Basic Psychological Needs Under Constrained Autonomy: A Substantive–Methodological Reflection and Analysis of School Leaders' Needs from a Self-Determination Theory Perspective

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Abstract

School leaders face intensifying demands, creating a leadership crisis. We apply Self-Determination Theory (SDT) to examine how leaders' basic psychological needs operate under constrained autonomy—formal authority amid persistent external controls. Using survey data from 1,950 Australian school leaders, we offer a substantive–methodological reflection that (a) extends validation of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) with novel methods and (b) demonstrates SDT's relevance to demanding leadership roles.

We validate the BPNSFS two-facet structure—three needs (autonomy, competence, relatedness) crossed with two valences (satisfaction, frustration)—across two waves via a 3×2 multitrait–multimethod (MTMM) design with time as method. We then link this structure to a nomological network of 64 workplace variables spanning job demands, resources, well-being, and burnout. Our substantive–methodological synergy supports four propositions:

- Satisfaction and frustration are separable and differentially predict well-being and ill-being;
- Active need thwarting and frustration, especially of autonomy, relates more strongly to ill-being than merely insufficient satisfaction;
- Demands map more strongly to frustration, while resources align more strongly with satisfaction, consistent with the Job Demands–Resources (JD-R) model and SDT's dual process model;
- Content-specific patterns emerge—autonomy relates to voice and justice, competence to efficacy, and relatedness to collegial support.

Across bivariate and multivariate (orthogonal-contrast) tests, autonomy frustration predicts burnout and intent to leave, whereas autonomy satisfaction predicts professional commitment and well-being—evidence of a constrained-autonomy paradox in which leaders have formal authority but limited practical discretion—extending SDT through methodological synergy in service of theoretical development.

Keywords: Basic Psychological Need Satisfaction and Frustration; self-determination theory; School leadership and well-being; Job Demands-Resources Model; Multitrait-Multimethod design; substantive-methodological synergy

Basic Psychological Needs under Constrained Autonomy in School Leaders: A Substantive–Methodological Reflection from a Self-Determination Theory Perspective

> *Wanted: A miracle worker who can do more with less, pacify rival groups, endure chronic second-guessing, tolerate low levels of support, process large volumes of paper, and work double shifts (75 nights a year). They will have carte blanche to innovate but cannot spend much money, replace any personnel, or upset any constituency.* (R. Evans, Education Week, 1995)

Evans's (1995) depiction of school principals as miracle workers remains painfully relevant today. School leaders are pivotal in shaping school environments, fostering teacher effectiveness, and driving student outcomes; yet, they face mounting workplace challenges, including excessive workloads, bureaucratic demands, accountability pressures, and diminishing resources. They also occupy myriad—sometimes conflicting—roles as instructional leaders, organizational and budgetary managers, and community figureheads, contributing to high levels of stress and burnout (Dicke et al., 2018; 2022; Leithwood et. al, 2008; Marsh, Dicke et al., 2023; Marsh, Lüdtke et al., 2023). Declining job control, paired with ever-increasing demands, is associated with adverse outcomes, including mental health challenges, burnout, and high turnover (Goldring & Taie, 2018; Riley et al., 2021). Accordingly, our reflection on the field focuses on the problem of constrained autonomy, defined as formal authority with limited discretion, as it impacts school leaders.

The variety of pressures on school leaders creates a complex ecology of demands and resources. Two complementary frameworks help make sense of this landscape: Self-Determination Theory (SDT; Ryan & Deci, 2017) and the Job Demands–Resources (JD-R) model (Bakker & Demerouti, 2007; 2017). SDT posits that well-being hinges on the satisfaction versus frustration of three fundamental psychological needs: autonomy, competence, and relatedness. Support for and satisfaction of these basic needs fosters vitality and autonomous motivation, whereas the thwarting and frustration of these needs leads to strain and ill-being (Ryan & Deci, 2017; Vansteenkiste et al., 2020). JD-R then offers a flexible taxonomy for workplace conditions that either drain or sustain these needs. Job demands (e.g., workload, emotional labor, time pressure, and controlling leadership) are conditions that frustrate needs, deplete energy, and foster ill-being. Job resources (e.g., autonomy, role clarity, task variety, peer support, and growth opportunities) support employee needs and motivation, and can buffer the impact of job demands. School leaders are a unique case

because they experience the supports and constraints of their environment as well as enact them for others, making school leadership a nuanced and novel context for applying SDT's motivational processes and the JD-R taxonomy. School leaders, in this sense, represent a boundary condition that reflects complex contextual features, which can strengthen, weaken, or channel known SDT processes without challenging the universality of basic needs. While JD-R identifies the challenges and supports that school leaders face, SDT explains how these workplace features shape their functioning. SDT proposes that well-being and ill-being arise through the satisfaction or frustration of three basic psychological needs: autonomy, competence, and relatedness. In the context of school leadership, the critical questions include: Which demands and resources matter most, and through what motivational mechanisms do they influence leaders' well-being? SDT offers a process-based framework for addressing these questions, clarifying how specific environmental conditions translate into psychological outcomes.

Reflecting on Self-Determination Theory (SDT) Under Constrained Autonomy: A Lens for Leadership Well-Being

SDT is a longstanding framework of motivation and well-being. It proposes that the satisfaction of three basic psychological needs—autonomy (experiencing volition and self-endorsement), competence (feeling effective), and relatedness (feeling cared for and connected)—is essential for adaptive functioning across contexts. Equally, SDT holds that when these needs are actively frustrated (e.g., coercion, failure, exclusion), functioning is impaired. Importantly, need satisfaction and need frustration are not endpoints of a single continuum: low satisfaction is not the same as high frustration, and each shows differential associations with outcomes—an observation supported by accumulating evidence, including meta-analytic reviews (Ryan et al., 2022).

In leadership roles characterized by constrained autonomy—formal authority paired with limited discretion—this dual-process architecture should be particularly evident. To prepare the ground for our analyses, we first summarize the applications of SDT in school settings, then specify school leaders as a theoretical boundary case, and finally detail the dual-process model and measurement approach that we test. Figure 1 summarizes the a priori logic: within constrained autonomy, job resources are expected to feed primarily into need satisfaction and positive outcomes, whereas job demands are expected to feed primarily into need frustration and negative outcomes (see Figure 1)."

Propositions Guiding Our Reflection on the Field

Building on this SDT lens in the context of constrained autonomy, we state four propositions that organize the analyses and make the theoretical contribution explicit. To rigorously test these expectations, we adopt SDT's dual-process architecture and a two-facet operationalization (BPNSFS; needs × valence), which also establishes Proposition 3 (JD-R alignment by valence) and the subsequent validation work.

1. Dual-process separability. Satisfaction and frustration are empirically separable processes that differentially predict well-being versus ill-being, and the 3 × 2 (content × valence) structure replicates across time—disconfirmed if satisfaction and frustration are near-collinear or if the 3 × 2 structure fails to replicate across time.
2. Autonomy frustration under constraint. In constraint-heavy leadership roles, autonomy frustration shows a strong, unique association with ill-being in multivariate, theory-aligned contrast models. Disconfirmed if its association does not exceed competing need variables in orthogonal-contrast tests.
3. JD–R by valence. Job demands relate more strongly to need frustration, whereas job resources relate more strongly to need satisfaction. Disconfirmed if domain-level omnibus tests favour the opposite pattern or fail to show this valence-specific asymmetry.
4. Content-specific pathways. After accounting for valence and time, autonomy is most strongly related to voice and justice, competence is most strongly related to efficacy and progress, and relatedness is most strongly related to collegial support. Disconfirmed if these content effects vanish once valence is modelled.

SDT in Schools: Students, Teachers, and the Leadership Chain

Research on students and teachers has established robust links between need satisfaction, motivation, and well-being in school contexts, providing the backdrop for Proposition 1 (separability and differential prediction) and Proposition 4 (content-specific pathways).

SDT has been widely applied in school settings to understand how basic psychological needs shape motivation, engagement, and well-being. Meta-analyses confirm that need satisfaction is strongly associated with these outcomes for both students (Howard et al., 2021) and teachers (Slemp et al., 2020). When teachers experience greater need satisfaction in their work, they are more autonomously engaged and satisfied (e.g., Nie et al., 2015). In turn, they are more likely to adopt autonomy-supportive teaching practices, which enhance student engagement and motivation (e.g., Haw & King, 2023; Reeve et al., 2022), all of which

provide the backdrop for Propositions 1 (separability and differential prediction) and 2 (content-specific pathways).

Crucially, the motivational chain within schools often begins with leaders. Teachers' psychological need satisfaction is influenced to a significant degree by the leadership styles of their leaders. For example, Collie et al. (2016) found that when Canadian teachers perceived their school leaders as autonomy-supportive, they reported greater need satisfaction, which in turn predicted more positive work-related attitudes and motivation. Nie et al. (2015) reported a similar pattern in the impact of school leaders on the motivation and wellness of Chinese teachers. More recently, Collie (2023) replicated this cascade effect in Australia, finding that when leaders were perceived as autonomy-supportive, teachers reported greater vitality, higher engagement, and lower turnover intentions. Conversely, leaders perceived as need-thwarting were associated with higher teacher turnover intentions. These findings underscore the cascading effects of principal leadership on teacher and student outcomes (Ryan et al., 2023).

Yet despite this influence, SDT research has focused mainly on students and teachers, with minimal attention to school leaders themselves. More broadly, there has been little empirical research on the psychological needs of organizational leaders, such as CEOs or senior managers. Although these roles are widely acknowledged as high-stakes and high-stress, the basic psychological needs of those occupying them—particularly autonomy and competence—remain understudied. These omissions reflect a gap in both SDT and occupational psychology, where leader well-being is often treated as a downstream outcome rather than examined through the motivational processes that sustain it (Kelloway & Barling, 2010; Quick, Cooper, Gavin, & Quick, 2008).

The Complex Ecology of School Leaders

Extending this lens to school leaders, we argue that leaders operate under constrained autonomy—formal authority paired with limited discretion—making them a particularly interesting focus for assessing autonomy satisfactions and frustrations. As articulated in Proposition 2 above, we suspect that autonomy issues should be especially salient in these leadership roles, with the greater salience of frustration, especially autonomy frustration, being a prominent source of distress and ill-being.

Although many professions involve leadership challenges, school leaders face a uniquely demanding set of responsibilities. They must foster a positive learning environment, support student well-being, and navigate high-accountability, politically charged systems (Hallinger, 2011; Riley et al., 2021). As job control

declines and administrative demands increase, leaders face growing threats to their psychological well-being. Unsurprisingly, school leader turnover remains high: in Australia, nearly half of newly appointed principals leave the role within three years (Wahlstrom et al., 2010; Goldring & Taie, 2018). This instability disrupts school culture and undermines student achievement (Bartanen et al., 2019; Grissom & Bartanen, 2019).

Despite their central role in shaping school outcomes, researchers have paid little attention to school leaders' own psychological needs through the lens of SDT. One notable exception is Chang et al. (2015), who surveyed over 1,500 U.S. K–12 principals. Using the Work Climate Questionnaire (Baard et al., 2004), they found that principals who perceived greater autonomy support from superintendents also reported stronger affective commitment, especially among newer leaders. This study highlights the relevance of motivational processes for principal well-being. However, it focused solely on autonomy and did not distinguish satisfaction from frustration, nor did it assess the complete set of basic needs. These limitations point to the need for theory-driven research that examines all three SDT needs using multidimensional constructs.

This research gap extends beyond education. Scholars have largely overlooked the psychological needs of CEOs and other high-level organizational leaders. Although these roles are known to involve chronic stress, ethical pressure, and decision-making complexity, few studies have examined their basic psychological needs, especially within SDT or motivational frameworks (Kelloway et al., 2010; 2020; Quick, Cooper, Gavin, & Quick, 2008). Leader well-being is often treated as a downstream consequence of organizational functioning rather than as a motivational construct worthy of direct analysis.

Leaders at the apex of the school hierarchy are simultaneously shaping and being shaped by the environments they lead. This dual role creates a constrained-autonomy paradox: although school leaders formally hold decision-making authority, external policies, mandates, and political forces often restrict their practical autonomy or pressure them toward specific outcomes. This paradox provides a powerful test of SDT's dual-process model, which differentiates between need satisfaction (a driver of adaptive functioning) and need frustration (a source of maladaptive outcomes). By examining how these processes function in high-responsibility, constrained-autonomy roles, we assess the explanatory power and generalizability of SDT in one of its most demanding real-world applications. We treat constrained autonomy as a context in which resources and demands are differentially channeled through need processes to outcomes (Figure 1). We next outline this dual-process model and our two-facet operationalization, which we use to test these claims.

Extending Self-Determination Theory to Apex Roles: The Dual-Process Model

Recent developments in SDT emphasize not only the positive role of need satisfaction but also the distinct, adverse effects of need frustration. According to SDT's dual-process model, these satisfaction and frustration are not merely opposite ends of a continuum; instead, they represent distinct processes. Thus, satisfaction and frustration can be independent motivational processes, each with unique antecedents and outcomes (Bartholomew et al., 2011; Vansteenkiste & Ryan, 2013).

This dual-process framework rests on the idea that low satisfaction does not necessarily imply high frustration, and vice versa. Moreover, need satisfaction is expected to be more strongly predicted by highly supportive environments (e.g., job resources), whereas frustration is expected to be most strongly predicted by highly controlling or threatening conditions (e.g., job demands), not merely by the absence of support (Haerens et al., 2015; Slemp et al., 2018). Critically, need satisfaction predicts the presence of positive functioning (e.g., vitality, engagement), while need frustration predicts the presence of maladaptive outcomes (e.g., burnout, turnover intentions)—not simply their absence.

In high-responsibility environments such as school leadership, both processes may operate simultaneously. The same role may offer opportunities for meaningful influence while also imposing excessive demands, ambiguity, or coercive oversight. SDT's dual-process model is therefore well suited to explain functioning in such mixed conditions.

The constrained autonomy that school leaders face places them in a psychologically complex position—at once empowered and restricted—creating fertile ground for both satisfaction and frustration to emerge. We argue that this paradox makes school leaders an ideal and novel population for testing SDT's dual-process model. Their position at the apex of the school hierarchy offers both the structural autonomy to shape their environment and the exposure to systemic constraints that may frustrate their needs. Unlike students or teachers, school leaders both craft and experience the climates they lead. This recursive influence raises new theoretical questions about how needs operate when leadership actors navigate the systems that they help design and shape.

To address this, we adopt a two-facet model of psychological needs, operationalized through the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015). This model distinguishes among six need states—autonomy, competence, and relatedness, as well as satisfaction or frustration—rather than collapsing them into a single category. We theorize that these differentiated need processes serve as

distinct motivational pathways through which environmental conditions (e.g., job demands and resources) influence functioning.

In doing so, we extend SDT's reach to apex leadership roles and explore whether the dual-process architecture generalizes to complex, politically exposed occupational contexts. To date, there is almost no research on school leaders' need satisfaction or need frustration, or their associations with wellness, and none from a dual-process perspective. Related work shows that work–family conflict (proximal to need frustration) is associated with burnout (e.g., Haar et al., 2018; Ten Brummelhuis et al., 2014) and that leaders with more intrinsic values report higher well-being (Roche & Haar, 2013). Thus, our current work addresses an important gap within the SDT literature. By applying this model to the work of school leaders, we not only test the structural assumptions of SDT but also identify the motivational forces that support or undermine leadership well-being. Grounded in theoretical refinement and real-world application, this approach positions SDT as a compelling framework for understanding leadership under pressure.

A Substantive–Methodological Synergy:
A Reflection on Advancing Theory Through Quantitative Innovation

Having established school leaders as a compelling focus for assessing both need satisfaction and frustration, we translate SDT's dual-process logic into a quantitative framework that treats six need states—autonomy, competence, and relatedness, each with satisfaction and frustration—as separable motivational processes. This structure lets us test how specific job conditions (e.g., emotional demands, peer trust) selectively engage these pathways and, in turn, shape principal wellbeing and functioning. In our substantive-methodology synergy (Marsh & Hau, 2007), we evaluate validity through complementary internal and external strategies: an extended MTMM analysis of structure and distinctiveness, and a theory-driven nomological network of 64 workplace variables that probes predictive/discriminant patterns. Full details and additional diagnostics are in SM §S3A, B2.

Multitrait–Multimethod (MTMM) Analysis: Internal Approach to Construct Validity

Our internal validation employs the MTMM framework, adapted to SDT's six BPNSFS facets (Autonomy, Competence, Relatedness × Satisfaction, Frustration), and utilizes a longitudinal design. In this framework, time functions as the method; we treat the two waves as two "methods" of observing the same constructs. Here, we briefly outline the MTMM procedure and innovative adaptations relevant to SDT's dual-

process model (for an expanded discussion, see the Supplemental Materials section xx). In the traditional MTMM approach:

- Convergent validity in MTMM refers to the situation where the same construct, measured with different methods, relates strongly (monotrait–heteromethod correlation> high). Here, for example, the test-retest correlation for each of the six BPNSFS factors should be substantial-- the construct is stable and coherently measured across occasions.
- Discriminant validity means that *different factors are* sufficiently distinct to be meaningfully distinguished. For example, correlations between the same Autonomy/Satisfaction measured at T1 and T1 (a test-retest convergent validity) should be higher than the correlation between Autonomy/Satisfaction and any other BPNSFS factor.

Time as a Method Factor

Time has long been recognized as a potential method factor in multitrait–multimethod (MTMM) designs (e.g., Campbell & O'Connell, 1967; Marsh, 2010, 2020; Nussbeck, Eid, & Lischetzke, 2006). From a validation standpoint, time is a relatively "weak" method factor—closer to test–retest reliability than to stronger method manipulations (e.g., informant or response format). Yet this also makes it a conservative test. If a model fails to meet basic validity criteria across time, it is unlikely to succeed under more demanding conditions (e.g., multiple raters or multiple instruments). Critically, we do not interpret differences between waves as growth or change processes.

Validating the Measurement Model

Before evaluating the MTMM matrix, we fit a multiple-indicator latent measurement model with 12 trait–method units (six BPNSFS facets × two times). Item-level indicators load on their designated factors at each wave. This latent approach tests the factor structure underpinning the BPNSFS factors. Critically, it removes measurement error from the trait–method correlations and avoids a key limitation of manifest MTMM matrices. The latent correlation matrix from this measurement model, which is used to assess convergent and discriminant validity, is the MTMM matrix. Support for this measurement model (good fit and appropriate parameter estimates is a precondition for the application of the MTMM paradigm (Marsh & Hocevar, 1988

Objective Summary via Asymptotic Parameter Comparisons (APCs).

To improve upon the largely subjective criteria proposed initially by Campbell and Fiske (1959), we apply formal asymptotic parameter comparison (APC) procedures to evaluate convergent and discriminant validity. Using the MODEL CONSTRAINT command in Mplus, we compute standard errors, confidence intervals, and statistical significance tests for theoretically meaningful comparisons among latent trait–method units. By formally evaluating these expectations, APCs move the analysis beyond descriptive summaries and provide direct statistical evidence for the distinctiveness and temporal stability of the six BPNSFS constructs. This approach transforms Campbell and Fiske's informal guidelines into statistically rigorous criteria (Raykov, 2011; Marsh, 2020), enhancing both the interpretability and precision of MTMM evaluations. In doing so, it addresses one of the most important historical criticisms of the original Campbell–Fiske framework: the absence of statistical tests for core validity claims.

Three-Facet MTMM Design Aligned to SDT's 3×2 Architecture

To reflect the conceptual architecture of the BPNSFS and extend standard MTMM models, we introduce a three-facet MTMM design that crosses two substantive trait facets—need content (autonomy, competence, relatedness) and need valence (satisfaction vs. frustration)—with a method facet (time). While traditional MTMM frameworks include only traits and methods, this expanded structure allows for a more nuanced test of SDT's dual-process model. This methodological innovation acknowledges that the BPNSFS is not simply a collection of six distinct scales but a structured framework composed of two theoretically meaningful facets: content and valence. Crossing these trait facets with time as a method factor enables us to test convergent and discriminant validity both within and across dimensions, as well as across measurement occasions.

By defining convergent and discriminant validity with time as a method, fitting a latent measurement model, and testing the three-part rule with APCs, we provide a formal and accessible MTMM evaluation of the BPNSFS. The result is a clear statement: the six facets are recognisable, distinct, and replicable across occasions—providing a secure measurement foundation for the subsequent external (nomological and orthogonal-contrast) analyses.

External Construct Validity: A Nomological Network of 64 Variables

To examine explanatory reach, we embed the six BPNSFS factors in a nomological network spanning job demands, resources, well-being, and commitment (64 variables from the Australian Principal OHS&W Survey). The external validity tests operationalize the arrows in Figure 1 by linking job demands and

resources to need satisfaction versus frustration, and in turn, to positive versus negative outcomes. Following reviewer guidance, we map each correlate to SDT's content and valence facets and posit directional expectations (SM §S3A, B). Because the six factors are expected to be correlated, we transform them into five orthogonal contrasts (C1–C5) that mirror the 3×2 structure—capturing, for example, a primary valence contrast (Satisfaction vs Frustration), content-specific contrasts (e.g., Autonomy vs the average of Competence/Relatedness), and interaction-like combinations. Orthogonalization substantially reduces multicollinearity and clarifies interpretation without changing the underlying theoretical focus on content × valence.

General Linear Model (GLM) tests based on a priori orthogonal contrasts

Overview. As noted in the Introduction (External Validity of BPNSFS Scales) and detailed in SM§S4, our aim is to evaluate theory at the multivariate level rather than relying on bivariate correlations or multiple regressions with six correlated BPNSFS scales. Because multiple regression treats facets as interchangeable, ignores the BPNSFS 3 × 2 architecture, and is prone to multicollinearity and suppression, we implement a GLM based on a priori planned contrasts. Operationally, we re-expressed the six BPNSFS scales as five orthogonal (uncorrelated) contrasts mirroring the 3 (content: autonomy, competence, relatedness) × 2 (valence: satisfaction vs. frustration) structure, yielding independent components that map directly onto SDT's content × valence logic (construction details and contrast matrices in SM §S4).

What is tested and how the results are summarized. Using the contrast representation, we examine patterns across conceptually defined sets of correlates (demands, resources, positive outcomes, negative outcomes), rather than treating outcomes in isolation. For simplicity and transparency, we report bivariate correlations between each outcome and each orthogonal contrast score. Because the contrasts are mutually orthogonal and standardized, these correlations are numerically identical to the standardized regression coefficients that would be obtained if all contrasts were entered simultaneously in a single model. We then organize and interpret these coefficients by domain to assess whether the predicted patterns (e.g., a positive valence signal for resources and positive outcomes, a negative valence signal for demands and negative outcomes, and content-specific distinctions) emerge at a multivariate, domain-level scale.

Why this approach is stronger than a six-predictor MR. First, it is theory aligned: we specified tests a priori to reflect SDT's content × valence design rather than post hoc "unique effects" of six overlapping predictors. Second, it is genuinely multivariate: evidence is aggregated and interpreted across sets of

conceptually related outcomes, matching the way the theory is framed. Third, it is statistically cleaner: orthogonal contrasts remove collinearity among predictors, reducing suppression and instability. Finally, interpretation is direct: estimates are expressed in the language of SDT (valence and content contrasts), rather than partial regression weights whose meaning can shift with predictor intercorrelations.

Methodological–Substantive Synergy in Service of Theory Development: A Roadmap for the Present Investigation

We designed our methodological choices to be theory-relevant, not merely technical. The three-facet MTMM (content×valence×time) tests SDT's 3×2 architecture at the measurement level; APCs replace informal validity judgments with statistical comparisons; and the orthogonal-contrast framework turns potentially ambiguous six-factor regressions into multivariate, theory-aligned tests of the nomological network. Together, these decisions show that satisfaction and frustration operate as distinct systems that generalise across content domains and replicate across occasions, and that their external relations follow SDT-consistent patterns within the ecology of school leadership.

We designed our approach as a bridge between theory development in Self-Determination Theory (SDT) and an analytic strategy that directly tests those claims. We align our measurement with SDT's 3 (Autonomy, Competence, Relatedness) × 2 (Satisfaction, Frustration) architecture and evaluate its validity both internally and externally in ways that speak to the theory rather than the technique.

Internally, we implement a multitrait–multimethod (MTMM) approach, treating the two waves (~12 months apart) as the method facet. A latent measurement model specifies twelve trait–method units (six facets × two times), from which we derive a latent MTMM matrix. Convergent validity is assessed as the strength of same-facet relations across time; discriminant validity is assessed as the distinctiveness of content domains within valence and of valence within content at a given time. We evaluated these expectations using asymptotic parameter comparisons (APCs), which provide standard errors, confidence intervals, and formal tests of the MTMM inequalities. Time functions methodologically (replicability across occasions), not substantively (no growth claims), yielding a conservative test of structural distinctiveness.

Externally, we position the six facets within a theory-driven nomological network of 64 workplace variables (demands, resources, well-being, commitment). To reduce multicollinearity and sharpen interpretation, we re-express the six facets as five orthogonal contrasts (C1–C5) that map the 3×2 structure.

Using these contrasts, we conduct omnibus, domain-level multivariate tests alongside coefficient-level estimates, asking whether theory-predicted patterns hold collectively as well as individually.

Together, this roadmap operationalises SDT's dual-process logic: it tests whether satisfaction and frustration are empirically distinct systems that generalise across content domains, replicate across occasions, and display SDT-consistent external relations in the ecology of school leadership.

Methods

Participants and Recruitment

Participants were 1,950 Australian school leaders who completed the national Principal Occupational Health, Safety, and Well-Being Survey in 2018 and/or 2019. Roles were principals (76%) and deputy/associate or other leadership team members (24%); 40% were men. The average age was 54 years (SD = 7.81). Leaders worked in primary (60%), secondary (26%), and other settings (14%; K–12, special education). The mean tenure in the current role was 6.5 years (SD = 5.8), with a total of 15.3 years (SD = 7.8) of leadership experience. Wave coverage within the analytic sample was as follows: 2018 = 83%, 2019 = 70%, and both waves = 53%.

Recruitment took place through national and state principal organizations. Participation was voluntary; respondents represent a large share of the Australian leadership workforce. Public reports from the broader study indicate close correspondence with national distributions in terms of gender, sector/school type, location, and experience (e.g., Riley et al., 2019, 2021). We therefore use the term "school leaders" throughout and interpret the findings within the Australian context.

Measures

Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS)

The BPNSFS (Chen et al., 2015) is a 24-item measure of autonomy, competence, and relatedness, each assessed as satisfaction and frustration (six 4-item subscales). Responses were on a 5-point scale (not true at all to completely true). Item wordings appear in SM §S1, and longitudinal invariance details are presented in the results.

Nomological Network (64 variables)

To evaluate external validity, we related the six BPNSFS facets to 64 variables from the Principal OHS&W Survey, organized by the Job Demands–Resources (JD–R) framework: Job Demands, Job Resources, Positive Outcomes, and Negative Outcomes. Representative examples include quantitative and

emotional demands, role clarity, vertical trust, job crafting, general health, job satisfaction, and burnout. A complete list with definitions and sources is in SM §S3A. Domains mirror the schematic in Figure 1 (demands/resources → need processes → outcomes).

Statistical Analyses

Analyses were conducted in Mplus v8 (Muthén & Muthén, 1998–2017) using robust maximum likelihood (MLR) with full information maximum likelihood (FIML) for missing data. Because leaders could respond in either or both years, we treated missingness as missing at random (MAR; Enders, 2010). Having two occasions enhances the plausibility of MAR by providing auxiliary information; time is treated as a method facet (replicability across occasions), rather than as a basis for temporal or causal inference. We used exploratory structural equation modeling (ESEM) with oblique target rotation to allow small, theory-consistent cross-loadings, thereby improving global fit and discriminant validity (e.g., Marsh, Morin, et al., 2014; Marsh, Muthén et al., 2009). Target loadings were freely estimated, and non-target loadings were initially set (not fixed) to zero. We compared alternative measurement models that varied in factor structure, time invariance, and inclusion of a priori correlated uniquenesses for the same item across waves (e.g., Jöreskog, 1979; Marsh & Hau, 1996).

The final model comprised 12 latent factors (six needs × two waves), which underpin the multitrait–multimethod (MTMM) analyses. Model adequacy was judged holistically using fit indices—the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA)—in combination with parameter interpretability and theory (Marsh, Hau, & Wen, 2004). We avoided rigid cut-offs; conventional ranges were treated as rules of thumb (Hu & Bentler, 1999; Kline, 2016; Marsh, Balla & McDonald, 1988). For tests of configural, metric, and—where supportable—scalar invariance, we considered changes in CFI/TLI/RMSEA together with asymptotic parameter comparisons (APCs) and substantive justification.

Measurement Modelling and MTMM Tests of Convergent and Discriminant Validity

Treating time (2018, 2019) as the method facet, we estimated the measurement model via ESEM and extracted the latent MTMM correlation matrix from the final 12-factor solution. This matrix provided the evidential base for convergent validity (same construct across time) and discriminant validity (different constructs within time, and satisfaction vs. frustration within content). To move beyond descriptive inspection, we implemented APCs in MODEL CONSTRAINT to test MTMM-implied inequalities (e.g.,

same-facet correlations across time exceeding cross-facet within-time correlations; Raykov & Marcoulides, 2004).

External Validity of BPNSFS Scales: Theoretical Mapping of the Nomological Network

We assessed external (nomological) validity in two steps. First, we mapped the six BPNSFS facets (three contents × two valences) to 64 workplace variables spanning demands, resources, and outcomes and compared theory-based directional predictions with the observed bivariate associations. These descriptive summaries, presented in tables and a heat map, provide an interpretable overview of where predictions and data converge or diverge; rationales for variable groupings, directional expectations, and scoring rules are provided in SM §S3B. We report the full network to preserve transparency and context for subsequent multivariate tests.

Multivariate GLM Tests Based on A Priori Orthogonal Contrasts.

We summarize external validity using the orthogonal-contrast GLM described in Methods. The six BPNSFS subscales are re-expressed as five a priori, mutually orthogonal contrasts that align with the 3 × 2 architecture—C1 (valence: satisfaction vs. frustration), C2 (autonomy vs. competence + relatedness), C3 (competence vs. relatedness), with C4–C5 included for completeness. Reported values are correlations with these contrasts; under our orthogonal, standardized coding, they are numerically identical to standardized GLM coefficients if the contrasts were entered simultaneously. Domain summaries follow the a priori JD–R grouping (resources/positive outcomes; demands/negative outcomes) pre-specified in SM §S3A–S3B. This reparameterization tests theory on independent components, reduces collinearity and suppression relative to six-predictor regressions, and yields architecture-aligned inferences at both the contrast and domain levels. We detail the construction of the contrasts in SM §S4.

Results

We report results in two parts: (1) internal construct validity using an extended MTMM approach, and (2) external validity within a nomological network of 64 workplace variables. Together, these analyses test SDT's dual-process model under constrained autonomy in school leadership, examining satisfaction and frustration as distinct motivational systems across needs, time, and occupational conditions.

Measurement model

We specified a 12-factor ESEM with six a priori BPNSFS facets (Autonomy, Competence, Relatedness × Satisfaction, Frustration) at two waves, aligning with the instrument's 3×2 architecture and SDT's dual-

process logic. The best-fitting 3×2 model with loading invariance and correlated uniquenesses showed excellent fit (RMSEA = .012; CFI = .991; TLI = .989; Table 1). Target loadings were moderate–strong (M = .68; range = .41–.90) and cross-loadings were small (M = .02). Two nested alternatives performed substantially worse: a three-factor model that collapses satisfaction and frustration within each need, and a two-factor model that collapses all satisfaction and all frustration items. Figure 2 depicts the 3×2 structure and the resulting 12 trait–method units that underlie the MTMM analyses. We present the ESEM measurement model specifications and item-level loadings in the Supplementary Materials (SM §S6).

MTMM Evaluation of BPNSFS's Construct Validity: Traditional Two-facet Approach

We evaluated convergent and discriminant validity using Campbell and Fiske's (1959; Marsh, 1989) MTMM logic (also see SM§S2A) applied to the latent correlation matrix from the 12-factor ESEM measurement model (six BPNSFS facets × two waves; see Figure 3, lower triangle). In this context, time is the method facet (2018 vs. 2019), and each latent factor represents a specific need facet at a specific wave. A color-keyed schematic of the two-facet MTMM view appears below the main diagonal in Figure 3. We consider three comparison types, color-coded in Figure 3:

1. Same Trait Different Method (ST-DM with method =time; convergent validity; red cells in the lower triangle): correlations between the same BPNSFS facet measured at different waves (e.g., Autonomy Satisfaction in 2018 with Autonomy Satisfaction in 2019; AS1 with AS2).
2. Different Traits Different Method (DT-DM discriminant cross-time correlations; light-grey cells): correlations between different facets measured at different waves (e.g., AS1 with CF2).
3. Different Traits Same Method (discriminant within-time correlations; dark-grey cells): correlations between different facets measured at the same wave (e.g., AS1 with CF1).

Using asymptotic parameter comparisons (APCs) on the latent correlations, we obtained the following (see block means with SEs in SM §S5):

- Convergent validity (same construct across time): mean r = .704, SE = .017, indicating substantial stability and coherence for each need facet across waves.
- Discriminant—cross-time (different constructs across time): mean r = .333, SE = .014; the convergent mean exceeded this by .371 (SE = .014).
- Discriminant—same-wave (different constructs within time): mean r = .436, SE = .013; the convergent mean exceeded this by .268 (SE = .017).

- Method effect of time: among different-construct pairs, same-wave correlations exceeded cross-time correlations by .103 (SE = .011).

The classic two-facet MTMM results support convergent and discriminant validity for the six BPNSFS factors; they are stable across occasions and empirically distinct. However, the BPNSFS is designed to differentiate two substantive facets—content (autonomy, competence, relatedness) and valence (satisfaction, frustration). Because a two-facet MTMM is too coarse for this architecture, we introduce an innovative extension that treats content and valence as separate trait facets rather than implicitly combining them into a single generic trait. We therefore recode the same latent matrix as a three-facet MTMM (Figure 3, upper triangle), crossing content × valence as trait facets and retaining time as the method facet. Planned comparisons utilize the same APC framework (block summaries in Table 2) to test whether support for convergent and discriminant validity generalizes to both content and valence facets.

MTMM Analysis of BPNSFS Responses: An Extended Three-Facet Approach

Recasting the same latent matrix in Figure 3 as a three-facet MTMM allows us to separate the two substantive facets of the BPNSFS—content (autonomy, competence, relatedness) and valence (satisfaction, frustration)—while retaining time as the method facet (upper triangle). Each correlation is classified as either the same or different in content (SC/DC), valence (SV/DV), and method (SM/DM), and is color-coded accordingly in Figure 3. This allows us to ask whether convergent and discriminant patterns hold when we test content and valence separately, rather than implicitly combined. For example (see Table 2 for the full set of 21 a priori planned comparisons).

- Convergent benchmark (SC–SV–DM; red). Mean r = .704, SE = .017, indexing the same content and same valence measured at different waves and serving as the cross-time convergence anchor (the same benchmark used in the two-facet view).
- Content discriminant validity across time (SC–DV–DM; light blue). Mean r = .513. The convergent-minus-content-only gap is .191 (SE = .013), supporting the discriminant validity of the content facet when valence differs.
- Valence discriminant validity across time (DC–SV–DM; light amber). Mean r = .313. The convergent-minus-valence-only gap is .391 (SE = .016), indicating that matching valence alone yields smaller cross-time similarity than matching content.

- Overall discriminant across time (DC–DV–DM; light green). Mean r = .263, SE = .026. The convergent-minus-overall-discriminant gap is .441 (SE = .017), the largest contrast and a stringent benchmark for discriminant validity across occasions.
- Content versus valence as trait facets. The content-only minus valence-only difference is .200 (SE = .017), indicating that content distinctions are the stronger separative force, while still showing evidence for convergent and discriminant validity of both facets.
- Method variance is modest and interpretable. Holding content and valence both different, same-wave correlations (DC–DV–SM; dark green) average r = .334, whereas cross-time correlations (DC–DV–DM; light green) average r = .263; the same-wave minus cross-time difference is .071 (SE = .011). This confirms a small, expected inflation for within-occasion pairings that the design explicitly partitions.

Planned APC comparisons support the full profile predicted by SDT's 3×2 architecture: the red block is highest; content-only (light blue) sits above valence-only (light amber); and both exceed the fully discriminant cross-time block (light green). Across the full set, 20 of 21 theory-consistent differences were supported in APC tests (Table 2). Together, the three-facet results (a) establish strong cross-time replication when content and valence both match, (b) demonstrate discriminant validity for both content and valence, with content exerting the stronger separative force, and (c) isolate a method effect of time that is smaller than the substantive facets. This pattern is precisely what SDT's dual-process model and the BPNSFS's 3×2 design predict.

External Validity of BPNSFS Scales: Theoretical Mapping of the Nomological Network

We evaluate external (nomological) validity by mapping the six BPNSFS facets—three contents (autonomy, competence, relatedness) crossed with two valences (satisfaction, frustration)—to a network of 64 workplace variables spanning demands, resources, and outcomes. We based theoretical predictions on SDT (see SM §S3B for details) and organized with the JD–R framework (demands/resources → need processes → outcomes; see figure 1). We summarize external validity using the orthogonal-contrast GLM described in Methods. Reported values represent correlations with C1–C3 (and, where informative, C4–C5), which are equivalent to standardized GLM coefficients under the orthogonal and standardized coding used in this study. Domain means are shown using the JD–R labels (resources/positive outcomes; demands/negative outcomes), as pre-specified in SM §S3A–S3B, with construction details provided in SM §S4. In

summarizing these relations, we present descriptive bivariate patterns in comparison to theoretical predictions (Table 3; also see the heatmap in Figure 4) and place primary emphasis on multivariate tests using orthogonal contrasts that represent the 3 × 2 architecture (see Table 4).

Theoretical Predictions Based on Bivariate Relations

Rationale and predictions (SDT × JD–R). We predicted that job resources would align primarily with need satisfaction and adaptive outcomes, and job demands would align primarily with need frustration, strain, and adverse outcomes. Within content, autonomy was expected to be most closely tied to voice/justice and valued choice, competence to efficacy/progress, and relatedness to collegial trust and social capital under the constrained-autonomy conditions of school leadership.

Scoring convention for tabled summaries. For the descriptive "Pred vs Obs" summaries in Table 3, we retain all 64 correlates to display the full network, count ties as ½, and keep "?" rows visible for completeness. Using this rule, valence predictions were correct for 60 of 63 scored cases (95.2%), and content predictions were correct for 58.5 of 64 (91.4%; 58 correct, 1 tie, 5 wrong). These counts provide a transparent snapshot of bivariate accuracy; however, our interpretation relies on the orthogonal-contrast framework, which tests the SDT × JD–R predictions at a multivariate level.

Illustrative patterns. The results support the construct validity of the BPNSFS by demonstrating that theoretically anticipated associations are largely upheld in a real-world leadership context, and illustrate how distinct SDT facets relate to workplace demands, resources, and outcomes. Examples include:

- Burnout, workload stress, and role conflict showed the strongest correlations with frustration rather than satisfaction, consistent with SDT's dual-process model.
- Job satisfaction, harmonious passion, and perceived justice align most strongly with autonomy, underscoring the centrality of volition and value alignment in leadership roles.
- Self-efficacy and resilience align with competence, while collegial trust and community support mapped onto relatedness—validating the discriminant structure of the content facet.

Most mismatches involved the content facet and occurred where multiple needs were theoretically plausible (e.g., negative affect linked to both competence and relatedness frustration) or where the external construct blended several motivational dimensions. These inconsistencies reflect the complexity of occupational experiences and highlight areas where further theoretical refinement may be warranted.

Having established that the bivariate patterns largely accord with theoretical predictions, we now evaluate the multivariate relations by implementing a GLM with a priori orthogonal contrasts that honor the BPNSFS 3 × 2 architecture and test theory at the domain level.

Multivariate GLM tests based on a priori orthogonal contrasts

Overview. We aim to test theoretical predictions at the multivariate level rather than rely on bivariate correlations or multiple regressions with six correlated BPNSFS scales. A typical six-predictor multiple-regression approach treats facets as interchangeable, ignores the BPNSFS 3 × 2 architecture, and is vulnerable to multicollinearity, suppression, and unstable partial effects. Instead, we implement a GLM based on a priori planned contrasts. Operationally, we re-expressed the six BPNSFS scales as five orthogonal (uncorrelated) contrasts that mirror the 3 (content: autonomy, competence, relatedness) × 2 (valence: satisfaction vs frustration) structure. This contrasts-based GLM tests theory on independent components, aggregates evidence across conceptually related outcomes, improves control of inferential error, and yields effect estimates that map directly onto the BPNSFS architecture (see construction details and contrast matrices in SM §S4).

Contrast set (C1–C5). The set of five contrasts (C1-C5) based on BPNSFS's 3 × 2 design is as follows.

C1: valence (satisfaction vs frustration)

C2: autonomy vs (competence + relatedness)

C3: competence vs relatedness

C4: valence × [autonomy vs others]

C5: valence × [competence vs relatedness]

Domain-level tests. Using these contrasts, we stack the 64 correlates within domains (demands, resources, positive outcomes, negative outcomes) and conduct omnibus Wald tests on contrast-specific association vectors. These planned-contrast GLM tests examine whether, as a set, associations conform to directional expectations (e.g., C1 positive for resources and positive outcomes, and negative for demands and negative outcomes) and whether content distinctions (C2–C3) hold jointly once valence is taken into account.

Valence effects (C1). C1 reflects the primary satisfaction–frustration contrast. As anticipated, C1 shows a coherent pattern across the nomological network (see Table 4): positive associations with job resources and positive outcomes and negative associations with job demands and negative outcomes (e.g., *r*

=.36 with resources, $r = .53$ with positive outcomes; $r = -.35$ with demands, $r = -.28$ with negative outcomes).

Content Effects (C2: Autonomy vs. Competence + Relatedness). Using the a priori categories (the category column in Table 4), autonomy satisfaction is stronger for resources and positive outcomes (C2 > 0), and autonomy frustration is stronger for demands and negative outcomes (C2 < 0). We classify "autonomy stronger" as C2 > 0 for resources/positive outcomes and C2 < 0 for demands/negative outcomes; counts exclude domain means. Concretely, 23 of 29 resources and 7 of 7 positive outcomes favor autonomy satisfaction (e.g., harmonious passion, meaning of work, leadership quality, job predictability). In contrast, 20 of 23 demands and 3 of 5 negative outcomes favor autonomy frustration (e.g., workload stress, role conflict, work pace/quantitative demands, work–family conflict, burnout).

Across all 64 outcomes, 53 satisfy the a priori rule, so autonomy has a strong content signal in this taxonomy. The mean values for C2 at the bottom of Table 4 mirror this pattern: resources ($r = .07$) and positive outcomes ($r = .09$) favor autonomy satisfaction, whereas demands ($r = -.11$) and negative outcomes ($r = -.03$) favor autonomy frustration. In summary, planned-contrast analyses reveal that, after accounting for the valence contrast (C1), the autonomy-versus-others contrast (C2) is directionally positive for most resources and positive outcomes, and directionally negative for most demands and negative outcomes. The domain means for C2 exhibit the same pattern (Table 4).

There are, of course, sensible exceptions. For example, self-efficacy aligns more strongly with competence, and support from colleagues/community aligns more strongly with relatedness. Thus, although autonomy has stronger effects on the 64 outcomes considered here, this conclusion will vary depending on the set of correlates. We now evaluate C3 (competence vs. relatedness).

Content Effects (C3: Competence vs. Relatedness). For C3 (competence minus relatedness), positive values indicate competence is stronger; negative values indicate relatedness is stronger. Beyond the broad valence pattern, C3 exhibits interpretable content distinctions: competence is more strongly associated with capability-focused indicators (e.g., self-efficacy, progress/goal attainment, resilience), whereas relatedness is more strongly related with interpersonal-climate indicators (e.g., support from colleagues, collegial trust, social capital). On the frustration side, competence is more closely related to internalizing/strain indicators (e.g., cognitive stress), while relatedness is more closely related to conflictual interpersonal dynamics (e.g.,

role conflict). These distinctions are smaller and less ubiquitous than the C2 effects, but remain evident once the valence contrast (C1) is modeled

Content effects (C2 and C3). The content contrasts clarify distinctions beyond global valence. For C2 (autonomy vs. competence + relatedness), autonomy aligns most strongly with resources and outcomes that reflect agency and valued choice (e.g., the meaning of work, harmonious passion). In contrast, autonomy frustration aligns negatively with demands and adverse outcomes. For C3 (competence vs. relatedness), competence satisfaction aligns with individual capacity indicators (e.g., self-efficacy, resilience), whereas relatedness aligns with interpersonal supports (e.g., collegial support, social capital). On the frustration side, competence is more related to strain/internalizing indices (e.g., cognitive stress), whereas relatedness is more related to conflictual interpersonal dynamics (e.g., role conflict). The planned-contrast GLM indicates that these content differences are present at the domain level once valence is controlled for; the magnitude of pairwise differences varies across individual correlates (see Supporting Information, §S4).

Interaction-like effects (C4 and C5). Effects are smaller and less frequent than the main contrasts, but they indicate context sensitivity: content salience shifts in accordance with the overall need state. For example, autonomy-related signals (relative to competence/relatedness) are most diagnostic for justice/commitment when overall need fulfillment is lower; competence shows a stabilizing relation with job insecurity under lower fulfillment.

Implications. Table 3 and Figure 4 provide a bivariate "Pred vs Obs" orientation. The planned-contrast GLM evaluates the same theoretical expectations across sets of correlates, ensuring that inferences reflect the BPNSFS 3 × 2 structure rather than six correlated predictors considered in isolation. Where we describe a facet as having a stronger association within a domain, that statement is supported by planned contrasts with appropriate error control (see SM §S4).

The planned-contrast GLM framework provides a theory-consistent and statistically transparent basis for separating valence and content effects, and linking the internal 3 × 2 structure to external correlates. It clarifies where autonomy-, competence-, and relatedness-relevant experiences carry unique weight and when those signals are amplified or muted by overall need satisfaction/frustration—offering a principled alternative to six-predictor multiple regression and guiding interpretation and targeted intervention in school-leadership contexts.

Discussion

Overview

Using longitudinal data from 1,950 Australian school leaders, we assessed the construct validity and applied relevance of the BPNSFS in a demanding leadership context. Our analyses, anchored in an extended MTMM framework, ESEM, APCs, and theory-driven orthogonal contrasts, largely supported SDT's dual-process model. Need satisfaction aligns with resources and adaptive functioning, whereas frustration aligns with demands and strain. Time was treated as a method facet (replicability across occasions), not as a basis for temporal or causal inference. Consistent with our guiding principles, we evaluated model adequacy holistically (interpretability, parsimony, and theory coherence alongside fit indices used as heuristics), and we aligned all inferential summaries with the scale's 3 × 2 architecture.

Substantive Findings

Distinctive Roles of Satisfaction and Frustration

Our findings reaffirm the core propositions of SDT's dual-process model in this novel application by showing that need satisfaction and frustration are not merely opposite ends of a continuum but distinct constructs with differential correlates. Need satisfaction related more strongly to job resources and positive outcomes—such as harmonious passion, job satisfaction, and social capital—highlighting its protective function for well-being. By contrast, need frustration was more closely linked to job demands and adverse outcomes, including stress, burnout, and emotional exhaustion. In the constrained-autonomy ecology of school leadership, this distinction is particularly salient: leaders can experience pockets of satisfaction alongside persistent frustration imposed by systemic constraints. Across the nomological network, autonomy was a strong content predictor (for 53 of 64 correlates), while competence and relatedness displayed domain-specific salience.

Our study also underscores that need frustration has explanatory power beyond the absence of need satisfaction; it often reflects the effects of active need thwarting factors in one's environment, with distinct antecedents and consequences. In complex and demanding leadership contexts, this distinction is particularly salient, as needs may be both partially satisfied by the provision of authority that allows one to influence outcomes and actively frustrated by systemic constraints and pressures that limit one's autonomy.

Implications for School Leader Well-Being

Our findings illuminate critical dynamics in the professional lives of school leaders. The separation of satisfaction and frustration by need content reveals differentiated psychological vulnerabilities and strengths. Autonomy frustration emerged as a key predictor of emotional labor, stress, and burnout, reflecting the toll of externally constrained leadership and bureaucratic mandates. In contrast, autonomy satisfaction was associated with finding meaning, exercising influence, and experiencing growth at work. Competence satisfaction supported resilience and professional efficacy, while its frustration corresponded to cognitive stress, insecurity, and reduced confidence in managing complex demands. Relatedness satisfaction played a central role in fostering collegial and community support, whereas relatedness frustration predicted interpersonal conflict and social disconnection.

Together, these findings emphasize the need for targeted interventions that reduce specific sources of frustration while enhancing opportunities for satisfaction. In JD–R terms, autonomy-supportive structures (voice/justice, valued discretion, trimming low-value constraints), competence-supportive development (targeted professional learning, timely feedback, progress visibility), and relatedness-supportive design (structured collaboration, trust-building routines, community partnership) are actionable levers to improve the well-being, effectiveness, and retention of school leaders (Brown & Wynn, 2009). Similarly, a focus on factors that thwart leaders' needs can have independent beneficial effects by reducing autonomy frustrations associated with ill-being and burnout.

Broader Contributions to SDT

Our reflection on the field extends SDT by for the first time testing its dual-process model in one of the most complex applied settings: school leadership. School leaders hold formal authority yet operate under external mandates, political oversight, and bureaucratic pressures that constrain daily autonomy. This constrained-autonomy paradox—structurally empowered but functionally restricted—creates a demanding, real-world test of SDT's claim that need satisfaction and need frustration are independent psychological processes with distinct consequences.

Findings affirm that autonomy, competence, and relatedness function differently in their satisfied and frustrated forms. Autonomy satisfaction is related to positive, meaning-laden work experiences (e.g., job satisfaction, the meaning of work), whereas autonomy frustration shows strong links to ill-being (e.g., burnout, stress, role conflict). Competence satisfaction aligned with capability-focused correlates (e.g., self-efficacy, progress/goal attainment, resilience), while its frustration corresponded to cognitive strain and

insecurity. Relatedness satisfaction fostered collegial trust and social capital, whereas relatedness frustration was associated with interpersonal conflict and social disconnection. Beyond autonomy's typical prominence as a strong content predictor across the nomological network, the competence-versus-relatedness contrast (C3) clarified that competence is more salient for capability indicators. In contrast, relatedness is more salient for interpersonal climate—content distinctions that matter for practice.

Crucially, the results reiterate that satisfaction and frustration are not opposite ends of a single continuum; they have distinct antecedents and consequences. Interventions that aim solely to enhance satisfaction may fall short unless accompanied by active mitigation of frustration. Sustainable motivation and well-being, therefore, require a two-track approach: support satisfaction (autonomy, competence, relatedness) and reduce sources of frustration in environments where leaders face high responsibility and limited discretion.

These insights advance SDT and have important implications beyond education. They may help explain functioning in similarly structured roles, such as senior public administrators, health service leaders, and corporate executives, where formal authority coexists with salient constraints. In these settings, the BPNSFS provides a practical diagnostic and developmental tool for identifying which need processes to prioritize and for designing context-sensitive interventions that support leaders' well-being and effectiveness.

Innovative Methodological Perspectives

Modernized MTMM Measurement and Design

We estimated the measurement model using ESEM, which allowed for small cross-loadings that improved discriminant validity relative to strict CFA, while retaining a confirmatory backbone. Importantly—and atypically for MTMM applications—we modeled multiple indicators per construct, yielding a fully latent MTMM correlation matrix that reduces measurement error and cleanly partitions trait and method variance. To move beyond descriptive Campbell–Fiske heuristics, we used asymptotic parameter comparisons (APCs) to obtain standard errors, confidence intervals, and directional tests for convergent and discriminant validity inequalities. Following Campbell and O'Connell (1967), we treated time (two occasions) as a method facet within the MTMM rather than as a basis for substantive longitudinal inference. This design has strategic value, as it offers a best-case evaluation of convergent and discriminant validity and can be easily implemented in studies with test–retest data.

Taxonomy and Domaining of External Correlates (JD–R Framework).

We assembled a JD–R–aligned taxonomy of 64 external correlates—to our knowledge, the largest and most systematically structured nomological network used with SDT to date. Correlates were classified a priori into resources/positive outcomes and demands/negative outcomes, providing a theoretical basis for descriptive summaries and for planned-contrast aggregation at the domain level. This design links theory to estimation: the JD–R taxonomy underpins the contrast framework (C1 valence; C2 autonomy vs. others; C3 competence vs. relatedness) and supports robustness checks that converge across a priori labels and observed valence (C1) orientation (numbers in Results; details in Table 4).

Orthogonal-Contrast Framework Aligned to BPNSFS's 3 × 2 Architecture

We evaluated external validity with planned orthogonal contrasts that mirror the scale's 3 × 2 structure: C1 (valence), C2 (autonomy vs. competence + relatedness), and C3 (competence vs. relatedness). This reparameterization replaces six correlated subscales with three theory-defined, orthogonal contrasts. It reduces multicollinearity and statistical suppression compared to multiple regression, which enters all six BPNSFS subscales simultaneously. It also yields more stable estimates that read directly in SDT's content × valence terms. Domain summaries follow the JD–R grouping (resources/positive outcomes vs. demands/negative outcomes). For interpretability, we used orthogonal, standardized contrasts that map directly to SDT's content × valence structure and reported contrast–outcome correlations are equal to the standardized GLM coefficients under this coding (see SM §S4). Within a GLM framework, we interpret each contrast as a within-person profile across content at a given occasion (i.e., relative need salience), not as longitudinal within-person change.

Practical Implications

Our findings have immediate implications for policy and practice. School systems aiming to reduce burnout and turnover among school leaders should consider both reducing need frustration and increasing opportunities for need satisfaction. Strategies may include enhancing decision-making autonomy by reducing unnecessary bureaucratic constraints, creating structured opportunities for peer collaboration and community-building, or offering professional development opportunities aligned with school leaders' evolving competence needs. Beyond education, the BPNSFS has clear value in other high-stakes domains (e.g., healthcare, corporate leadership), where identifying need-thwarting environments may inform interventions to promote engagement, retention, and psychological well-being.

Limitations and Future Directions

Several limitations frame our interpretations. First, the nomological associations are cross-sectional within a wave; arrows in Figure 1 are heuristic and theory-based rather than causal. Second, time was treated as a method facet across two occasions in the MTMM design; stronger longitudinal designs with more waves (e.g., latent state–trait or STARTS) are required to model change. Third, conclusions rely on full-information maximum likelihood under a missing-at-random assumption; although two waves provide auxiliary information, departures from MAR could bias estimates. Fourth, reliance on self-report is appropriate for subjective need states but would benefit from triangulation with multi-informant and behavioral indicators (e.g., turnover, absence, performance). Fifth, the sample is Australian; SDT and the BPNSFS are broad frameworks, but institutional ecologies vary, so replication in non-Western and structurally distinct systems is needed. Sixth, our 64-correlate taxonomy is unusually comprehensive and JD–R aligned. However, it is not exhaustive, and its a priori classification may be imperfect for some variables; future work could extend coverage to organizational-structure correlates (e.g., accountability regimes, resourcing formulas) and sector-specific outcomes.

Finally, this study is among the few to examine motivational processes, mental health, and well-being among organizational leaders in high-responsibility roles. School leaders—like CEOs, senior managers, and public administrators—operate at the apex of formal hierarchies while navigating substantial external constraints, a constrained-autonomy paradox that offers a meaningful target for examining SDT's dual-process model. While our findings clarify how these dynamics function in educational leadership, future research should extend to leadership science more generally—replicating and refining these results in sectors such as healthcare, corporate, and public administration—to assess generalizability and inform context-sensitive interventions that support leader well-being and effectiveness.

Conclusions and New Perspectives: Reflections on the Field

Using a national sample of Australian school leaders, we validated the BPNSFS and confirmed SDT's dual-process model in a context of constrained autonomy—formal authority coupled with persistent external controls. Need satisfaction aligned more with resources and adaptive outcomes, whereas need frustration aligned more with demands and strain, underscoring that these are distinct constructs rather than merely polar opposites. The breadth of the nomological network, organized within a JD–R framework (64 correlates), strengthens the external validity of these conclusions.

Content-specific patterns were consistent and interpretable. Autonomy satisfaction related to meaning, influence, and professional growth, while autonomy frustration was a key predictor of burnout, emotional labor, and workload stress. Competence satisfaction aligned with resilience and self-efficacy; its frustration corresponded to cognitive strain and diminished confidence in managing complex demands. Relatedness need satisfaction fostered collegial trust and social capital; its frustration related to interpersonal conflict and social disconnection. Across domains, autonomy typically showed a strong content signal, with competence and relatedness exhibiting domain-specific salience (capability versus interpersonal climate).

Analytically, ESEM with multiple indicators, a fully latent MTMM matrix tested via APCs, and orthogonal contrasts aligned to the scale's 3 × 2 architecture provided testable validity evidence and interpretable effects that map directly onto SDT's content × valence logic. Time was treated as a method facet, supporting estimation and measurement checks without implying temporal inference.

These results have practical and policy relevance. Autonomy-supportive structures (voice/justice, valued discretion, and trimming low-value constraints), competence-supportive development (targeted professional learning, timely feedback, and progress visibility), and relatedness-supportive design (structured collaboration, trust-building routines, and community partnership) offer actionable levers to sustain motivation, resilience, and effectiveness among school leaders. More broadly, the pattern should generalize to other high-responsibility roles with salient constraints (e.g., senior public administration, healthcare, corporate leadership), positioning the BPNSFS as a practical diagnostic for designing context-sensitive interventions that support leader well-being and performance.

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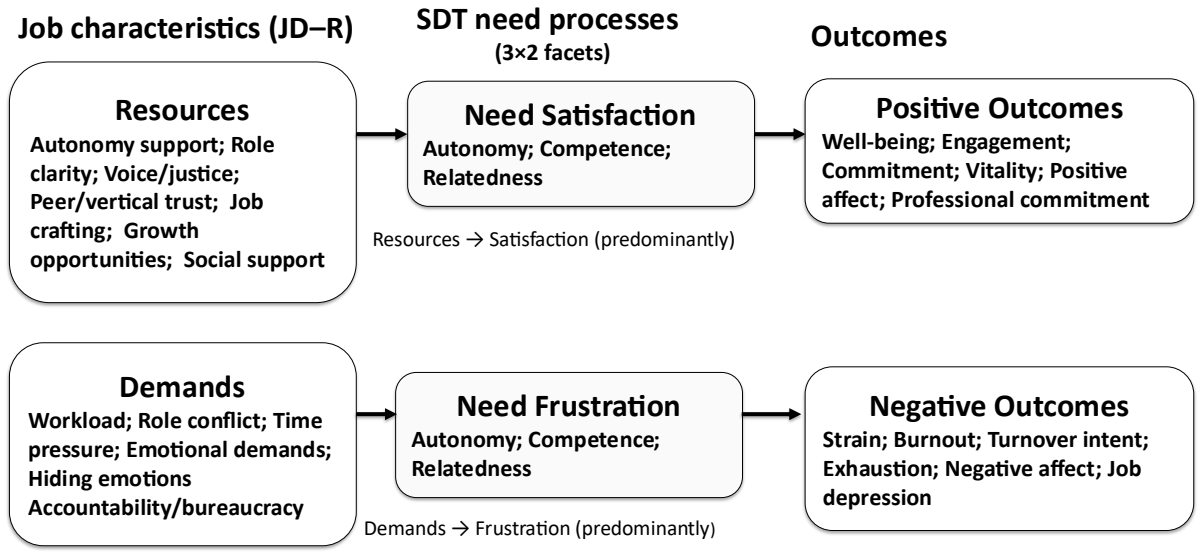
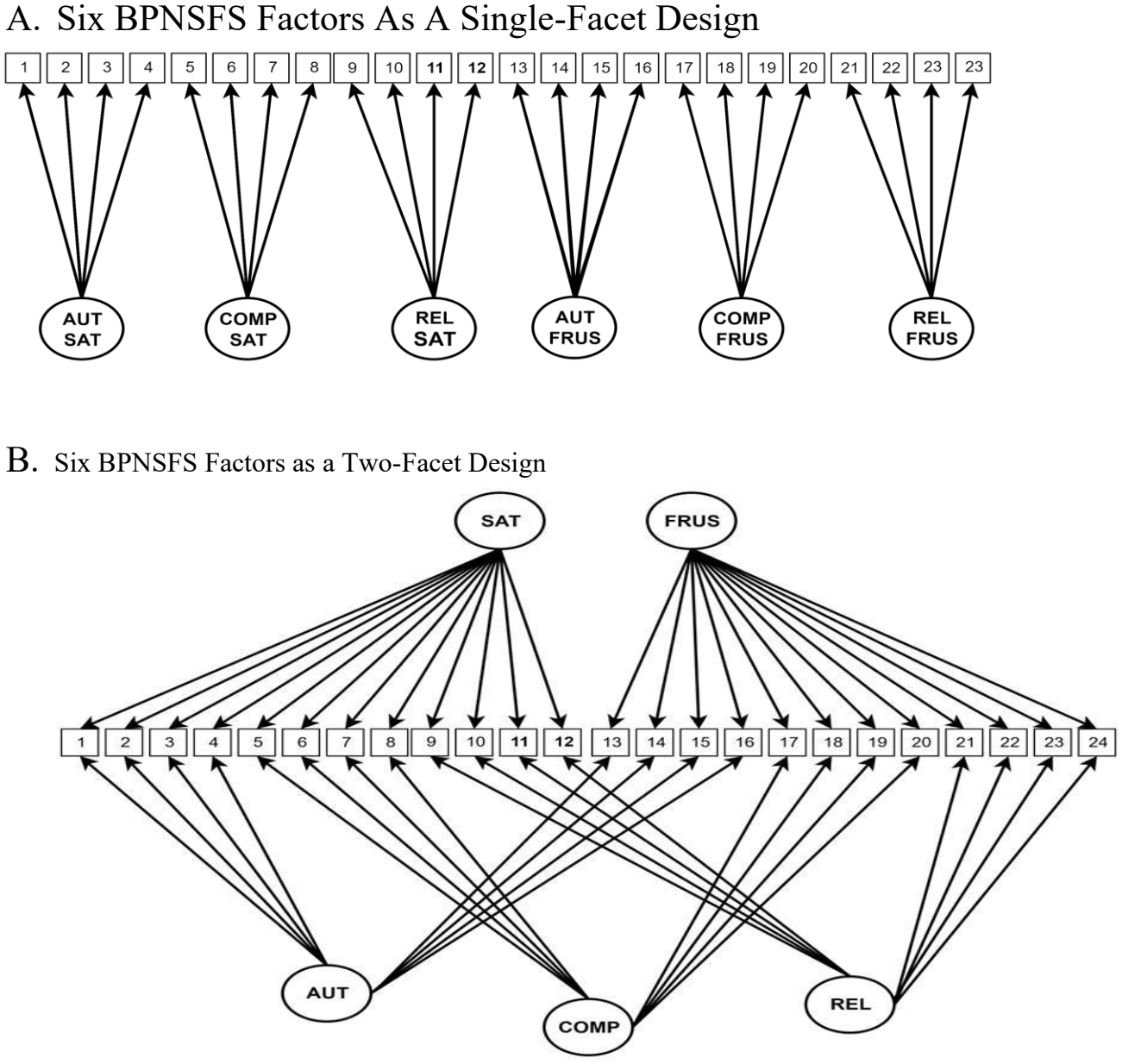
Figure 1. Constrained autonomy in school leadership: mapping job demands and resources to need processes and outcomes



Note. Conceptual schematic linking job characteristics organized by the Job Demands–Resources framework (JD–R) to need processes specified by Self-Determination Theory (SDT) and to outcomes. Examples of resources include autonomy support, role clarity, voice/justice, peer/vertical trust, job crafting, growth opportunities, and social support; examples of demands include workload, role conflict, time pressure, emotional demands, requirements to hide emotions, and accountability/bureaucracy. Predominant pathways are resources → need satisfaction → positive outcomes (well-being, engagement, vitality, professional commitment) and demands → need frustration → negative outcomes (strain, burnout, turnover intent, exhaustion, negative affect, job depression). The lists are illustrative rather than exhaustive, and arrows denote stronger—not exclusive—expectations. Empirical tests of these patterns appear in Figure 3 (heat map) and Supplementary Materials Section S4 (multivariate orthogonal-contrast analyses). Abbreviations: JD–R = Job Demands–Resources; SDT = Self-Determination Theory.

Figure 2

Single- and Two-Facet Representation of the Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS)

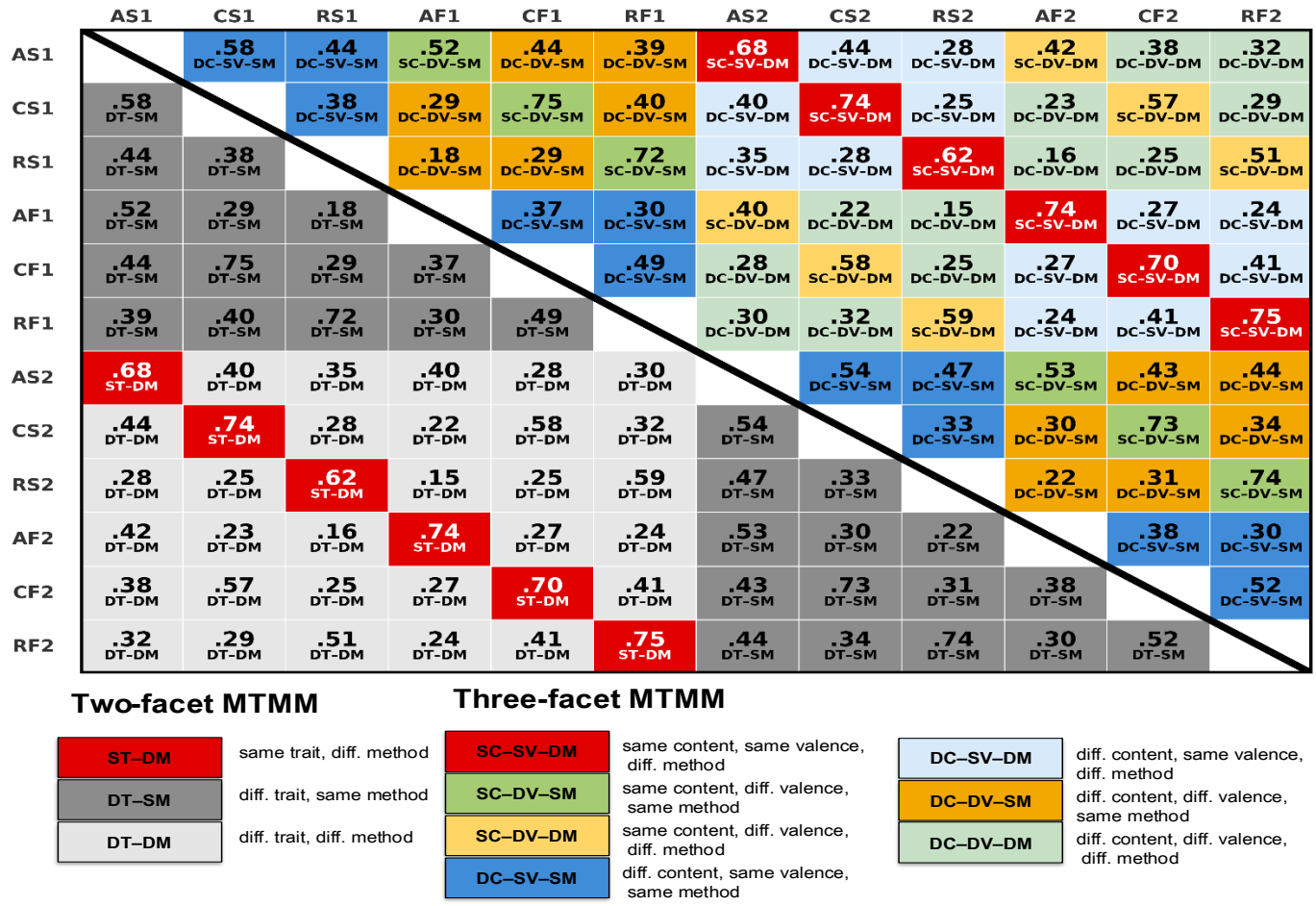


Note: AUT = autonomy, COMP = competence, REL = relations, SAT = satisfaction, FRUS = Frustration.

The BPNSFS consists of 24 items, divided into six subscales representing need satisfaction and need frustration in relation to three content areas (AUT, COMP, RE). In the single-facet representation (A), there are six factors (AUT_SAT, COMP_SAT, REL_SAT, AUT_FRUS, COMP_FRUS, REL_FRUS). The 3x2 two-facet representation (B) has a content facet with three factors (AUT, COMP, REL) and a valence facet with two factors (SAT and FRUS).

Figure 3

Multitrait–multimethod (MTMM) correlations for BPNSFS: Two-facet and Three-facet MTMM Models Figure 3 MTMM_combined_SD_codes_v7.png

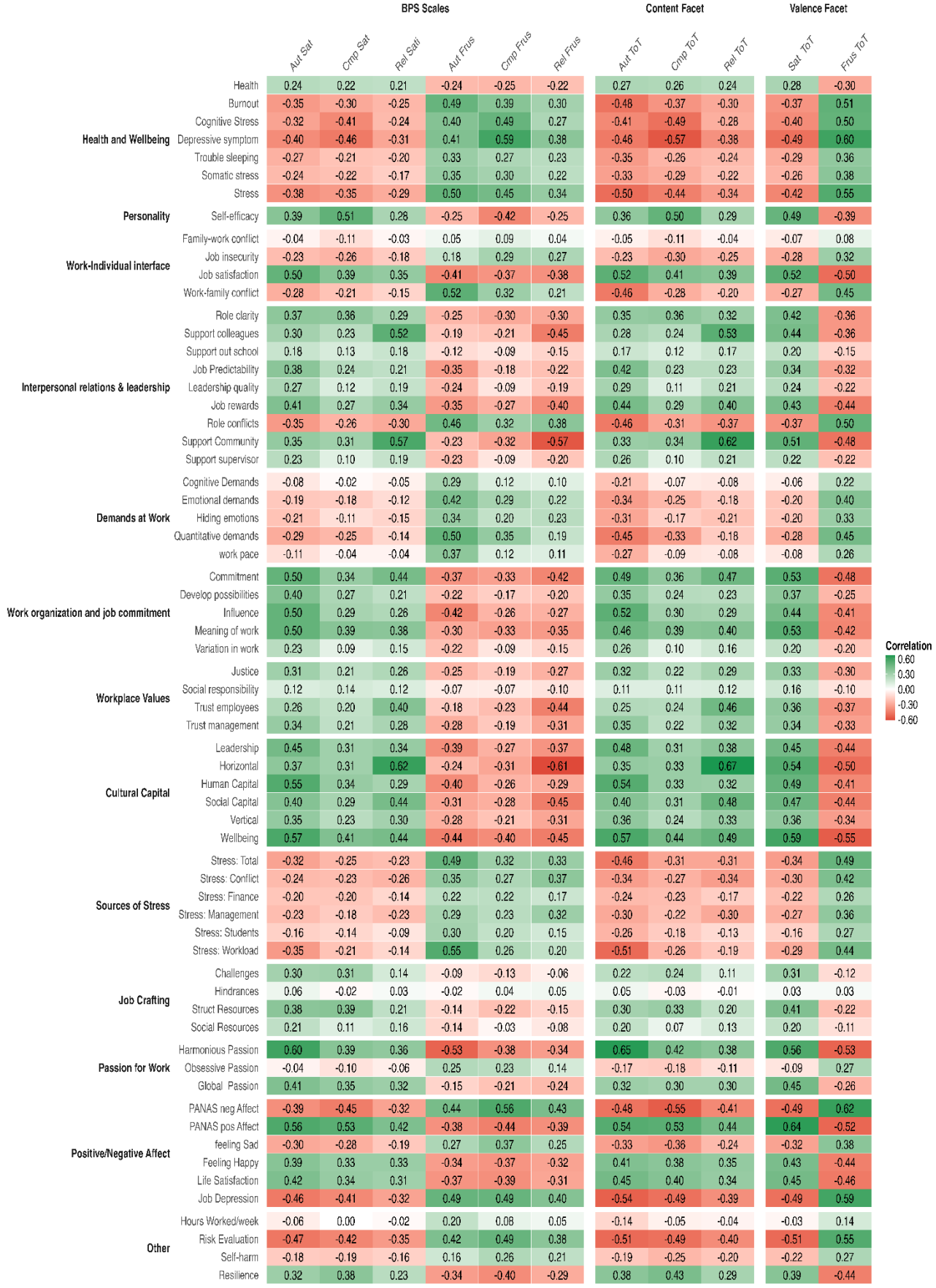


Note. Cells represent latent correlations among the 12 trait–occasion factors from the 12-factor model (M3B in Table 1), which we fitted to the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS). We measured the six BPNSFS constructs (A = Autonomy, C = Competence, R = Relations) × (S = Satisfaction, F = Frustration) at two time points (Time 1 and Time 2). For example, **AS1** denotes Autonomy–Satisfaction at Time 1.

Two-facet MTMM view (Lower Triangle). We tested time as the method facet (replicability across occasions). Shading represents the three combinations of the six traits and two methods (time), as shown in the legend: **ST–DM**, **DT–SM**, and **DT–DM**. Thus, for example, the correlation between Autonomy–Satisfaction at Time 1 and Competence–Satisfaction at Time 2 (**AS1** with **CS2**, r = .44) is in the **DT–DM** block (different trait, different method). Visual inspection indicates that **ST–DM** (convergent validity) correlations are generally larger than those in the **DT–SM** and **DT–DM** blocks. Block means and APC tests are reported in Table 3. This traditional two-facet MTMM design treats the six BPNSFS factors as a single set of traits without differentiating between content and valence (see Figure 2A).

Three-facet decomposition (upper triangle). We re-expressed the same correlation matrix in the upper triangle using **content** facets (A, C, R), valence facets (S, F), and method facets (Time 1, Time 2). Combinations of the three facets result in seven categories of correlations, each with a different color, indexing whether a pair shares content and/or valence and whether the method differs (see legend). Thus, for example, the same correlation between Autonomy–Satisfaction at Time 1 and Competence–Satisfaction at Time 2 (**AS1** with **CS2**, r = .44) is now in the **DC–SV–DM** block (different content, same valence, different method). Extending the MTMM logic, statistical comparisons among the blocks allow assessment of convergent and discriminant validity for the BPNSFS content and valence facets (see Table 3). This innovative three-facet MTMM design treats the six BPNSFS factors as reflecting distinct content and valence facets (see Figure 2B), consistent with the instrument's design and the theoretical underpinnings of Self-Determination Theory.

Figure 4 Heatmap Relating 64 Outcomes to BPNSFS Responses (also see Table 3)



Note. This heatmap illustrates the correlations between 64 outcome variables (rows) and six Basic Psychological Needs (BPN) subscales: autonomy satisfaction, competence satisfaction, relatedness satisfaction, autonomy frustration, competence frustration, and relatedness frustration. It also includes three aggregated indices: total satisfaction, total frustration, and satisfaction minus frustration. We grouped outcome variables by theoretically coherent domains (e.g., health and well-being, demands at work, interpersonal relations, cultural capital). Color gradients represent the strength and direction of the correlations: red tones indicate stronger positive correlations, blue tones indicate stronger negative correlations, and neutral tones indicate correlations near zero. This figure provides a visual complement to Table 4, offering an overview of the broader nomological network of BPN constructs. Entries are correlations between each outcome and the orthogonal BPNSFS contrasts (C1–C5); under the orthogonal and standardized coding, these equal the standardized GLM coefficients. Domain summaries follow the a priori JD–R labels (resources/positive outcomes; demands/negative outcomes) specified in SM § 3A–3 B. Contrast definitions, scaling conventions, and stacking rules are provided in SM §S4.

Table 1

Goodness-of-fit for Basic Measurement Models of Longitudinal Invariance Positing Two, Three, and Six Factors

Factor Model	χ^2	df	RMSEA	CFI	TLI	AIC
Two-Factor Model (Valence)						
M1: 2 Valence x 2 Time Factors	11365	1030	.061	.750	.726	241272
M1A: M1 + loading invariance over time	11416	1074	.060	.750	.737	241251
M1B: M1A2 + CUs	9409	1050	.054	.798	.783	238864
Three-Factor Model (Content)						
M2: 3 Content x 2 Time Factors	4371	981	.042	.887	.870	169085
M2A: M2 + loading invariance over time	4444	1044	.041	.887	.878	169034
M2B: M2A + Cus	3676	1020	.037	.912	.902	168170
Six-Factor Model (3×2 facets**)**						
M3: 3 Content x 2 Valene x 2 time factors	1467	834	.020	.979	.972	165836
M3A: M3 + loading invariance over time	1563	942	.018	.979	.975	165747
M3B: M3a + CUs	1195	918	.012	.991	.989	165375

Note. χ^2 = chi-square; df = degrees of freedom; RMSEA = root mean square error of approximation; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; AIC = Akaike Information Criterion; **CUs** = a priori correlated uniquenesses for the same item across waves. The six-factor 3×2 model with loading invariance and CUs (M3B) fits best across indices. Model 1 posits two factors, each occurring twice (one for satisfaction and one for frustration). Model 2 posits three factors over two times (combining the matching Need Satisfaction and Need Frustration factors). Model 3 posits six factors consistent with BPNSFS's design. For each model, alternatives include the invariance of factor loadings over time (M1A, M2A, M3A) and the addition of correlated uniquenesses (CUs) relating responses to the same item at Time 1 and Time 2 (M1B, M2B, M3B).

Table 2.
Three-Facet MTMM (Content × Valence × Time) Block Means and Pairwise Mean Differences for Latent Correlations (from Figure 3)

MTMM Category	Color Code	No.	Mean	SE	Means & Mean Differences (and SE) for Seven Categories						
					1 (.704)	2 (.664)	3 (.513)	4 (.424)	5 (.313)	6 (.334)	7 (.263)
SC-SV-DM	Red	1	.704	.017	—	.040 (.017)	.191 (.013)	.280 (.019)	.391 (.016)	.370 (.019)	.441 (.017)
SC-DV-SM	Dark Blue	2	.664	.014		—	.151 (.012)	.240 (.014)	.351 (.019)	.330 (.014)	.401 (.018)
SC-DV-DM	Light Blue	3	.513	.013			—	.089 (.019)	.200 (.017)	.179 (.018)	.250 (.016)
DC-SV-SM	Dark Amber	4	.424	.015				—	.111 (.012)	.090 (.008)	.161 (.014)
DC-SV-DM	Light Amber	5	.313	.016					—	-.021 (.012)	.050 (.009)
DC-DV-SM	Dark Green	6	.334	.014						—	.071 (.011)
DC-DV-DM	Light Green	7	.263	.016							—

Note. Entries are block means and pairwise mean differences (with SEs) from the color-coded latent MTMM correlation matrix in Figure 3 (upper triangle). We classified each pair by same vs. different content (SC/DC: autonomy, competence, relatedness), valence (SV/DV: satisfaction, frustration), and method (SM/DM: Time 1 vs. Time 2). Seven blocks are reported: SC–SV–DM (red; convergent, cross-time), SC–DV–SM (dark blue), SC–DV–DM (light blue), DC–SV–SM (dark amber), DC–SV–DM (light amber), DC–DV–SM (dark green), and DC–DV–DM (light green). "Mean" gives the block average correlation; "SE" its standard error. Upper-triangle cells report row–minus–column mean differences; the SE for each difference appears on the following line in parentheses. For example, the convergent mean is $r = .704$ (SC–SV–DM; red) and the fully discriminant cross-time mean is $r = .263$ (DC–DV–DM; light green); their difference is .441 (SE = .017), supporting discriminant validity. Based on the a priori ordering of categories, all 21 asymptotic parameter comparison (APC) tests were predicted to be positive; 20 of 21 planned differences were significantly positive and one was nonsignificantly negative.

Table 3
Nomological Links to BPNSFS Facets: Predicted vs. Observed Valence (S/F) and Content (A/C/R)

		Valence			Content												
Variable	**Cat**	**Pred**	**Obs**	**✓**	**Pred**	**Obs**	**✓**	**AS**	**CS**	**RS**	**AF**	**CF**	**RF**	**ATot**	**CTot**	**RTot**	**STot**	**FTot**
Health & Wellbeing																		
Health	OP	?	F		A	A	✓	.24	.22	.21	-.24	-.25	-.22	.27	.26	.24	.28	-.30
Burnout	ON	F	F	✓	A	A	✓	-.35	-.3	-.25	.49	.39	.3	-.48	-.37	-.30	-.37	.51
Cognitive Stress	D	F	F	✓	C	C	✓	-.32	-.41	-.24	.40	.49	.27	-.41	-.49	-.28	-.40	.50
Depressive symptoms	D	F	F	✓	A?	C	✗	-.4	-.46	-.31	.41	.59	.38	-.46	-.57	-.38	-.49	.60
Trouble sleeping	D	F	F	✓	A	A	✓	-.27	-.21	-.20	.33	.27	.23	-.35	-.26	-.24	-.29	.36
Somatic stress	D	F	F	✓	A?	A	✓	-.24	-.22	-.17	.35	.3	.22	-.33	-.29	-.22	-.26	.38
Stress (general)	D	F	F	✓	A	A	✓	-.38	-.35	-.29	.5	.45	.34	-.50	-.44	-.34	-.42	.55
Personality																		
Self-efficacy	R	S	S	✓	C	C	✓	.39	.51	.28	-.25	-.42	-.25	.36	.50	.29	.49	-.39
Work–Individual interface																		
Family–work conflict	D	F	F	✓	C?	C	✓	-.04	-.11	-.03	.05	.09	.04	-.05	-.11	-.04	-.07	.08
Job insecurity	D	F	F	✓	A?	C	✗	-.23	-.26	-.18	.18	.29	.27	-.23	-.3	-.25	-.28	.32
Job satisfaction	OP	S	S	✓	A	A	✓	.5	.39	.35	-.41	-.37	-.38	.52	.41	.39	.52	-.50
Work–family conflict	D	F	F	✓	A?	A	✓	-.28	-.21	-.15	.52	.32	.21	-.46	-.28	-.2	-.27	.45
Interpersonal relations & leadership																		
Role clarity	R	S	S	✓	C	C	✓	.37	.36	.29	-.25	-.30	-.3	.35	.36	.32	.42	-.36
Support colleagues	R	S	S	✓	R	R	✓	.30	.23	.52	-.19	-.21	-.45	.28	.24	.53	.44	-.36
Support outside school	R	S	S	✓	R	A	✓	.18	.13	.18	-.12	-.09	-.15	.17	.12	.17	.20	-.15
Job predictability	R	S	S	✓	A?	A	✓	.38	.24	.21	-.35	-.18	-.22	.42	.23	.23	.34	-.32
Leadership quality	R	S	S	✓	R?	A	✗	.27	.12	.19	-.24	-.09	-.19	.29	.11	.21	.24	-.22
Job rewards	R	S	F	✗	C	A	✗	.41	.27	.34	-.35	-.27	-.4	.44	.29	.4	.43	-.44
Role conflicts	D	F	F	✓	A	A	✓	-.35	-.26	-.30	.46	.32	.38	-.46	-.31	-.37	-.37	.50
Support community	R	S	S	✓	R	R	✓	.35	.31	.57	-.23	-.32	-.57	.33	.34	.62	.51	-.48
Support supervisor	R	S	S	✓	R?	A	✗	.23	.1	.19	-.23	-.09	-.2	.26	.10	.21	.22	-.22
Demands at work																		
Cognitive demands	D	F	F	✓	C	A	✗	-.08	-.02	-.05	.29	.12	.1	-.21	-.07	-.08	-.06	.22
Emotional demands	D	F	F	✓	R?	A	✗	-.19	-.18	-.12	.42	.29	.22	-.34	-.25	-.18	-.20	.40
Hiding emotions	D	F	F	✓	A	A	✓	-.21	-.11	-.15	.34	.20	.23	-.31	-.17	-.21	-.20	.33
Quantitative demands	D	F	F	✓	A	A	✓	-.29	-.25	-.14	.50	.35	.19	-.45	-.33	-.18	-.28	.45
Work pace	D	F	F	✓	A?	A	✓	-.11	-.04	-.04	.37	.12	.11	-.27	-.09	-.08	-.08	.26
Work organization & commitment																		
Commitment	R	S	S	✓	R?	A	✗	.50	.34	.44	-.37	-.33	-.42	.49	.36	.47	.53	-.48
Development possibilities	R	S	S	✓	C	A	✗	.40	.27	.21	-.22	-.17	-.2	.35	.24	.23	.37	-.25

Influence	R	S	S	✓	A	A	✓	.50	.29	.26	-.42	-.26	-.27	.52	.3	.29	.44	-.41
Meaning of work	R	S	S	✓	A	A	✓	.50	.39	.38	-.3	-.33	-.35	.46	.39	.4	.53	-.42
Variation in work	R	S	S	✓	A?	A	✓	.23	.09	.15	-.22	-.09	-.15	.26	.10	.16	.20	-.20
Workplace values																		
Justice	R	S	S	✓	A	A	✓	.31	.21	.26	-.25	-.19	-.27	.32	.22	.29	.33	-.30
Social responsibility	R	S	S	✓	R	R	✓	.12	.14	.12	-.07	-.07	-.1	.11	.11	.12	.16	-.10
Trust employees	R	S	F	✗	R	R	✓	.26	.2	.4	-.18	-.23	-.44	.25	.24	.46	.36	-.37
Trust management	R	S	S	✓	R?	A	✗	.34	.21	.28	-.28	-.19	-.31	.35	.22	.32	.34	-.33
Cultural capital																		
Leadership	R	S	S	✓	R?	A	✗	.45	.31	.34	-.39	-.27	-.37	.48	.31	.38	.45	-.44
Horizontal	R	S	S	✓	R?	R	✓	.37	.31	.62	-.24	-.31	-.61	.35	.33	.67	.54	-.50
Human capital	R	S	S	✓	C	A	✗	.55	.34	.29	-.4	-.26	-.29	.54	.33	.32	.49	-.41
Social capital	R	S	S	✓	R	R	✓	.4	.29	.44	-.31	-.28	-.45	.4	.31	.48	.47	-.44
Vertical	R	S	S	✓	A	A	✓	.35	.23	.3	-.28	-.21	-.31	.36	.24	.33	.36	-.34
Wellbeing	R	S	S	✓	A?	A	✓	.57	.41	.44	-.44	-.4	-.45	.57	.44	.49	.59	-.55
Sources of stress																		
Stress: Total	D	F	F	✓	A	A	✓	-.32	-.25	-.23	.49	.32	.33	-.46	-.31	-.31	-.34	.49
Stress: Conflict	D	F	F	✓	A	A	✓	-.24	-.23	-.26	.35	.27	.37	-.34	-.27	-.34	-.30	.42
Stress: Finance	D	F	F	✓	A	A	✓	-.2	-.2	-.14	.22	.22	.17	-.24	-.23	-.17	-.22	.26
Stress: Management	D	F	F	✓	A	A	✓	-.23	-.18	-.23	.29	.23	.32	-.30	-.22	-.3	-.27	.36
Stress: Students	D	F	F	✓	A	A	✓	-.16	-.14	-.09	.30	.20	.15	-.26	-.18	-.13	-.16	.27
Stress: Workload	D	F	F	✓	A	A	✓	-.35	-.21	-.14	.55	.26	.20	-.51	-.26	-.19	-.29	.44
Job crafting																		
Increase Challenges	R	S	S	✓	C	C	✓	.30	.31	.14	-.09	-.13	-.06	.22	.24	.11	.31	-.12
Reduce Hindrances	R	S	S	✓	A?	A	✓	.06	-.02	.03	-.02	.04	.05	.05	-.03	-.01	.03	.03
Increase Structural resources	R	S	S	✓	C	C	✓	.38	.39	.21	-.14	-.22	-.15	.30	.33	.20	.41	-.22
Increase Social resources	R	S	S	✓	R	A	✗	.21	.11	.16	-.14	-.03	-.08	.20	.07	.13	.20	-.11
Passion for work																		
Harmonious passion	OP	S	S	✓	A	A	✓	.60	.39	.36	-.53	-.38	-.34	.65	.42	.38	.56	-.53
Obsessive passion	ON	F	F	✓	C?	C	✓	-.04	-.10	-.06	.25	.23	.14	-.17	-.18	-.11	-.09	.27
Global passion	OP	S	S	✓	A	A	✓	.41	.35	.32	-.15	-.21	-.24	.32	.30	.30	.45	-.26
Affect & Negative affect																		
PANAS Negative affect	ON	F	F	✓	C?	C	✓	-.39	-.45	-.32	.44	.56	.43	-.48	-.55	-.41	-.49	.62
PANAS Positive affect	OP	S	S	✓	A?	A	✓	.56	.53	.42	-.38	-.44	-.39	.54	.53	.44	.64	-.52
Feeling sad	ON	F	F	✓	C?	C	✓	-.30	-.28	-.19	.27	.37	.25	-.33	-.36	-.24	-.32	.38
Feeling happy	OP	S	F	✗	A	A	✓	.39	.33	.33	-.34	-.37	-.32	.41	.38	.35	.43	-.44
Life satisfaction	OP	S	F	✗	A	A	✓	.42	.34	.31	-.37	-.39	-.31	.45	.40	.34	.45	-.46
Job depression	D	F	F	✓	A	A	✓	-.46	-.41	-.32	.49	.49	.40	-.54	-.49	-.39	-.49	.59
Other																		

Hours worked per week	D	F?	F	✓	A?	A	✓	-.06	.00	-.02	.20	.08	.05	-.14	-.05	-.04	-.03	.14
Risk evaluation	D	F	F	✓	A?	A	✓	-.47	-.42	-.35	.42	.49	.38	-.51	-.49	-.4	-.51	.55
Self-harm	ON	F	F	✓	A?	C	✗	-.18	-.19	-.16	.16	.26	.21	-.19	-.25	-.2	-.22	.27
Resilience	R	?	F		C	C	✓	.32	.38	.23	-.34	-.4	-.29	.38	.43	.29	.39	-.44
Category means																		
All Demands	D		F			A		-.25	-.22	-.18	.36	.29	.24	-.35	-.28	-.23	-.27	.38
All Resources	R		S			A		.34	.24	.29	-.24	-.21	-.27	.33	.24	.30	.36	-.31
All Negative outcomes	ON		F			C		-.20	-.20	-.14	.23	.27	.19	-.24	-.25	-.18	-.22	.29
All Positive outcomes	OP		S			A		.47	.4	.35	-.37	-.39	-.35	.48	.43	.38	.51	-.48

Note. Table reports standardized correlations between 64 correlates and the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) facets. Correlates are grouped as Positive Outcomes (OP), Negative Outcomes (ON), Demands (D), and Resources (R). Facet scales are AS = Autonomy Satisfaction, CS = Competence Satisfaction, RS = Relatedness Satisfaction, AF = Autonomy Frustration, CF = Competence Frustration, RF = Relatedness Frustration; content totals are ATot, CTot, RTot and valence totals are STot and FTot. "Pred" columns list theory-based facet predictions for valence (S = Satisfaction; F = Frustration) and content (A = Autonomy; C = Competence; R = Relatedness). "Obs" columns indicate the observed facet based on totals: observed valence is S if $|STot| \geq |FTot|$, else F; observed content is the A/C/R total with the largest absolute correlation. A check mark (✓) indicates the prediction matched the observed facet; a cross (✗) indicates a mismatch; rows with Pred = "?" are not scored. As summarized in the text, valence-facet predictions were correct for 60 of 63 scored correlates (95.2%) and content-facet predictions for 58.5 of 64 (91.4%; 58 correct, 1 tie, 5 wrong). . The rationale for predictions appears in SM §S3B. The figure provides a visual complement to these relations (see Figure 3).

Table 4

Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) Orthogonal Contrasts and Pairwise Comparisons: Correlations with Nomological Network Variables

Variable	Cat	BPS Scale Orthogonal Contrasts					Pairwise Comparisons		
		C1	C2	C3	C4	C5	Aut-Cmp	*Aut-Rel*	Cmp-Rel
Health & Wellbeing									
Health	OP	**.31**	*.03*	*.01*	.00	**-.04**	.00	*.02*	*.03*
Burnout	ON	**-.47**	**-.17**	**-.05**	*-.03*	*-.02*	**-.09**	**-.16**	**-.07**
Cognitive Stress	D	**-.48**	*-.04*	**-.19**	*-.02*	*.01*	**.10**	**-.11**	**-.21**
Depressive symptoms	D	**-.58**	**.01**	**-.17**	*.00*	*.00*	**.14**	**-.06**	**-.19**
Trouble sleeping	D	**-.35**	**-.11**	**-.01**	*-.01*	*.01*	**-.07**	**-.09**	*-.03*
Somatic stress	D	**-.34**	**-.10**	**-.05**	*-.02*	*-.01*	*-.04*	**-.10**	**-.07**
Stress (general)	D	**-.53**	**-.13**	**-.06**	*.01*	*-.02*	**-.04**	**-.13**	**-.09**
Personality									
Self-efficacy	R	**.48**	*-.03*	**.20**	*.00*	*.03*	**-.16**	**.06**	**.21**
Work–Individual interface									
Family–work conflict	D	**-.08**	*.02*	**-.07**	*.00*	*-.03*	**.06**	*-.01*	**-.07**
Job insecurity	D	**-.32**	**.04**	**-.05**	**-.04**	**.05**	**.08**	*.02*	**-.05**
Job satisfaction	OP	**.55**	**.14**	*-.01*	**-.04**	*-.02*	**.09**	**.10**	*.02*
Work–family conflict	D	**-.38**	**-.25**	**-.05**	*-.03*	*-.03*	**-.16**	**-.23**	**-.09**
Interpersonal relations & leadership									
Role clarity	R	**.42**	*.02*	*.03*	*-.03*	*.01*	*-.02*	*.02*	**.04**
Support colleagues	R	**.43**	**-.11**	**-.28**	*-.02*	*-.03*	*.03*	**-.25**	**-.27**
Support outside school	R	**.19**	*.03*	**-.06**	*-.04*	*-.04*	**.05**	*-.01*	**-.06**
Job predictability	R	**.36**	**.22**	*-.03*	*-.02*	*.02*	**.18**	**.16**	*.00*
Leadership quality	R	**.25**	**.16**	**-.11**	*.01*	*-.03*	**.18**	**.07**	**-.09**
Job rewards	R	**.47**	**.10**	**-.13**	*-.03*	*-.02*	**.13**	*.01*	**-.10**
Role conflicts	D	**-.47**	**-.14**	**.08**	*-.01*	*.01*	**-.13**	**-.07**	**.05**
Support community	R	**.53**	**-.16**	**-.27**	*-.01*	*.00*	*-.03*	**-.29**	**-.27**
Support supervisor	R	**.24**	**.12**	**-.13**	*.01*	**-.04**	**.15**	*.03*	**-.11**
Demands at work									
Cognitive demands	D	**-.15**	**-.15**	*.03*	**-.06**	*.04*	**-.13**	**-.11**	*.01*
Emotional demands	D	**-.32**	**-.15**	**-.05**	**-.07**	*-.03*	**-.08**	**-.14**	**-.07**
Hiding emotions	D	**-.28**	**-.14**	**.06**	**-.07**	*.00*	**-.13**	**-.09**	*.04*
Quantitative demands	D	**-.39**	**-.23**	**-.11**	**-.05**	*-.03*	**-.11**	**-.24**	**-.14**
Work pace	D	**-.18**	**-.21**	*.02*	**-.08***	*-.02*	**-.18**	**-.17**	**-.01**
Work organization & commitment									
Commitment	R	**.54**	**.10**	**-.12**	**-.05**	*-.04*	**.11**	**.01**	**-.10**
Development possibilities	R	**.33**	**.14**	*-.01*	*-.02*	*-.01*	**.11**	**.11**	**.01**
Influence	R	**.46**	**.27**	*-.02*	*-.02*	*.01*	**.21**	**.21**	*.02*
Meaning of work	R	**.51**	**.08**	*-.03*	*-.03*	*.00*	**.05**	**.04**	*.00*
Variation in work	R	**.23**	**.14**	**-.08**	*.01*	*-.02*	**.15**	**.08**	**-.06**
Workplace values									
Justice	R	**.34**	**.08**	**-.08**	**-.07***	*-.03*	**.09**	*.01*	**-.07**
Social responsibility	R	**.14**	*-.01*	*-.01*	**-.04**	*-.02*	*-.01*	*-.01*	*.00*
Trust employees	R	**.39**	**-.11**	**-.22**	*.00*	*-.02*	*.00*	**-.21**	**-.22**
Trust management	R	**.37**	**.10**	**-.12**	**-.04**	*-.03*	**.13**	*.01*	**-.10**
Cultural capital									
Leadership	R	**.48**	**.15**	**-.10**	*-.02*	*-.01*	**.15**	**.07**	**-.07**
Horizontal	R	**.56**	**-.17**	**-.33**	*.00*	*-.01*	*.00*	**-.33**	**-.33**
Human capital	R	**.49**	**.25**	*-.02*	*-.03*	*.00*	**.19**	**.20**	*.02*
Social capital	R	**.49**	*.01*	**-.18**	**-.05**	*-.02*	**.08**	**-.09**	**-.16**
Vertical	R	**.38**	**.09**	**-.11**	**-.06**	*-.03*	**.11**	*.02*	**-.09**
Wellbeing	R	**.62**	**.13**	**-.07**	**-.05**	*-.03*	**.11**	**.06**	**-.04**
Sources of stress									
Stress: Total	D	**-.44**	**-.18**	*.02*	**-.05**	*.01*	**-.14**	**-.14**	**-.01**
Stress: Conflict	D	**-.39**	*-.04*	**.08**	*-.01*	*-.02*	**-.05**	*.02*	**.07**
Stress: Finance	D	**-.26**	**-.05**	**-.05**	*-.02*	*.00*	*.00*	**-.06**	**-.06**
Stress: Management	D	**-.34**	**-.05**	**.09**	*-.03*	*.02*	**-.07**	*.01*	**.07**
Stress: Students	D	**-.24**	**-.12**	*-.04*	**-.05**	*.02*	**-.07**	**-.12**	**-.06**

Stress: Workload	D	**-.39**	**-.33**	*-.03*	**-.07**	*.02*	**-.24**	**-.29**	**-.07**
Job crafting									
Increase Challenges	R	**.23**	**.06**	**.11**	*-.02*	*.01*	*-.03*	**.10**	**.12**
Reduce Hindrances	R	*.00*	**.07**	*-.03*	*.01*	*-.01*	**.08**	**.05**	-.02
Increase Structural resources	R	**.34**	**.04**	**.12**	**-.08**	*.03*	**-.05**	**.08**	**.13**
Increase Social resources	R	**.17**	**.11**	**-.07**	*.00*	**-.06***	**.12**	**.06**	**-.06**
Passion for work									
Harmonious passion	OP	**.59**	**.29**	**-.01**	*.01*	.00	**.21**	**.23**	*.04*
Obsessive passion	ON	**-.19**	*-.03*	**-.06**	**.00**	*-.01*	*.02*	**-.05**	**-.06**
Global passion	OP	**.38**	*.02*	*-.01*	**-.04**	.01	*.00*	*.00*	*.00*
Affect & Negative affect									
PANAS Negative affect	ON	**-.59**	*.00*	**-.13**	*-.01*	*.02*	**.10**	**-.05**	**-.14**
PANAS Positive affect	OP	**.62**	**.06**	**.06**	*-.02*	*-.02*	*-.02*	**.07**	**.08**
Feeling sad	ON	**-.38**	*-.04*	**-.10**	*.00*	*-.03*	**.05**	**-.07**	**-.12**
Feeling happy	OP	**.47**	**.06**	*.01*	*-.02*	*.00*	*.02*	**.05**	*.03*
Life satisfaction	OP	**.49**	**.10**	**.04**	*-.03*	*.02*	*.03*	**.09**	**.06**
Job depression	D	**-.58**	**-.13**	**-.07**	*.03*	*.00*	*-.03*	**-.13**	**-.10**
Other									
Hours worked per week	D	**-.09**	**-.12**	**.01**	*-.02*	*-.01*	**-.10**	**-.10**	**-.01**
Risk evaluation	D	**-.58**	**-.08**	**-.07**	*.01*	*-.01*	**.00**	**-.09**	**-.09**
Self-harm	ON	**-.26**	*.03*	**-.04**	*-.03*	*-.04*	**.07**	*.01*	**-.05**
Resilience	R	**.45**	*.02*	**.12**	*.02*	*.02*	**-.07**	**.07**	**.14**
Category means									
All Demands	D	**-.35**	***-.11***	**-.03**	***-.03***	*.00*	**-.06**	**-.10**	**-.05**
All Resources	R	**.36**	**.07**	**-.07**	*-.02*	*-.01*	**.07**	*.01*	**-.06**
All Negative outcomes	ON	**-.28**	***-.03***	**-.06**	*-.01*	*-.02*	**.03**	**-.05**	**-.07**
All Positive outcomes	OP	**.53**	***.09***	**.02**	*-.03*	*.00*	**.03**	**.08**	**.05**

Note. This table reports standardized correlations between 64 nomological-network variables and the BPNSFS orthogonal contrast scales (C1–C5), together with pairwise content comparisons (A = Autonomy, C = Competence, R = Relatedness). We grouped the correlates into four categories: Positive Outcomes (OP), Negative Outcomes (ON), Demands (D), and Resources (R). The contrasts, defined earlier, are mutually orthogonal summaries of the 2 (Valence: satisfaction vs. frustration) × 3 (Content: autonomy, competence, relatedness) facet structure, enabling multivariate interpretation of need-related patterns without overlap among contrasts. We grouped variables by conceptual domains: Demands (D), Resources (R), Positive Outcomes (OP), and Negative Outcomes (ON). Values in light gray are not statistically significant at $p < .05$. Pairwise columns present differences between content-domain correlations (e.g., A − C, A − R, C − R), clarifying which need content most strongly aligns with each variable once valence is taken into account. This matrix complements the earlier description of the contrast construction and highlights the distinct—and jointly modeled—relations between basic psychological needs and workplace and well-being indicators for educational leaders. Entries are correlations between each outcome and the orthogonal BPNSFS contrasts (C1–C5); under the orthogonal and standardized coding, these equal the standardized GLM coefficients. Domain summaries follow the a priori JD–R labels (resources/positive outcomes; demands/negative outcomes) specified in SM §3A–3B. Contrast definitions, scaling conventions, and stacking rules are provided in SM §S4.