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The Need Satisfaction and Frustration Scale (NSFS): An in-depth psychometric validation among Italian workers

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Abstract

Studies have suggested that basic psychological needs are associated with a variety of workplace dimensions across different cultures such as psychological well-being, burnout, motivation, and job design. Consequently, validated psychometric scales could facilitate researchers and counsellors to better understand the processes of employees' basic psychological needs. The present paper evaluated the psychometric properties of the Italian version of the Need Satisfaction and Frustration Scale (NSFS). The evaluation included confirmatory factor analyses (CFA), internal consistency, convergent validity and discriminant validity. The sample comprised 309 Italian workers (61.6% females), with a mean age of 41.94 years ($SD = \pm 10.71$). The survey including the Needs Satisfaction and Frustration Scale (NSFS), Satisfaction with Life Scale (SWLS) and the Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire (SMBQ). The results of CFA supported a first-order six-factor solution. The NSFS subscales showed good internal consistencies (Cronbach alphas ranging from 0.88 to 0.95; McDonald omegas ranging from 0.88 to 0.95). Overall, need satisfaction was positively associated with life satisfaction, and need frustration was positively associated with cognitive weariness. The findings indicate that the NSFS is a psychometrically reliable and valid measure for assessing the basic psychological need satisfaction and frustration among Italian workers. The study expands the literature on basic psychological needs and shows important associated dimensions in the Italian context.

Keywords: Needs Satisfaction and Frustration Scale, Italian workers, psychometric evaluation, life satisfaction, cognitive weariness

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Introduction

The concept of basic psychological needs, based on Ryan and Deci's (2017) self-determination theory, has progressively become an element of growing interest in psychology studies, particularly organizational psychology (e.g., Arshadi, 2010; Gerber & Anaki, 2021; Holmquist et al., 2023; Olafsen et al., 2018; Rahmadani et al., 2019). Concurrently with the exploration of the significance of basic psychological needs at work, a wave of research has focused on examining the psychometric characteristics of associated instruments (Holmquist et al., 2023). Across different cultures and linguistic iterations, a multitude of studies have empirically affirmed the differentiation between need satisfaction and frustration (Chen et al., 2015; Costa et al., 2017; Holmquist et al., 2023; Liga et al., 2020; Longo et al., 2016, 2018; Tóth-Király et al., 2019). More recently, the notion of need satisfaction has emerged as a comprehensive continuum encapsulating both the fulfillment and thwarting of needs in life overall (Tóth-Király et al., 2018) and in the work context (Gillet et al., 2020). Yet, in contrast to the well-grounded theoretical underpinnings of need satisfaction and frustration, the concept of need satisfaction appears to be theoretically less rooted in basic psychological needs theory (e.g., Gillet et al., 2020; Holmquist et al., 2023; Sánchez-Oliva et al., 2017; Tóth-Király et al., 2018).

The relationship between culture and the perception of psychological needs is a complex and nuanced field that has captured the attention of researchers (e.g., Holmquist et al., 2023). Research has shown that Western cultures tend to value individualism and personal autonomy, whereas Eastern cultures tend to attach more importance to relationships and social interdependence (e.g., Hoxha & Ramadani, 2023; Markus and Kitayama, 1991). These cultural differences can profoundly influence the perception and prioritization of psychological needs (Hoxha & Ramadani, 2023). For example, in an individualistic culture, it might be more important for individuals to satisfy the need for autonomy and self-expression, whereas in a collectivist culture, the need for belonging and social harmony might be more relevant. Moreover, comparative research studies conducted by Ryan and Deci (2000) have shown that people from different cultures attach different levels of importance to the psychological needs for autonomy, competence, and relatedness. This suggests that the perception and satisfaction of psychological needs may be influenced by the culture they belong to. Consequently, this could affect the dimensionality and structure of the different instruments for assessing basic psychological needs, as highlighted by previous research (e.g., Holmquist et al., 2023). Therefore, there is both theoretical and empirical evidence that support the importance of exploring this aspect. Consequently, it is necessary to further explore the different cultural and linguistic versions of instruments assessing basic psychological needs to investigate their dimensionality and the concept of need satisfaction, in accordance with previous studies (e.g., Alexe et al., 2022; Holmquist et al., 2023; Longo et al., 2014). Therefore, the present study assessed the dimensionality of the Need Satisfaction and Frustration Scale (NSFS; Longo et al., 2016) among a cohort of Italian workers.

Basic psychological needs

A fundamental tenet of basic psychological needs theory emphasizes the importance of three basic needs – autonomy, competence, and relationship – in promoting psychological development, integrity, and personal well-being, when these are fulfilled (Ryan & Deci, 2017). This theory emphasizes the central importance of each core need, highlighting their distinction and non-substitutability (Holmquist et al., 2023; Ryan & Deci, 2000). Autonomy is about individuals' desire for autonomy and the opportunity to exercise free will and agency (Ryan & Deci, 2000).

The need for competence refers to the intrinsic drive of individuals to engage effectively with their environment and to feel sufficiently capable (Holmquist et al., 2023; White, 1959). The need for relationships, on the other hand, reflects the human propensity to have interactions and connect with significant others, as well as to be cared for and to care for others (Ryan & Deci, 2000). The need for relationships/relatedness encompasses the human inclination to establish connections with significant others and to both receive and provide care and support (e.g., family).

As pointed out by Holmquist et al. (2023), initially, research on basic psychological needs focused primarily on the notion of need satisfaction and its predictive influence on positive and negative outcomes, particularly within the work environment. Based on this line of research, individuals who report higher scores of need satisfaction show high scores on variables indicating adaptive dimensions such as well-being and life satisfaction. Moreover, those who report low levels of need satisfaction are more prone to score highly on dysfunctional variables such as job distress and cognitive weariness (e.g., Alexe et al., 2022; Holmquist et al., 2023; Longo et al., 2016). However, studies conducted subsequently have not coherently supported the ability of low basic needs satisfaction to predict maladaptive outcomes. This has led to an interest in investigating in more detail the negative experiences that are not satisfactorily captured by the concept of low need satisfaction (Bartholomew et al., 2011; Costa et al., 2015).

This interest has led, especially in recent years, to a theoretical differentiation between satisfaction and frustration of basic psychological needs, which has over time been increasingly accepted by researchers (e.g., Alexe et al., 2022; Holmquist et al., 2023; Longo et al., 2018, 2020). In fact, according to studies carried out (e.g., Holmquist et al., 2023), need frustration can be understood as the deprivation of a fundamental need, which represents cases in which an individual's fundamental psychological needs are hindered in the current situation or context (Ryan & Deci, 2017). Considering this conception, experiences of need frustration go beyond the "simple" absence of need satisfaction and, consequently, can offer a more complete and in-depth explanation for adverse outcomes, such as emotional exhaustion and distress (Holmquist et al., 2023; Tindall & Curtis, 2019). The workplace acts as an environment in which the needs of the workers themselves can be cultivated, or hindered, with the satisfaction of needs which therefore favors psychological well-being and health in general. Instead, on the contrary, when these needs are thwarted and frustrated, this can lead to negative health consequences (Deci et al., 2017; Holmquist et al., 2023).

The introduction of the concept of basic psychological need satisfaction, defined as a continuum that includes both satisfaction and satisfaction of the three basic psychological needs, is a relatively recent development (Gillet et al., 2020; Holmquist et al., 2023). Some researchers (e.g., Tóth-Király et al., 2018) have demonstrated that basic psychological needs are more accurately represented as comprising specific factors (i.e., need satisfaction and frustration) rather than a global factor (need satisfaction).

Recent research (e.g., Alexe et al., 2022; Holmquist et al., 2023; Longo et al., 2018, 2020) has also shown that need satisfaction is positively associated with well-being dimensions, meanwhile need frustration is positively associated with maladaptive outcomes. For example, previous studies have found that higher levels of need satisfaction are associated with higher levels of life satisfaction (Holmquist et al., 2023), and higher levels of need frustration are associated with higher levels of cognitive weariness (Holmquist et al., 2023). These results could be explained in line with the conceptualization of the basic needs of self-determination theory (SDT, Ryan & Deci, 2000): the basic needs include autonomy (the feeling of having choices and control over one's life), competence (the sense of being competent in the activities one undertakes) and social connectedness (connecting with others). Research suggests that when these needs are met, individuals are more likely to experience positive emotions, engage meaningfully in activities and achieve a sense of personal fulfilment (resulting in overall improved life satisfaction). On the other hand, the frustration of needs can be associated with negative outcomes, such as cognitive weariness, which can manifest itself through symptoms such as stress, anxiety, or burnout (Deci et al., 2017). However, the availability of in-depth theoretical descriptions of global need satisfaction is limited (Holmquist et al., 2023).

Assessment instruments for the satisfaction of needs and the frustration of needs in the workplace

As described by Holmquist et al. (2023) and Longo et al. (2018), numerous psychometric instruments have been developed to assess the satisfaction of basic psychological needs in the workplace. For example, the Basic Psychological Needs Satisfaction at Work Scale is a commonly used measure, to assess the satisfaction of autonomy, competence, and relationship needs (Deci et al., 2001). However, several studies have raised some concerns about the effective validity of this scale, mainly related to reliability issues and the high inter-correlation between the subscales (e.g., Holmquist et al., 2023; Longo et al., 2018). As a result of these potential issues, several new scales have been designed and developed. (e.g., Tafvelin & Stenling, 2018).

Nevertheless, need satisfaction represents only one aspect of basic psychological needs, and there is significant evidence (e.g., Holmquist et al., 2023) to suggest that need frustration is essential for understanding and explaining negative outcomes (Deci et al., 2001; 2017). The dual process model, which recognizes need satisfaction and need frustration as distinct constructs, has stimulated the development of new psychometric scales to assess these two dimensions (e.g., Alexe et al., 2022; Holmquist et al., 2023; Longo et al., 2018).

For example, the Balanced Measure of Psychological Needs (Sheldon & Hilpert, 2012) and the Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015), both assess general need satisfaction and frustration (Holmquist et al., 2023).

More recently, Longo et al. (2016) developed the 18-item Need Satisfaction and Frustration Scale (NSFS) in response to the lack of need satisfaction and frustration measures suitable for work and educational contexts (Holmquist et al., 2023). A six-factor structure of the NSFS, with three satisfaction and three frustration dimensions, was reported among 762 British university students and American workers (Longo et al., 2016). Subsequently, these results were replicated among 959 Spanish university students (Longo et al., 2018), in a group of 642 Romanian professional athletes (Alexe et al., 2022) and in a cohort of 2123 Swedish workers (Holmquist et al., 2023).

Three factor models of the NSFS have also been reported in the literature (e.g., Aurell and Wilsson, 2015). The three factors, in line with SDT theory, reflect the three basic needs: autonomy, relatedness and competence. Variations in the two-factor model have also been tested (e.g., Holmquist et al., 2023). This structure is based on the dual-process model and on the distinction between two-dimensional models of basic needs including a unified frustration dimension and a unified satisfaction component. Such a valence-focused model does not distinguish the needs (autonomy, relatedness, and competence) as different from each other.

The present study

To date, there are no studies that have validated the NSFS in the Italian context, which poses limitations for Italian researchers wanting to examine these basic psychological needs. To address this gap, the goal of the present study was to translate the NSFS into Italian and evaluate its psychometric properties. More specifically, the present study evaluated the factorial structure of the NSFS within a cohort of Italian workers, employing confirmatory factor analysis (CFA) to examine its factorial structure. Consistent with previous studies (e.g., Aurell & Wilsson, 2015; Holmquist et al. 2023; Longo et al., 2016), the robustness of three different factor models were tested: (i) a two-factor model (need satisfaction and need frustration, Figure 1 [Supplementary Materials]), (ii) a three-factor model (autonomy, competence, and relatedness, Figure 2 [Supplementary Materials]) and (iii) a six-factor model (satisfaction with autonomy, satisfaction with relationship, satisfaction with competence, frustration for autonomy, frustration for relationship, and frustration for competence, Figure 3 [Supplementary Materials]). These analyses of the NSFS's dimensionality aimed to enhance the theoretical comprehension of basic psychological needs in an Italian context. Furthermore, to evaluate the validity of the NSFS, after identifying the most fitting model, the main types of validity (convergent and discriminant) and reliability of the scale were tested. Finally, the nomological network approach was adopted to examine the interrelationships among constructs and to analyze the construct validity of a psychological test or measure.

Aligned with the basic psychological need theory, it was hypothesized that need satisfaction (satisfaction with autonomy [Factor 1], satisfaction with relationship [Factor 3], and satisfaction with competence [Factor 5]) would be positively associated with life satisfaction (H_1), and that need frustration (frustration for autonomy [Factor 2], frustration for relationship [Factor 4], and frustration for competence [Factor 6]) would be positively associated with cognitive weariness (H_2).

Methods

Participants and procedure

Between November and December 2023, a link to an online survey was advertised on several Italian online forums and social network platforms (e.g., Facebook, WhatsApp, Telegram, LinkedIn). The inclusion criteria were the following: (i) being at least 18 years old; (ii) understanding the Italian language; (iii) providing informed consent; and (iv) being employed (i.e., health workers, general medicine, psychologists, psychiatrists, lawyers, etc.). Participants who did not meet all the criteria were excluded from the study. The final sample comprised 309 participants, with three-fifths being female ($n = 212$, 61.6%). The average age of participants was 41.94 years ($SD = \pm 10.71$; males $n = 41.54$ years, $SD = \pm 9.54$; females $n = 42.12$ years $SD = \pm 11.22$).

Sample size

To determine the appropriate sample size for CFA, a power analysis was also conducted using *a priori* structural equation modeling software (Soper, 2022). Based on the power analysis (number of latent variables: 4; number of observed variables: 18; probability level [p]: .05; statistical power .95; and effect size .50), the minimum sample size required was 207 (Soper, 2022).

Translation protocol

The NSFS was translated from English into Italian by two native Italian speakers, using internationally accepted practices (e.g., Ulvdydién, 2013). Initially, the authors of the present study independently translated the items from English into Italian. Then, the items and translations were compared with each other and with the original version of the scale in English (i.e., back-translation). No significant discrepancies were found between the compared versions. Finally, the items that best reflected the original meaning were retained, following the consensual agreement of the authors. Before distributing the survey, the translated scale was tested among a small sample of individuals of different ages and educational levels ($n = 25$). None of the participants had any problems answering the questions.

Measures

Socio-demographic information. Within the online survey, questions were included regarding the socio-demographic

aspects of the participants (for example age, gender, level of education, and type of work).

Need Satisfaction and Frustration Scale (NSFS). The NSFS (Longo et al., 2016) was used to assess needs satisfaction and frustration basic needs. The NSFS consists of 18 items comprising six dimensions. Each item is rated on a seven-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Each item starts with the stem “*In my study/in my work*” followed by a statement. For instance, (i) “*I feel completely free to make my own decisions*” (autonomy satisfaction; Factor 1), (ii) “*I feel forced to follow directions regarding what to do*” (autonomy frustration; Factor 2), (iii) “*I feel highly effective at what I do*” (competence satisfaction; Factor 3), (iv) “*I doubt whether I am able to carry out my tasks properly*” (competence frustration; Factor 4), (v) “*I feel the people I interact with really care about me*” (relatedness satisfaction; Factor 5), and (vi) “*Sometimes, I feel a bit rejected by others*” (relatedness frustration; Factor 6). Scores range from 9 to 63 for both the need satisfaction and need frustration dimensions, with higher scores indicating a higher level of need satisfaction or frustration.

Satisfaction With Life Scale (SWLS). The SWLS (Diener et al., 1985; Italian version: di Fabio et al., 2012) was used to assess life satisfaction. The scale comprises five items (e.g., “*In most ways, my life is close to my ideal*”), each rated on a seven-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Scores range from 1 to 35, and higher scores indicate greater life satisfaction. Cronbach’s alpha in the present study was excellent ($\alpha = .92$).

Shirom-Melamed Burnout Questionnaire (SMBQ): The five-item ‘Cognitive Weariness’ subscale from the 14-item SMBQ (Shirom & Melamed, 2006; Italian version: Protano et al., 2019) was used to assess cognitive weariness. Items (“*I feel I am not thinking clearly*”) assess the extent to which individuals experience the described items throughout most of their day and are rated on a seven-point Likert scale from 1 (*almost never*) to 7 (*almost always*). Scores range from 5 to 35, and higher scores indicate greater cognitive weariness. Cronbach’s alpha in the present study was excellent ($\alpha = .94$).

Data analysis

In the present study, the normality of the data was analyzed following the guidelines proposed by Muthén and Kaplan (1985), which indicate skewness and kurtosis in the interval ± 1 as the ideal item interval. However, the maximum allowable limit is ± 2 for skewness and ± 7 for kurtosis (Hair et al., 2010). In addition, the Shapiro-Wilk normality test was used (Mishra et al., 2019). Subsequently, further statistical analyses were performed, including: (i) the main descriptive indicators of the NSFS elements (i.e., means, standard deviations, asymmetry, and kurtosis); and (ii) internal consistency (i.e., Cronbach’s alpha and composite reliability $> .70$; Cheung et al., 2023; McDonald, 1999; Zinbarg et al., 2005).

Second, the factorial structure of the Italian version of the NSFS was examined using confirmatory factor analysis (CFA). To evaluate the main NSFS model, comprising six factors, and the two alternative models, comprising two and three factors respectively, specific indices were used (Cheung

et al., 2023; Kline, 2011, 2016) including: chi-square, non-normed fit index ($NNFI \geq .95$), comparative fit index ($CFI \geq .95$), goodness of fit index ($GFI \geq .95$), adjusted goodness of fit index ($AGFI \geq .95$), root mean square error of approximation ($RMSEA \leq .08$), and root mean square residual ($RMSR \leq .80$). Furthermore, acceptable saturation occurred on all items ($\lambda_{ij} \geq .50$; Ferguson & Cox, 1993). Parsimony indices (i.e., expected cross validation index, ECVI) were used, which do not have specific thresholds for normalization. However, smaller values indicate greater parsimony and fit (Byrne, 2016).

Third, convergent and discriminant validity were examined. With regard to convergent validity, the recommendations of Cheung et al. (2023) were followed: (i) construct reliability (CR) values equal to or exceeding .7, (ii) all standardized factor loadings (λ) are .5 or higher (if below this threshold, it must not be significantly lower for $p < .05$), and (iii) Average Variance Extracted (AVE; Fornell & Larcker, 1981) values are .5 or higher (values below this threshold $< .5$, must be non-significant for $p < .05$). With regards to discriminant validity, the recommendations Cheung et al. (2023) were applied: (i) evidence of convergent validity; and (ii) absence of indicator cross-loads on other constructs and (iii) maximum shared variance (MSV) should be $< AVE$. Finally, to obtain further significant evidence for discriminant validity, the Heterotrait-monotrait Ratio of Correlations ($HTMT$; Cheung et al., 2023; Hair et al., 2022) approach was used. $HTMT$ values $< .85$ are indicated as having good discriminant validity. Finally, coefficients of correlation (Pearson's r) were employed to establish the relationship between the NSFS and the other measures.

Structural equation modeling

To investigate the nomological network of the retained model, along with measures of life satisfaction and cognitive weariness, structural equation modeling (SEM) was employed, according to Holmquist et al. (2023). Within the structural equation model, the factors representing basic needs served as predictors for the outcome variables, namely life satisfaction and cognitive weariness. More specifically, the present study investigated the nomological network of basic psychological needs by examining their associations with life satisfaction and cognitive weariness. These two outcome variables were selected to test the two hypotheses that need satisfaction would

be positively associated with life satisfaction (H_1), and that need frustration would be positively associated with cognitive weariness (H_2). See Figure 1 (Supplementary Materials).

Analysis software

The analyses were performed using SPSS Statistics v.27 (IBM Corporation, 2020), R Studio (2021), JAMOVI 2.3 (The Jamovi Project, 2023), and JASP version 0.18 (JASP Team, 2020).

Ethical approval

The study was conducted according to the Declaration of Helsinki for medical research involving human participants and was approved by the Ethical Committee of Niccolò Cusano University, Rome. All participants gave their informed consent to participate in the study. The identity of the participants was anonymous, and the data were stored in an encrypted online archive, accessible only to the authors of the present study.

Results

Sociodemographic characteristics

Participants ($n = 309$) worked an average of 33.53 hours per week ($SD = \pm 12.25$; males $n = 36.69$ hours per week $SD = \pm 12.55$], females = 32.08 hours per week $SD = \pm 11.55$). Just over one-third of participants were married ($n = 124$, 36%), and two-fifths had a university degree ($n = 141$, 41%). Table 1 (and Tables S2, S3, and S4 in the Supplementary Materials) summarize the main socio-demographic characteristics of the sample and the main test used.

Confirmatory factor analysis of the Need Satisfaction and Frustration Scale

The present study analyzed the distribution of the 18 NSFS items (Table S4, Supplementary File), with a six-factor structure. Normality tests showed that the skewness values ranged from .31 to 1.05 while the kurtosis values fluctuated between .25 and .88.

Tab 1. Descriptive statistics of factors in the Needs Satisfaction and Frustration Scale (N=309)

Variable	Mean	SD	Skewness	Kurtosis
Autonomy satisfaction*	14.15	5.50	-.55	-.82
Autonomy frustration*	10.06	5.29	.36	-.88
Relatedness satisfaction*	13.97	5.09	-.61	-.64
Relatedness frustration*	8.67	4.95	.78	-.30
Competence satisfaction*	15.78	4.56	-1.05	.53
Competence frustration*	8.39	4.95	.81	-.35
CW-SMBQ **	13.93	8.38	.87	-.25
SWLS ***	21.52	7.91	-.31	-.77

Note: *Factors of basic psychological need satisfaction and frustration (in the NFRS), **CW-SMBQ = Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire, ***SWLS = Satisfaction with Life Scale, SD = Standard deviation.

Tab 2. Factor loadings of the Need Satisfaction and Frustration Scale (N=309).

Factor	Item	Estimate	SE	z-value	p	95% CI		Std. Est. (all)
						Lower	Upper	
F1 Autonomy satisfaction	NFRS1	1.69	.06	25.23	< .001	1.55	1.82	.92
	NFRS3	1.87	.06	27.92	< .001	1.74	2.00	.94
	NFRS6	1.80	.07	25.17	< .001	1.66	1.94	.93
F2 Autonomy frustration	NFRS2	1.58	.07	21.31	< .001	1.43	1.73	.84
	NFRS4	1.73	.07	23.59	< .001	1.59	1.88	.86
	NFRS5	1.65	.07	21.74	< .001	1.50	1.79	.82
F3 Relatedness satisfaction	NFRS7	1.36	.08	15.87	< .001	1.19	1.53	.70
	NFRS9	1.70	.07	22.74	< .001	1.56	1.85	.91
	NFRS12	1.71	.07	22.19	< .001	1.56	1.86	.92
F4 Relatedness frustration	NFRS8	1.47	.08	17.46	< .001	1.31	1.64	.79
	NFRS10	1.55	.08	18.10	< .001	1.38	1.72	.84
	NFRS11	1.59	.07	21.89	< .001	1.45	1.74	.87
F5 Competence satisfaction	NFRS14	1.33	.07	17.52	< .001	1.18	1.48	.85
	NFRS16	1.60	.07	20.41	< .001	1.45	1.75	.96
	NFRS17	1.46	.08	17.55	< .001	1.29	1.62	.89
F6 Competence frustration	NFRS13	1.38	.09	14.22	< .001	1.19	1.57	.77
	NFRS15	1.61	.08	19.75	< .001	1.45	1.77	.89
	NFRS18	1.65	.06	25.31	< .001	1.53	1.78	.88

Note: CI = confidence interval, Std. Est. (all) = standardized factor loadings values.

Tab 3. Heterotrait-monotrait (HTMT) ratio of the Need Satisfaction and Frustration Scale (n=309).

	1	2	3	4	5	6	7
1. F1	-						
2. F2	0.67	-					
3. F3	0.64	0.50	-				
4. F4	0.47	0.51	0.56	-			
5. F5	0.52	0.37	0.56	0.49	-		
6. F6	0.37	0.46	0.44	0.72	0.66	-	
7. CW-SMBQ	0.48	0.42	0.44	0.61	0.60	0.64	-
8. SWLS	0.64	0.43	0.58	0.53	0.64	0.52	0.62

Note: F1 = Autonomy satisfaction; F2 = Autonomy frustration; F3 = Relatedness satisfaction; F4 = Relatedness frustration; F5 = Competence satisfaction; F6 = Competence frustration. SMBQ = Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire, SWLS = Satisfaction with Life Scale.

Therefore, the data were normally distributed (i.e., the items did not exceed the maximum of ± 2 for skewness and ± 7 for kurtosis, Hair et al., 2010). Given the absence of a clear academic consensus on the indicators for assessing model reliability (e.g., Boomsma, 2000; Cheung et al., 2023), model fit was examined using multiple criteria (see 'Data analysis'). The results of the CFA, for a six-factor model (maximum likelihood estimator) were as follows: chi-square test $\chi^2 = 234.49$, $df = 120$, $n = 309$; with $\chi^2/df = 1.95$, with the ratio of χ^2 to degrees of freedom $df < 3$ to consider the data-model fit as acceptable, Kline, 2011); $p < .01$, $CFI = .97$, $NNFI = .97$, $RMSEA = .05$, $90\% CI: .04; .06$, $p = .18$; $SRMR = .03$, $GFI = .93$, $ECVI = 2.5$. The obtained indices were sufficient, and all factor loadings were high and statistically significant on all items ($min = .70$, $max = .94$; i.e., $\lambda_{ij} \geq .50$, see Table 2 for details).

Furthermore, the two-factor model (need satisfaction and need frustration) was tested. The results indicated that: $\chi^2 =$

6211.74 , $df = 306$, $n = 309$; with $\chi^2/df = 20.29$, $p < .001$, $CFI = .66$, $NNFI = .58$, $RMSEA = .207$; $90\% CI: .20; .21$; $p < .05$, $SRMR = .15$, $GFI = .84$, and $ECVI = 3.8$. Finally, the three-factor model (autonomy, competence, and relatedness) was also tested. The results indicated that: $\chi^2 = 1226.73$; $df = 116$, $n = 309$; with $\chi^2/df = 10.57$; $p < .001$, $CFI = .79$, $NNFI = .75$, $RMSEA = .15$; $90\% CI: .15; .16$; $p < .05$, $SRMR = .10$, $GFI = .97$, and $ECVI = 4.4$. The CFA indicated that the six-factor solution best fitted the data. Therefore, the six-factor model was retained for the subsequent analysis.

Reliability

Different types of reliability (i.e., internal consistency) were investigated. To analyze the reliability of the measure and internal consistency, Cronbach's alpha, McDonald's omega

(McDonald, 1999) and composite reliability (CR) were used. Cronbach alphas for each factor in the present study were: .95 (Factor 1), .88 (Factor 2), .88 (Factor 3), .87 (Factor 4), .92 (Factor 5), and .88 (Factor 6), and could not be improved by removing any items. Similarly, the McDonald's omega of each factor ranged from .88 to .95. The CR of each factor ranged from .88 to .95, with all CRs not significantly lower than .80 ($p < .05$). Consequently, all constructs demonstrated adequate CR in the study (see Table S5 and Table S6 in Supplementary Materials).

Convergent and discriminant validity

To test convergent and discriminant validity, a model was constructed (via R's 'measureQ' function), which included the three scales used (i.e., NSFS, SWLS, and the Cognitive Weariness subscale on the SMBQ). The overall model fit was: $\chi^2 = 363.75$; $df = 254.00$, $RMSEA = .03$, $90\% CI: .02$; $.04$, $p = .99$; $CFI = .97$, and $SRMR = .03$. The measurement model fitted the data well. As shown in Table S7, no item

had a standardized factor loading significantly lower than .7. The AVE (Table S5) of all factors were not significantly lower than .5 ($p < .05$), raising no concerns. The construct reliability was $min = .88$, $max = .95$. Therefore, convergent validity was established. Discriminant validity was also investigated. First, the fit indices indicated that the measurement model without secondary loading fitted the data well (Table S7). Secondly, the HTMT correlation matrix was evaluated (Table 3 and Table S9). No value was significantly higher than .85, and the MSV was $< .70$ (i.e., $< AVE$). Therefore, discriminant validity was also established.

Correlation analysis

The correlations between the six factors on the NFRS, life satisfaction (SWLS), and cognitive weariness were investigated. Overall, the factors related to satisfaction of basic psychological needs correlated positively (and significantly) with life satisfaction, and negatively (and significantly) with cognitive weariness (all p -values $< .001$) (Table 4). On the other hand, the

Tab 4. Correlation analysis between the Need Satisfaction and Frustration Scale test factors and life satisfaction (SWLS) and the Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire (n=309).

Variable	1	2	3	4	5	6	7
1. F1	—						
2. F2	-.63***	—					
3. F3	.58***	-.48***	—				
4. F4	-.43***	.44***	-.51***	—			
5. F5	.49***	-.34***	.50***	-.45***	—		
6. F6	-.34***	.41***	-.40***	.65***	-.60***	—	
7. CW-SMBQ	-.38***	.33***	-.36***	.53***	-.54***	.58***	—
8. SWLS	.60***	-.41***	.51***	-.44***	.56***	-.45***	-.50***

Note: *** $p < .001$; F1 to F6 are NFRS test factors: F1 = Autonomy satisfaction; F2 = Autonomy frustration; F3 = Relatedness satisfaction; F4 = Relatedness frustration; F5 = Competence satisfaction; F6 = Competence frustration. CW-SMBQ = Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire, SWLS = Satisfaction with Life Scale

Tab 5. SEM – Need Satisfaction and Frustration Scale (NSFS) subscales predicting outcomes (n=309).

Variable	Predictor	Estimate	SE	95% CI		β	z	p
				Lower	Upper			
SWLS	F1	.25	.08	.09	.40	.23	5.25	.004
	F2	.06	.07	-.07	.19	.07	.95	.34
	F3	.34	.08	.20	.44	.38	5.15	<.001
	F4	-.02	.09	-.19	.15	-.02	-.25	.80
	F5	.26	.08	.10	.41	.24	3.13	.002
	F6	-.15	.10	-.34	.04	-.15	-1.51	.13
CW-SMBQ	F1	-.06	.07	-.20	.07	-.07	-.93	.35
	F2	-.01	.07	-.14	.13	-.01	-.08	.93
	F3	.04	.08	-.12	.20	.04	.53	.59
	F4	.22	.09	.04	.41	.23	2.41	<.01
	F5	-.31	.09	-.48	-.14	-.29	-3.59	<.001
	F6	.25	.11	.05	.46	.25	2.41	<.01

Note: F1 to F6 are NFRS factors: F1 = Autonomy satisfaction; F2 = Autonomy frustration; F3 = Relatedness satisfaction; F4 = Relatedness frustration; F5 = Competence satisfaction; F6 = Competence frustration. CW-SMBQ = Cognitive Weariness subscale of the Shirom-Melamed Burnout Questionnaire, SWLS = Satisfaction with Life Scale, β = Standardized beta coefficient.

factors associated with the need of frustration factors correlated positively (and significantly) with cognitive weariness and negatively (and significantly) with life satisfaction (all p -values $< .001$) (Table 4). Life satisfaction and cognitive weariness correlated negatively (and significantly) with each other ($p < .001$) (Table 4).

Nomological network – SEM analysis

The structural equation model (SEM, *Bootstraps* = 1000, Figure 1 Supplementary Material) utilized latent factors from a first-order six-factor model to predict outcome variables, specifically life satisfaction (SWLS) and cognitive weariness (SMBQ subscale). The model demonstrated a robust fit to the data: $\chi^2 = 484.12$, $df = 282.00$, $p < .001$, $RMSEA = .05$, 90% $CI: .04; .06$, $p = .42$, $CFI = .97$, and $SRMR = .04$. All latent variables were effectively defined by their respective items. The findings indicated that satisfaction of basic psychological needs emerged as a key predictor of life satisfaction in the model: autonomy satisfaction $-\beta = .23$ ($p < .01$); relatedness satisfaction $-\beta = .38$ ($p < .001$); competence satisfaction $-\beta = .24$ ($p < .01$). The need of frustration factors globally predicted cognitive weariness: relatedness frustration $-\beta = .23$, $p < .01$; and competence frustration $-\beta = .25$ ($p < .01$). However, autonomy frustration was not significant ($\beta = -.01$, $p > .05$) (Table 5).

Discussion

The present study investigated the reliability, validity, and factor structure of the Italian version of the Need Satisfaction and Frustration Scale (NSFS) among a sample of Italian workers. The findings provided support for a six-factor first-order model of the NSFS. Psychometric analyses showed that the Italian NSFS had good internal reliability and consistency. The results were in line with recent literature (e.g., Holmquist et al., 2023) which showed very similar results (e.g., a six-factor structure). Furthermore, these results confirmed the hypotheses by providing psychometric evidence that need satisfaction and frustration are two distinct factors, and supporting the conceptual basis of self-determination theory (Deci et al., 2017). The psychometric analyses carried out in the present study were conducted following the latest guidelines in psychometrics, providing a robust and in-depth analysis (Cheung et al., 2023).

A noteworthy finding in the present study was that the anticipated pattern of satisfaction is a more accurate predictor of positive outcomes, while frustration emerged as a more robust predictor of negative outcomes (obtained in the structural equation modeling). This aligns with the tenets of basic psychological needs theory (Holmquist et al., 2023). More specifically, the results support the assertion that needs frustration is a more effective predictor of cognitive weariness than needs satisfaction (apart from the autonomy frustration factor which in the present study did not significantly predict negative outcomes, although it was significantly positively

associated with them, which has also been reported in previous studies [e.g., Holmquist et al., 2023]). These results are in line with previous research, where not all factors significantly predicted the outcomes but were nevertheless significantly associated with them (e.g., Holmquist et al., 2023).

Looking at the correlations, it was found that the factors related to satisfaction of basic psychological needs were associated significantly and positively with life satisfaction and negatively and significantly with cognitive weariness. On the other hand, the factors associated with the need of frustration factors were significantly and positively correlated with cognitive weariness, and negatively and significantly with life satisfaction (supporting both H_1 and H_2). An important contribution of the present study lies in the contextual evaluation of need satisfaction, need frustration, and overall basic psychological need satisfaction within the cultural framework of the Italian working environment. This extends the applicability of the concepts to a new cultural context, providing insight into the dynamics of basic psychological needs in the Italian context.

The present study also contributes significantly to the literature by offering initial evidence concerning the convergent validity of the NSFS. Specifically, the Average Variance Extracted (AVE) scores for each of the six component factors exceeded the ideal threshold of .50, indicating that the items within each factor adequately captured the core essence of that particular factor. This indicates robust convergent validity because higher AVE scores imply a stronger correlation among items within the same construct. In terms of discriminant validity, the findings align with those reported by Longo et al. (2018) and Alexe et al. (2022), who reported a well-defined and distinct six-factor structure. The present study also found that the Heterotrait-Monotrait Ratio of Correlations (HTMT) values were below the threshold of .85. This suggests that the six distinct factors in the NSFS are indeed differentiated constructs, supporting the instrument's ability to accurately distinguish between different aspects of need satisfaction and frustration. Moreover, the validation of this scale in Italian could be useful for foreign researchers such as those who intend to conduct cross-cultural comparisons (e.g., Italy-USA, Italy-Sweden) or translate into another language (e.g., Korean), using the results of the Italian version of the NSFS as a comparison instrument.

Limitations and future directions

The results of the present study must be considered in light of specific limitations. Firstly, the participant group comprised only a self-selected convenience sample of the general Italian population, of which the majority were females. Secondly, it cannot be excluded that social desirability factors may have influenced the answers of the participants when completing the survey. Further studies utilizing larger and more representative samples of Italian participants are necessary to confirm the preliminary results provided by the present study (e.g., a nationally representative sample with more male participants). Future studies, with a larger and more representative sample are needed to confirm the factorial solution outlined in the present study. In addition, future studies could consider other variables to be included in an SEM model, such as

anxiety, stress, depression, well-being, motivation, and self-esteem. Finally, a further limitation of the present study was that the autonomy frustration factor did not significantly predict negative outcomes, which poses potential limits to the nomological validity of the scale. Future research should investigate this in more detail.

Conclusions

This study builds on previous research in the area of basic needs theory and supports the hypothesis that satisfaction and frustration are distinct but interconnected constructs. Importantly, each construct demonstrated superior and significant predictive ability for positive and negative outcomes, respectively. Additionally, the study evaluated a novel needs satisfaction and frustration scale tailored for employed individuals surpassing previous psychometric studies in terms of internal reliability and structural validity. The NSFS allows for a more nuanced and accurate assessment of the impact of need satisfaction and frustration in the unique contexts of work in an Italian territorial setting.

Supplementary Materials

Supplementary material may be retrieved at the following link: <https://osf.io/wqcvd/files/osfstorage/6673f991e02bac0234b21bac>

Ethical approval

The research was conducted according to the Declaration of Helsinki for medical research involving human participants and was approved by University Niccolò Cusano in Rome Ethical Committee, Italy. All participants gave their online consent to participate in the study. The identity of the participants was anonymous, and the data were stored in an encrypted online archive, accessible only to the authors of the present study.

Informed Consent Statement

Informed consent was obtained from all participants involved in the study.

Data Availability Statement

Research data are available upon reasonable request to the corresponding author.

Conflict of interest statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The authors declare that there are no conflicts of interest.

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None.

Author Contributions

PS: Writing – review & editing, Conceptualization, Formal Analysis

RP: Methodology, Supervision, Writing, Project administration

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MDG.: Review & editing, Supervision, Writing

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