlations calculated to examine criterion-related validity can be found in Table 2. As expected, we found positive associations between BNS and job satisfaction, life satisfaction, work engagement, performance, and affective organizational commitment. Additionally, all basic needs were positively correlated to identified and intrinsic motivation and negatively associated with burnout and amotivation. In addition, competence satisfaction was negatively associated with extrinsic and introjected regulation.

Cultural measurement invariance

A summary of basic descriptive statistics, including means, standard deviation, and Cronbach's alpha for BNS in the German, Dutch and Italian samples, can be found in Table 3. The results of the German sample are very similar to the Dutch and Italian samples. Cronbach´s alpha for the German sample ranges from α = 0.77 to α = 0.83, for the Dutch Sample from α = 0.78 to α = 0.80, and for the Italian sample from α = 0.77 to α = 0.82. CMI analysis is necessary to investigate, whether the absolute values of mean and standard deviation are comparable.

Results of the multi group comparisons for CMI between the German and the Dutch, as well as the Italian sample can be seen in Table 4. First, when comparing the baseline model of the W-BNS-G to the Dutch and the Italian version, respectively, configural measurement invariance can be assumed. Second, fit indices of the model testing metric invariance showed a worse fit for the Dutch and the Italian sample. Still, metric measurement can be assumed for both languages, since the χ^2-test is sensitive to larger sample sizes and the differences of the global fit indices were below the defined threshold of 0.01 (see Table 4). Last, scalar measurement invariance could not be obtained either for the Dutch or the Italian version. The differences in all fit indices clearly exceeded 0.01. Releasing items stepwise based on their modification indices revealed that partial scalar measurement invariance could be established neither for the Dutch nor the Italian version of the W-BNS.

Discussion

The main goal of this study was to develop and validate a German version of the W-BNS. Therefore, we intended to replicate the factor structure, reliability, and validity of the original version for the W-BNS. Further we tested for CMI between the German, the original Dutch, and the Italian sample.

Our results replicated the three-factor structure of the W-BNS for the German version, as the CFA fitted the data well according to its value of $\chi^2/df = 2.73$, smaller than 3. The RMSEA and CFI were around the standard thresholds, indicating acceptable to good model fit (Browne & Cudeck, 1992; Schermelleh-Engel et al., 2003). Only the NFI closely missed the threshold of 0.90 for acceptable model fit (Marsch & Grayson, 1995; Schumacker & Lomax, 1996)

Table 2 Correlations between W-BNS-G factors and criterion-related scales

Variable	1	2	3
1. W-BNS_G: Autonomy			
2. W-BNS_G: Competence	.32** [.25, .39]		
3. W-BNS_G: Relatedness	.40** [.34, .47]	.26** [.19, .33]	
4. Job Satisfaction	.74** [.71, .77]	.24** [.16, .31]	.39** [.33, .46]
5. Life Satisfaction	.32** [.25, .39]	.26** [.19, .33]	.27** [.20, .34]
6. Work Engagement	.69** [.65, .73]	.28** [.21, .35]	.43** [.37,.49]
7. Performance	.29** [.22, .36]	.58** [.53, .63]	.16** [.09, .24]
8. Organizational Commitment	.58** [.52, .62]	.15** [.08, .23]	.39** [.32, .45]
9. Burnout: Exhaustion	-.55** [-.60, -.49]	-.29** [-.36, -.22]	-.32** [-.38, -.25]
10. Burnout: Loss of Meaning	-.68** [-.72, -.63]	-.23** [-.30, -.16]	-.37** [-.43, -.30]
11. Burnout: Reduced Efficacy	-.49** [-.55, -.43]	-.39** [-.45, -.32]	-.33** [-.39, -.26]
12. MWMS: Amotivation	-.52** [-.58, -.46]	-.18** [-.26, -.11]	-.37** [-.43, -.30]
13. MWMS: Extrinsic motivation	-.07 [-.14, .01]	-.16** [-.23, -.08]	-.06 [-.14, .01]
14. MWMS: Introjected Motivation	.06 [-.02, .13]	-.08* [-.16, -.00]	.02 [-.05, .10]
15. MWMS: Identified Motivation	.43** [.37, .49]	.19** [.12, .26]	.31** [.23, .37]
16. MWMS: Intrinsic Motivation	.69** [.65, .73]	.24** [.17, .31]	.40** [.34, .47]

Note. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$

Table 3 Summary of descriptive statistics for the different languages of the W-BNS

Construct / Inventory	Mean	SD	α	Reference
German version				
BNS: Autonomy	3.27	0.73	0.77	
BNS: Competence	4.15	0.62	0.83	
BNS: Relatedness	3.70	0.77	0.78	
Dutch Version				
BNS: Autonomy	4.20	0.65	0.78	Van den Broeck et al., 2010
BNS: Competence	4.50	0.52	0.80	Van den Broeck et al., 2010
BNS: Relatedness	4.60	0.58	0.79	Van den Broeck et al., 2010
Italian version				
BNS: Autonomy	3.20	0.78	0.81	Colledani et al., 2018
BNS: Competence	4.10	0.60	0.82	Colledani et al., 2018
BNS: Relatedness	3.50	0.76	0.77	Colledani et al., 2018

Note. SD Standard Deviation, *α* Cronbach's alpha, *BNS* Basic Need Satisfaction

with a value of 0.89. However, it needs to be highlighted that the NFI is sensitive to sample (Bearden et al., 1982). Medsker et al. (1994) therefore suggest focusing on the CFI which is, other than the NFI, population-based. Thus, when considering all fit indices, we assume an acceptable to good model fit for our data. Focusing on the three factors themselves, all items were loading significantly on their intended latent factor. Besides, we proved good internal consistency and intercorrelation of the three basic need scales matching the results of the original W-BNS.

Regarding validity analysis, we could extensively establish construct validity: As expected, task autonomy was more strongly associated with autonomy than competence and relatedness satisfaction. Social support was most strongly related to relatedness compared to autonomy

and competence satisfaction. Thus, we could confirm the hypothesized construct validity for autonomy and relatedness satisfaction. Only skill utilization was unexpectedly more strongly associated with autonomy than competence satisfaction.

Moreover, we could extensively confirm criterion-related validity for the W-BNS-G by proving the expected correlations between BNS and variables, that assess employees' optimal functioning: As expected, BNS was positively associated with job satisfaction, work engagement, life satisfaction, affective organizational commitment as well as performance and negatively associated with burnout. Additionally, we found positive relationships between the BNS and more autonomous types of motivation, i.e., intrinsic and identified motivation, and negative associations between BNS and amotivation. Furthermore, competence was negatively associated with two more controlled forms of motivation, extrinsic and introjected regulation. Thus, these results not only demonstrate the validity of the scale, but also support previous research concerning SDT (e.g., Van den Broeck et al., 2016, 2021) and are in line with the results of the original W-BNS (Van den Broeck et al., 2010).

Last, we compared the German version of the W-BNS to the original Dutch W-BNS as well as the Italian version of the W-BNS. We found similar Cronbach's alpha values for all basic needs across all three versions of the W-BNS and no noticeable differences for any conducted analysis. Investigating CMI between the German, the original Dutch, and the Italian sample, multi group comparisons showed that there is partial CMI between the German sample and both the Dutch and the Italian sample. For two of three levels, i.e., configural and metric invariance, we could demonstrate measurement invariance between the different versions. Thus, the three basic needs are being conceptualized similarly by participants in all three countries (configural

Table 4 Summary of cultural invariance analyses between different languages of the W-BNS

Model	Fit indices									
	χ^2(df)	CFI	RMSEA [90% CI]	SRMR	Model comp.	$\Delta\chi^2$(df)	ΔCFI	ΔRMSEA	Δ SRMR	Decision
Dutch version										
Model A: Configural invariance	885.29 (264)	.896	.066 [.061-.071]	.056	_	_	_	_	_	_
Model B: Metric invariance	930.52 (279)	.891	.066 [.061-.071]	.061	A	45.23 (15)	.005	0	.005	Accept
Model C: Scalar invariance	4239.47 (294)	.326	.160 [.156-.164]	.260	B	3308.95 (15)	.565	.094	.199	Reject
Italian version										
Model A: Configural invariance	956.96 (264)	.912	.061 [.057-.065]	.049	_	_	_	_	_	_
Model B: Metric invariance	1007.57 (279)	.907	.061 [.057-.065]	.057	A	50.61 (15)	.005	0	.008	Accept
Model C: Scalar invariance	2071.09 (294)	.774	.093 [.089-.096]	.082	B	1063.52 (15)	.133	.032	.025	Reject

Note. All χ^2 tests and $\Delta\chi^2$ were significant, *p* <.001

measurement invariance). Additionally, associations of the W-BNS-G with other variables can be compared across samples from Germany, the Netherlands and Italy (metric measurement invariance). As we could not support full or partial scalar measurement invariance for the Dutch and the Italian sample, mean differences in the basic needs cannot be compared across studies in these countries. To illustrate the added value of our results, we would like to give an example: Imagine a HR professional in a German-speaking company, who wants to use the W-BNS-G to capture BNS among the employees. The results of previous research using the Dutch and Italian versions can be transferred, i.e., positive correlations between BNS and various outcome variables persist. However, the absolute values cannot be compared. Autonomy, for example, might have a value of 4.2. Assuming an average of 3.5 in a Dutch study, it is not possible to directly compare the values in a way that allows the HR professional to assume from the results that the level of autonomy among the employees in the company is above average. In general, a practitioner as well as a researcher from German-speaking countries thus cannot use the mean values from Italian and Dutch studies to compare or quantify the extent of need satisfaction in their respective context. For research, this means that norm scores have to be developed for the different language versions of the W-BNS and that researchers should control for language when collecting data across different language groups.

Limitations and suggestions for future research

On a positive note, we recruited a sample with participants working 33.56 h per week ($SD = 9.94$) on average that is thus representative for the German average. Still, our sample was biased towards female (71%) and younger participants ($M = 28.08$ years). To guarantee the representativity of the W-BNS-G for other samples, we tested for measurement invariance between gender and proved full measurement invariance across the gender of the participants for the W-BNS-G (see Appendix 4 Table 8). Therefore, mean differences on the latent factors can be compared across gender. This ties in with existing research on need satisfaction and gender differences (Ryan et al., 2022). However, future studies should closely examine potential gender differences or -alternatively - recruit a more representative sample regarding age and gender. Our sample was also slightly more educated than the German average. However, previous research (e.g., Van Den Broeck et al., 2008) has shown that the educational level is unrelated to need satisfaction. This aligns with one central proposition of SDT assuming that regardless of a person's age, cultural background, or individual preferences, the satisfaction of these basic needs

is fundamentally important for their psychological health and motivation (Ryan et al., 2022). Nevertheless, assessing the W-BNS-G among different samples to compare SDT-related outcomes across different educational backgrounds could be an interesting research topic for future studies with the W-BNS-G serving as a suitable measurement tool of BNS for German language.

Further, skill utilization was expected to be more strongly associated with competence satisfaction than autonomy and relatedness, but in fact, was highest correlated to autonomy. This finding was already reported for one sample in the original study (Van den Broeck et al., 2010) and may indicate that there is a theoretical discrepancy between competence and skill utilization. Skill utilization might be conceptualized as being free to use one's skills at work and less as feeling able to master those skills. Thus, skill utilization might not be fully appropriate to validate competence. Future research should investigate the construct validity of competence with different scales than skill utilization.

Another limitation within the measurement tools we assessed for validity analysis is the relatively low reliability observed in some subscales, such as Extrinsic Regulation of the MWMS and Reduced Efficacy of the German version of the Burnout Inventory. The lower internal consistency of these subscales could introduce measurement error, potentially affecting the strength of the observed relationships between BNS and these scales. While the overall findings remain robust, and our results align with previously proven associations between BNS, motivation, and burnout, future research should aim to validate these subscales further and consider alternative measurement tools to ensure a more reliable assessment of the constructs in the German language.

Given the cross-sectional design of the study and the inclusion of numerous variables, we assessed whether common method bias is apparent in our study. First, the investigation of impression management revealed that impression management did not confound participants' answers as our participants did not show a higher exaggeration of positive qualities or understatement of negative qualities (Kemper et al., 2014). Additionally, we included two attention check items in our survey and only considered participants in the final data set, when they answered both items correctly to ensure conscious participation. Second, to statistically control for common method bias, we included a marker variable in our correlation analysis based on the procedure suggested by Kock et al. (2021). Our analysis revealed, that none of the correlations involving the marker variable were significant (see OSF for more detailed information), suggesting that common method bias is not a significant concern in our study (Richardson et al., 2009).

Finally, this paper describes a cross-sectional study providing initial evidence of the good psychometric qualities of the scale. Thus, future research and empirical data assessing the scale in theoretical or practical investigations would help to gain further insights into the ecological validity of the scale.Currently, there are only two scales to assess BNS in German language, namely for the context of mental health (Heissel et al., 2018) and in exercise (Rackow et al., 2013).

Thus, another suggestion for future research might be investigating the applicability of the W-BNS-G in different domains by replacing "at work/at my job" with other formula such as "at school", and subsequently validating these adaptations.

Practical implications

The German W-BNS provides a measurement tool with multiple applications for human resource (HR) professionals and organizations. Primarily, the W-BNS-G can be employed as a validated instrument to regularly assess the degree of autonomy, competence, and relatedness satisfaction that employees experience in their roles. This enables HR professionals to develop and implement targeted interventions aimed at fostering the satisfaction of these needs, which, in turn, might enhance employee well-being (Vansteenkiste et al., 2007), job satisfaction (Van den Broeck et al., 2010), and overall performance (Van Wingerden et al., 2018) among other positively associated outcomes (Van den Broeck et al., 2016).

Additionally, the W-BNS-G holds significant utility in shaping and enhancing organizational culture. By leveraging the scale to monitor the extent to which employees' basic needs are met, HR professionals can foster an organizational climate that prioritizes employees' needs and enhances intrinsic or– more broadly– autonomous motivation and engagement while reducing turnover intentions accordingly (Ryan & Deci, 2017). Organizational initiatives that encourage social connectivity (relatedness), facilitate skill development (competence), and support autonomy are likely to lead to increased employee engagement, performance, and lower turnover rates, thus contributing to organizational success (Ryan et al., 2022).

Furthermore, the W-BNS-G can be strategically incorporated into leadership development programs. Previous research (Chiniara & Bentein, 2016; Hudecek et al., 2024; Jensen & Bro, 2018; Kovjanic et al., 2013) already provided insights into how BNS mediates the effect of servant and transformational leadership styles on employee motivation, performance, and organizational citizenship behavior. In addition, research shows the valuable impact of need support from the leader and colleagues for employee outcomes (Slemp et al., 2024). The W-BNS-G can serve as an instrument to develop and validate different leadership development programs accordingly to promote BNS and, thus, desired work-related outcomes.

Finally, in the context of organizational change, such as the increasing power shift from institutions to individuals or during restructuring or digital transformation, the W-BNS-G provides valuable insights into the psychological impact of these changes on employees. Given these changes, organizations must develop a deeper understanding of how to build motivating and engaging cultures that benefit both employees and organizations (Rigby & Ryan, 2018). By utilizing the scale, HR professionals can identify potential areas of low need satisfaction, allowing them to design or support change management processes that align with employees' need satisfaction and psychological well-being. Such informed interventions can mitigate resistance to change and promote smoother transitions, ultimately fostering greater acceptance and adaptation to organizational shifts (Ittner et al., 2019).

Thus, integrating the W-BNS-G into various HR practices to assess employees' BNS enables organizations to cultivate a more motivating, satisfying, and productive work environment, supporting individual well-being and organizational growth.

Conclusion

The three-factor structure, reliability, and validity of the original W-BNS were replicated for the W-BNS-G. Further, we showed partial CMI with the Dutch and the Italian sample. In summary, the W-BNS-G is recommended as a valid tool for future research and practical investigations regarding basic needs in the organizational context in German language.

Appendix 1

Table 5 German items of the W-BNS-G and English items of the W-BNS

German Item	Original Item
Need for autonomy	
Ich habe das Gefühl, ich kann bei meinem Job ich selbst sein	I feel like I can be myself at my job
Bei der Arbeit habe ich oft das Gefühl, dass ich den Anordnungen anderer Menschen folgen muss (R)	At work, I often feel like I have to follow other people's commands (R)
Wenn ich wählen könnte, würde ich Dinge bei der Arbeit anders machen (R)	If I could choose, I would do things at work differently (R)
Die Aufgaben, die ich bei der Arbeit machen muss, stehen in Einklang mit dem, was ich wirklich machen möchte	The tasks I have to do at work are in line with what I really want to do
Ich fühle mich frei, meinen Job so zu machen, wie ich glaube, dass er am besten gemacht werden könnte	I feel free to do my job the way I think it could best be done
In meinem Job fühle ich mich gezwungen, Dinge zu tun, die ich nicht tun möchte (R)	In my job, I feel forced to do things I do not want to do (R)
Need for competence	
Ich fühle mich in meinem Job nicht wirklich kompetent (R)	I don't really feel competent in my job (R)
Ich beherrsche wirklich meine Aufgaben bei meinem Job	I really master my tasks at my job
Ich fühle mich kompetent bei meinem Job	I feel competent at my job
Ich zweifle daran, ob ich fähig bin, meinen Job richtig auszuführen (R)	I doubt whether I am able to execute my job properly (R)
Ich bin gut in den Dingen, die ich in meinem Job mache	I am good at the things I do in my job
Ich habe das Gefühl, dass ich sogar die schwierigsten Aufgaben bei der Arbeit schaffen kann	I have the feeling that I can even accomplish the most difficult tasks at work
Need for Relatedness	
Ich fühle mich bei meinem Job nicht wirklich mit anderen Menschen verbunden (R)	I don't really feel connected with other people at my job (R)
Bei der Arbeit fühle ich mich als Teil einer Gruppe	At work, I feel part of a group
Ich pflege nicht wirklich Umgang mit anderen Menschen bei meinem Job (R)	I don't really mix with other people at my job (R)
Bei der Arbeit kann ich mit Menschen über Dinge reden, die mir wirklich wichtig sind	At work, I can talk with people about things that really matter to me
Ich fühle mich oft alleine wenn ich mit meinen Kollegen zusammen bin (R)	I often feel alone when I am with my colleagues (R)
Einige Menschen mit denen ich arbeite, sind enge Freunde von mir	Some people I work with are close friends of mine

Note. (R) Reversed item. The items were translated using the translation/back-translation procedure (Brislin, 1970)

Appendix 2

Table 6 Overview of psychological measures with number of items, Cronbach's alpha and example item

Construct / Inventory	Item Count	Range	α	Reference	Example Item
BNS: Autonomy	6	1 (strongly disagree) to 5 (strongly agree)	0.77	Based on Van den Broeck et al., 2010	I feel like I can be myself at my job
BNS: Competence	6	1 (strongly disagree) to 5 (strongly agree)	0.83	Based on Van den Broeck et al., 2010	I really master my tasks at my job
BNS: Relatedness	6	1 (strongly disagree) to 5 (strongly agree)	0.78	Based on Van den Broeck et al., 2010	Some people I work with are close friends of mine
MWMS	19	1 (not at all) to 7 (completely)	0.63-0.93	Gagné et al., 2015	I make an effort at work to get others' approval (e.g., supervisor, colleagues, family, clients…)
Work Engagement	9	1 (never) to 7 (always)	0.76	Sautier et al., 2015	I am enthusiastic about my job
Burnout	9	1 (strongly disagree) to 5 (strongly agree)	0.43-0.87	Wörfel et al., 2015	I doubt the significance of my work
Job Resources: Task autonomy	9	1 (strongly disagree) to 5 (strongly agree)	0.86-0.89	Stegmann et al., 2010	The job allows me to plan how I do my work
Job Resources: Skill utilization	8	1 (strongly disagree) to 5 (strongly agree)	0.76-0.85	Stegmann et al., 2010	The job requires a variety of skills
Job Resources: Social support	6	1 (strongly disagree) to 5 (strongly agree)	0.79	Stegmann et al., 2010	People I work with take a personal interest in me
Performance	5	1 (not at all/very bad) to 6 (completely/very good)	0.82	Danner, 2014	II achieve agreed upon or specified goals
Job Satisfaction	8	1 (not at all) to 5 (completely)	0.88	Fischer & Lück, 2014	I really enjoy my work
Organizational commitment	5	1 (not at all) to 5 (completely)	0.91	Felfe et al., 2002	I would be very happy to spend the rest of my working life in this organization
Impression management	6	1 (not at all) to 5 (completely)	0.57-0.58	Kemper et al., 2014	In an argument, I always remain objective and stick to the facts
Life Satisfaction	5	1 (not at all) to 7 (completely)	0.86	Janke & Glöckner-Riest (2012)	So far, I have achieved the essential things I want for my life

Note. α Cronbach's alpha, *BNS* Basic Need Satisfaction, *MWMS* Multidimensional Work Motivational Scale

Appendix 3

Table 7 Factor loadings for the CFA three-factor model of the W-BNS-G

W-BNS-G item	Factor loading		
	1	2	3
Need for autonomy			
Ich habe das Gefühl, ich kann bei meinem Job ich selbst sein [I feel like I can be myself at my job]	0.68		
Bei der Arbeit habe ich oft das Gefühl, dass ich den Anordnungen anderer Menschen folgen muss (R) [At work, I often feel like I have to follow other people's commands (R)]	0.50		
Wenn ich wählen könnte, würde ich Dinge bei der Arbeit anders machen (R) [If I could choose, I would do things at work differently (R)]	0.54		
Die Aufgaben, die ich bei der Arbeit machen muss, stehen in Einklang mit dem, was ich wirklich machen möchte [The tasks I have to do at work are in line with what I really want to do]	0.65		
Ich fühle mich frei, meinen Job so zu machen, wie ich glaube, dass er am besten gemacht werden könnte [I feel free to do my job the way I think it could best be done]	0.60		
In meinem Job fühle ich mich gezwungen, Dinge zu tun, die ich nicht tun möchte (R) [In my job, I feel forced to do things I do not want to do (R)]	0.59		
Need for competence			
Ich fühle mich in meinem Job nicht wirklich kompetent (R) [I don't really feel competent in my job (R)]		0.65	
Ich beherrsche wirklich meine Aufgaben bei meinem Job [I really master my tasks at my job]		0.73	
Ich fühle mich kompetent bei meinem Job [I feel competent at my job]		0.79	
Ich zweifle daran, ob ich fähig bin, meinen Job richtig auszuführen (R) [I doubt whether I am able to execute my job properly (R)]		0.61	
Ich bin gut in den Dingen, die ich in meinem Job mache [I am good at the things I do in my job]		0.76	
Ich habe das Gefühl, dass ich sogar die schwierigsten Aufgaben bei der Arbeit schaffen kann [I have the feeling that I can even accomplish the most difficult tasks at work]		0.59	
Need for relatedness			
Ich fühle mich bei meinem Job nicht wirklich mit anderen Menschen verbunden (R) [I don't really feel connected with other people at my job (R)]			0.67
Bei der Arbeit fühle ich mich als Teil einer Gruppe [At work, I feel part of a group]			0.74
Ich pflege nicht wirklich Umgang mit anderen Menschen bei meinem Job (R) [I don't really mix with other people at my job (R)]			0.62
Bei der Arbeit kann ich mit Menschen über Dinge reden, die mir wirklich wichtig sind [At work, I can talk with people about things that really matter to me]			0.58
Ich fühle mich oft alleine wenn ich mit meinen Kollegen zusammen bin (R) [I often feel alone when I am with my colleagues (R)]			0.62
Einige Menschen mit denen ich arbeite, sind enge Freunde von mir [Some people I work with are close friends of mine]			0.51

Note. $N = 648$. (R) Reversed item. The current study reports on the German version of the items. 1 = Autonomy, 2 = Competence, 3 = Relatedness. All loadings were significant, $p < 0.001$

Appendix 4

Table 8 Summary of measurement invariance analyses between gender for the W-BNS-G

Model	Fit indices				Model comp.	$\Delta\chi^2$(df)	ΔCFI	ΔRMSEA	Δ SRMR	Decision
	χ^2(df)	CFI	RMSEA [90% CI]	SRMR						
Model A: Configural invariance	572.40(264)	0.913	0.060 [0.053-0.067]	0.053	_	_	_	_	_	_
Model B: Metric invariance	590.99 (279)	0.912	0.059 [0.052-0.065]	0.061	A	18.59 (15)	0.001	0.001	0.008	Accept
Model C: Scalar invariance	633.10 (294)	0.905	. 060 [0.053-0.066]	0.058	B	42.11(15)	0.007	0.001	0.003	Accept

Note. All χ^2 tests and $\Delta\chi^2$ were significant, $p < 0.001$

Declarations

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