COMPOSITION OF FACTORS AND PSYCHOMETRIC CHARACTERISTICS OF THE PERCEIVED STRESS SCALE

IN A SAMPLE OF ROMANIAN EMPLOYEES

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Abstract: The present study investigates the composition of factors and psychometric qualities of the Perceived Stress Scale among Romanian employees. This scale is widely used on a professional level, but its structure is unclear. 342 employees participated in an online survey between March and May 2025. Of these, 205 were from the educational sector and 137 from non-educational sectors. Two problematic items were excluded due to their inappropriate statistical behavior, resulting in an eight-item version. Four confirmatory models were estimated, including a single-factor model, a second-order factor model, a bifactorial model, and two first-order correlated factors representing perceived stress and perceived coping ability. The correlated factor model was the most coherent and parsimonious representation of the data, while the bifactorial solution presented insignificant loadings. Multi-group confirmatory factor analyses supported configural, metric, and scalar invariance across genders and residential settings, facilitating meaningful comparisons of latent means. Configurational and metric invariance was confirmed in occupational terms, with parameter variations between domains. The PSS-8 has been demonstrated to serve as a reliable and effective instrument for the purpose of monitoring occupational stress and evaluating interventions designed to alleviate stress and augment coping resources. The findings lend support to the practice of reporting both the overall score and the subscales in both organizational contexts. However, the cross-sectional nature of the study, the online recruitment methodology, and gender imbalance are acknowledged limitations. Nevertheless, the data obtained provide a solid foundation for future longitudinal research using this instrument.

Keywords: employees, factorial model, measurement invariance, perceived stress, psychometric validation.

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1. Introduction

Stress is an inherent aspect of contemporary working life, and can be conceptualized as an evaluation of whether the demands of life exceed the resources that an individual can mobilize at a given moment. This assessment is important because it predicts how people feel, think, and act at work, including attention and learning, sleep, seeking help, and health. In the educational environment, the risks are visible. Selye (1976) described stress as a set of physical and psychological responses to adverse conditions, which we can characterize as unpredictable. All of this later demonstrated in his studies the significant impact that stress can have on health (Breitenbach et al., 2021). Perceived stress also differs depending on the time and duration of exposure to the stressor, as well as the time it takes for the consequences to manifest before they can be effectively managed (Godoy et al., 2018).

In educational contexts, stress is omnipresent, posing a challenge for teachers around the world and we can understand it simply as a series of unpleasant states (Liu & Onwuegbuzie, 2012). At some point, their resources to manage stress are running out (Leung et al., 2010). Teachers face many difficult and sensitive tasks every day, and understanding their needs helps design prevention and intervention programs to improve their well-being and, implicitly, the quality of education (Moreno Lucas & Morales Rodríguez, 2023). Accordingly, stress on teachers has a negative effect on teaching workforce stability (Wong et al., 2017). In addition, stress can arise as early as the training period for future teachers who, although motivated by positive views about the profession, face academic demands that test their progress and self-confidence (Núñez-Regueiro et al., 2023). Teachers who report high levels of stress tend to show more fatigue and lower quality teaching, and their students feel the effects in the classroom atmosphere and behavior. Therefore, valid measurement is a practical necessity. The Perceived Stress Scale (PSS), originally proposed in 14 items and later reduced to 10 items, is the most widely used tool in the field to capture this assessment as a global, recent (last month) experience (Herrero & Meneses, 2006; Lee, 2012). In practice, organizations and researchers rely on the PSS scale because it is short, easy to administer, and predictive of outcomes that are important for professional life. However, the lack of clarity of the construct can be misleading. Studies conducted in various countries (Jiang et al., 2023; Medvedev et al., 2017) do not provide a clear consensus on the structure of the PSS Scale. Some studies support a general perceived-stress factor, others identify two correlated dimensions—distress and perceived control—and still others propose a bifactor structure shaped by item wording. This fundamental inquiry has direct implications for scoring, interpreting scores, and directing interventions.

Teaching is widely recognized as a highly demanding profession, and teachers face multiple challenges—such as overcrowded classrooms, heavy workloads, limited resources, and student misbehavior—that can undermine their motivation and engagement (Azouaghe et al., 2025). When risk factors outweigh protective factors, teachers' coping abilities are compromised, often leading to stress and negative outcomes (Prilleltensky et al., 2016). The stress felt by teachers is also reflected in their relationships with students, even leading to conflicts (Whitaker et al., 2015). Ignored stress can even lead to leaving the job, to abandoning a dream for some educators (Dilekçi et al., 2025; Ryan et al., 2017). Their choices are explained by the negative evolution of stress, which in turn causes anxiety and depression (Hooker et al., 2025). At a certain point, teachers who feel overwhelmed no longer can regulate their emotions and no longer can cope with the effects of the stressors around them. However, stress

is also felt strongly on a physical level (De Simone et al., 2016). Some teachers develop a somatization disorder (Howard et al., 2017). In any case, it has been well demonstrated over time that stress has often been the starting point of serious diseases (Cohen et al., 2016).

The literature draws attention to the need for increased caution in transferring results between different cultural or occupational contexts. Although many studies support a two-dimensional structure consistent with stress theory, they also note that positive and negative item wording can introduce method effects that affect construct interpretability (Lee, 2012; Michaelides et al., 2016). Analyses of item responses continue to indicate potential local dependency and differential functioning of items in student samples and suggest that a shortened scale may function more clearly after the removal of problematic items (Nielsen & Dammeyer, 2019). At the same time, extensive validation studies in health and community contexts have supported both unidimensional and two-factor models, with some evidence for bifactorial structures capturing a strong general stress factor alongside more narrow domains (Dominguez Lara et al., 2024; Jiang et al., 2023; Kocalevent et al., 2007). In short, the PSS has proven to be robust, but its factorial composition is not fully established and may depend on the population, language, and analytical approach.

The Romanian context adds two reasons to reexamine these issues. Initial, the PSS has a Romanian adaptation, but the evidence is limited in scope, leaving open questions about the structure and invariance of the measurement in working adults in the educational and non-educational sectors (Dumitrescu et al., 2014). However, the scale is compatible with teacher respondents and provides relevant information that may contribute to clear interventions (Siqueira Reis et al., 2010).

International studies link teachers' professional demands and resources to perceived stress and burnout, with clear consequences for well-being and retention, underscoring the need for accurate and comparable measurement in local systems (Jeon et al., 2024). Other evidence links perceived stress to self-regulation, sleep, and mood, reinforcing its central role as a risk marker and lever for intervention in everyday occupational health programs (He et al., 2025; Hou & Hu, 2023). Hence, schools are of particular importance in this context, a point that decision-makers in the field need to recognize. For a long time, knowledge about stress has been closely linked to the educational setting. In short, a concise and valid PSS for Romanian employees would help practitioners select, monitor, and evaluate support efforts and allow researchers to study stress as a common pathway linking working conditions to mental health. Applying the refined PSS-8 to teachers can help schools systematically measure educators' stress levels, providing actionable data to support interventions.

The broader picture of measurement also justifies the present study. Methodological analyses emphasize that conclusions about the dimensionality of the PSS may change depending on the modeling perspective. Classical Confirmatory Factor Analyses (CFA) often indicates a two-factor correlated model, while bifactorial models and exploratory structural equation models sometimes reveal a dominant general factor that supports reporting a total score, plus specific factors that may retain significance after controlling for general stress (Michaelides et al., 2016). Item Response Theory (IRT) and the Rasch model, in turn, encourage examination of item dependencies and measurement errors in different subgroups, as well as evaluation of the possibility of eliminating items that may improve model fit and scale interpretability without compromising reliability. These approaches help ensure that measurement instruments are fair, consistent, and accurate across diverse populations (Nielsen & Dammeyer, 2019). Cross-cultural validations mostly replicate two dimensions but sometimes recommend local item adaptations (Jiang et al., 2023; Khalaf et al., 2024), and COVID-19 studies highlight the need to check structure and invariance in different populations before comparisons (Becerra-García et al., 2024; Mehta et al., 2023), which is relevant for Romanian employees.

One approach validates perceived stress by examining its links with other psychosocial factors. Longitudinal and imaging studies show that high stress predicts long-term mental-health decline, partly through reduced self-control, with clear evidence in teachers (Schonfeld et al., 2017). This suggests the presence of specific, regular mechanisms that could serve as targets for training programs (He et al., 2025). Experimental studies and surveys link stress to sleep loss, a common pathway on both school nights and work nights, which impairs performance and mood the next day (Hou & Hu, 2023). A second line of research emphasizes the protective role of social and collegial support, which consistently predicts better task adaptation and shows that stress levels shift with context and resources (Hamama, 2025; Ali, 2025). Together, these aspects justify an instrument that is sensitive enough to capture variations in Romanian professional environments and stable enough to support group comparisons. Consequently, PSS captures teachers' stress as a dynamic state influenced by social support (both familial and collegial), highlighting how stress levels fluctuate with their resources.

The research questions guiding the study are the following:

Does the PSS scale administered to Romanian employees behave as a single construct, as two correlated domains, or as a structure with a general factor and residual specificities related to wording or content? Do these scores function equivalently across key groups that matter for labor policy in Romania, such as women and men, urban and rural residents, and employees in education field versus other fields?

2. Current state of research

Debates on the PSS structure center on whether perceived stress is best represented by a general factor or by two correlated dimensions linked to item polarity. Numerous CFA studies show that a two-factor model—distress and perceived self-efficacy/inefficacy—fits well in community and clinical samples, while still allowing for a common stress core (Michaelides et al., 2016; Nielsen et al., 2016; Jatić et al., 2023).

Bifactor studies likewise find a strong general factor plus specific variance tied to reverse wording, supporting the use of both total and subscale scores (Dominguez Lara et al., 2024). This tension between correlated and bifactor models appears in cross-national validations, where two-component solutions often remain competitive and the utility of the total score depends on the strength of the general factor (Jiang et al., 2023; Lee, 2012). Reliability and convergent validity have been consistently supported across populations. Reviews highlight the PSS-10 as the most balanced version in terms of accuracy and brevity (Schneider et al., 2020), with the PSS-4 serving as a rapid screening tool (Ruisoto et al., 2020).

The effects of positive versus negative wording remain a key technical issue. Structural analyses have shown that item polarity can introduce methodological variance, which explains why two-factor, wording-oriented solutions recur even when the theoretical construct is unidimensional (Michaelides et al., 2016; Nielsen & Dammeyer, 2019). Bifactor models explicitly address this issue by separating common variance from polarity-specific variance, and the general factor dominance index guides the decision to report the total score (Dominguez Lara et al., 2024; Michaelides et al., 2016).

In terms of cross-cultural validation, there is a solid basis for using the PSS in various linguistic and cultural contexts. In European and Asian settings, two-component structures and good fit indicators have been confirmed, and invariance testing has supported comparisons between subgroups of gender or clinical status (Jiang et al., 2023; Lee, 2012). The early Romanian adaptation confirmed semantic equivalence but called for updated confirmatory analyses on occupational samples (Dumitrescu, 2014), while Latin American studies favored the PSS-10 for its expected correlations with well-being indicators, reinforcing convergent validity in educational contexts (Ruisoto et al., 2020).

In terms of criterion and predictive validity, longitudinal studies have linked PSS scores to trajectories of mental health and functioning, including learning performance, showing that high levels of perceived stress are associated with low educational efficacy and, often, with the maintenance of internalizing

symptoms (Suh et al., 2025). Recent work also identifies mechanisms such as rumination-driven bedtime delay, which undermines sleep and mood (Hou & Hu, 2023). In educational contexts, self-reported stress correlates with curricular load, practice demands, and emotional pressure, supporting the need for early screening and intervention (Jeon et al., 2024).

Studies on PSS measurement invariance generally support configurational and metric equivalence across genders and clinical groups, and in some cases scalar invariance, enabling latent-mean comparisons without item-level distortions (Jiang et al., 2023; Nielsen & Dammeyer, 2019). Systematic analyses highlight the usefulness of multi-group approaches in national validations and recommend careful reporting of ΔCFI and ΔRMSEA as primary indices, in line with current standards (Schneider et al., 2020). In distinct cultural spaces, links between perceived stress and temporal orientations or attachment styles have been described, suggesting potential moderating effects of socio-cultural variables on PSS dimensions and, implicitly, on the interpretation of intergroup differences (Khalaf et al., 2024).

At the intersection of psychometrics and organizational applications, three recurring methodological directions emerge. The first is the clarification of dimensionality through competing models, with an emphasis on separating wording variance, to justify the use of the total score and, where appropriate, the coping and distress subscales (Dominguez Lara et al., 2024; Michaelides et al., 2016). The second concerns invariance across categories relevant to work, such as gender, age, or job type, to allow for valid comparisons between subgroups and monitoring changes over time at the organizational level (Jatic et al., 2023). The third concerns contextual adaptations, from migrations to the online environment to short versions for screening, with demonstration of format equivalence and structural stability in real work samples (Herrero & Meneses, 2006; Ruisoto et al., 2020).

The literature connects perceived stress with cognitive and motivational markers important for occupational performance. Links between stress, learning intentions, and academic outcomes have been documented, highlighting the importance of synthetic but sensitive metrics in professional development assessments (Suh et al., 2025). At a mechanistic level, pathways from stress to mental health are being discussed, including the role of self-control and emotional regulation, which may function as mediating variables in predictive models that include PSS (He et al., 2025). Additionally, connections with rumination and sleep hygiene indicate that PSS scores can help identify intervention targets for reducing cumulative risks in working populations (Hou & Hu, 2023).

Finally, recent literature has integrated the PSS into intervention programs and change contexts, from organizational support to reflective practice training,

with results that support both the scale's sensitivity to contextual variations and its relevance to educational and human resource policy decisions (Ait Ali et al., 2025; Zheng et al., 2024). Consistent connections with health indicators and extensive evidence on structure and invariance position the PSS as a key tool for assessing stress in modern organizations, provided that factor modeling and scoring decisions are reported transparently. This positioning is reinforced by cross-cultural validations and demonstrations of equivalence across administration formats, which facilitate widespread use in research and practice (Herrero & Meneses, 2006; Jiang et al., 2023; Ruisoto et al., 2020).

3. Research methodology

3.1. Participants

The study included 342 employees from Romania, recruited through professional networks, advertisements on social platforms, and organizational partnerships, covering both the public and private sectors. Participants completed an online questionnaire, with informed consent, and the data collected was anonymized, without including personally identifiable information.

The sample structure was representative of the country's workforce distribution, with a predominance of women, an aspect that was subsequently addressed through specific analyses of gender invariance. Although part of a broader research program, this study focused specifically on evaluating the PSS's psychometric properties among employees, using an independent sample for validation.

3.2 Procedure

Participants were provided with a unique link to access the online questionnaire. At the outset, they were presented with the purpose of the study, their right to withdraw, and confidentiality guarantees, followed by obtaining informed consent.

The PSS items were administered together with a broader set of psychosocial measures, but in this paper, we focus exclusively on the analysis of the PSS scale, the updated Romanian version. The protocol applied complies with good practices for the development and validation of psychological instruments, including clear steps for piloting, translation, and structural verification through confirmatory factor analysis (CFA), in accordance with recommendations in international literature and recent studies dedicated to scale development.

3.3 Instrument

The Perceived Stress Scale (PSS) (Cohen & Williamson, 1988) was used in its 10-item version (PSS-10) (Table 1), a widely used instrument for assessing perceptions of the degree to which life events are considered unpredictable, uncontrollable, and overwhelming. The PSS-10 (Nielsen & Dammeyer, 2019) has been robustly validated in diverse contexts and cultures, supported by both unidimensional models and two-factor or bifactorial models. Scoring was performed on a six-point Likert scale, with recoding of positively worded items, followed by aggregation at the total score and subscale levels, as appropriate.

The adoption of the PSS-8 was supported by prior international evidence and by our analyses showing greater structural stability and fewer issues from reverse-scored items. The final form includes eight items grouped into two correlated subscales: Distress (items 1, 2, 3, 9, 10) and Coping (items 5, 7, 8). Items 6 and 4 were removed due to inconsistent loadings and local dependencies. For the total PSS-8 score, coping items are reverse-coded so that higher values reflect greater perceived stress, while raw subscale scores allow separate interpretation of helplessness (Distress) and perceived control (Coping).

Table no. 1. *Division of PSS-10 items (Cohen & Williamson, 1988) into two subscales: Distress and Coping*

Distress (PD)	Coping (PC)
SP1. How often during the past month have you been upset about something that happened unexpectedly?	
SP2. How often during the past month have you felt that you were unable to control the important things in your life?	*SP4. How often during the last month have you felt confident about your ability to handle your personal problems?**
SP3. How often during the last month have you felt nervous and "stressed"?	SP5. How often during the past month have you felt that things went as you wanted it?
*SP6. How often during the past month, have you experienced that you could not cope with everything you had to do?**	SP7. How often during the past month have you been able to handle things that annoy you?
SP9. How often during the past month have you been angry about things you had no control over?	SP8. How often during the past month have you felt that you were on top of things?
SP10. How often during the last month have you felt difficulties were piling up so high that you could not handle them?	

Note: The item marked with an asterisk (*) was removed from the final model.

3.4 Data analysis

3.4.1. Descriptive analysis

Data preprocessing included the evaluation of missing values, distributions, and the identification of extreme values. Isolated missing cases were treated by imputation based on maximum likelihood, a method integrated into the structural modeling process. Subsequently, descriptive indicators such as mean, standard deviation, skewness, and kurtosis were calculated, and correlations between items were estimated using coefficients in accordance with standard procedures recently applied in mixed clinical and non-clinical sample studies.

3.4.2. Validation of the measurement model

The analytical approach followed a two-stage structure. Initially, three alternative models proposed in the literature on PSS were evaluated on the working sample: the unifactorial model, the two-factor correlated model, and the bifactor model, using confirmatory factor analysis (CFA) with robust estimation (Hair et al., 2019). The final choice of model was based on fit indicators such as CFI, TLI, RMSEA (calculated with 90% confidence intervals), and SRMR, while also considering informational parsimony.

Reliability was assessed with Cronbach's alpha, and convergent validity with the average variance extracted (AVE) indicator, following standard guidelines for psychological measurement. To align with modern validation practices, scale development and structural verification were reported according to current psychometric standards, including CFA for structural validity and subgroup invariance tests for generalizability. Recent validations call for transparent modeling and cross-cultural checks. Given structural inconsistencies, we prioritized parsimonious models, with the shift to the PSS-8 reflecting evidence that reverse-scored positive items add method variance.

3.4.3. Measurement invariance

Invariance was assessed using multigroup confirmatory factor analysis (MG-CFA), considering three classifications: gender, urban versus rural residence, and professional field. The procedure followed the standard sequence of invariance testing—configural, metric, scalar, and strict—with decisions based on changes in fit indices, according to the thresholds $\Delta CFI \leq .01$ and $\Delta RMSEA \leq .015$, and χ^2 differences were used only as additional evidence, taking into account their sensitivity to sample size and possible group imbalances. The thresholds adopted, as well as the decision-making logic, reflect current practice in PSS literature and

educational validation studies aimed at comparability between demographic groups or context.

When scalar invariance was confirmed, latent means were compared by fixing the reference group's mean to zero. The procedure followed current guidelines for invariance testing, ensuring transparent reporting, documenting any partial relaxations, and allowing group comparisons only after the required invariance level was met—consistent with standards in transnational validations.

4. Results

4.1. Descriptive analysis

Descriptive statistics for the ten PSS items were computed for the full sample of Romanian employees (N = 342). Item means ranged from 2.37 to 3.59, with standard deviations between 1.08 and 1.24. Confidence intervals were narrow, indicating good precision, and the full response range (1–6) was used for all items, suggesting adequate variability and no range restriction.

First, the mean of the most frequently reported problems or feelings of overload was above the median point of the scale, with the highest mean score recorded for SP3 (M = 3.59), followed by SP9 (M = 3.36) and SP1 (M = 3.27). The positively worded items, scored inversely in the standard version, had lower raw means, with SP4R recording the lowest value (M = 2.37), while SP7R and SP8R were close to the middle of the scale (M = 2.79 and 3.05, respectively). Recoding these items is necessary for interpreting the total scores, so that the raw means directly indicate stress levels.

The sum of raw, non-recoded means was around 30 points, near the midpoint of the 10–60 range, indicating a moderate level of daily stress. The dispersion of responses was homogeneous, with similar standard deviations for all items, indicating a balanced distribution and good discrimination capacity of the scale.

Normality tests showed slight positive skew across all items (0.161–0.795), with the strongest skew for SP6 and SP2, indicating more frequent low-to-mid responses. Kurtosis values were near zero (−0.671 to 0.718), with SP6 most deviant and SP8R somewhat flatter. These deviations fall within acceptable limits for robust factor analyses and are unlikely to compromise model results.

Overall, the statistical descriptions (Table 2) support the use of PSS items, which adequately cover the theoretical content, use the entire response scale, and show comparable variability. Notably, positively worded items have lower raw means, as expected prior to recoding. Among these, SP6 and SP4R stand out with distinct distribution characteristics.

Table no. 2. *Summary statistics for PSS items (means, standard errors (SE), 95% confidence intervals (CI), medians, standard deviations (SD), skewness, kurtosis, and their standard errors)*

			95% Confidence Interval				Skewness		Kurtosis	
	Mean	SE	Lower	Upper	Median	SD	Skewness	SE	Kurtosis	SE
SP1	3.27	0.0588	3.16	3.39	3.00	1.09	0.638	0.132	0.152	0.263
SP2	2.77	0.062	2.65	2.89	3.0	1.15	0.784	0.132	0.489	0.263
SP3	3.59	0.0585	3.48	3.71	3.50	1.08	0.255	0.132	-0.284	0.263
SP4R	*2.37*	0.0636	2.24	2.49	2.0	1.18	0.656	0.132	-0.344	0.263
SP5R	2.96	0.0594	2.84	3.08	3.0	1.10	0.161	0.132	-0.641	0.263
SP6	2.89	0.0588	2.78	3.01	3.0	1.09	0.795	0.132	0.718	0.263
SP7R	2.79	0.0623	2.67	2.91	3.00	1.15	0.349	0.132	-0.516	0.263
SP8R	3.05	0.0671	2.91	3.18	3.0	1.24	0.318	0.132	-0.671	0.263
SP9	3.36	0.0677	3.2	3.49	3.0	1.25	0.304	0.132	-0.333	0.263
SP10	2.98	0.0659	2.85	3.11	3.00	1.22	0.523	0.132	-0.196	0.26

Notes. The CI of the mean assumes sample means follow a t-distribution with N – 1 degrees of freedom

Because the PSS includes both negative and positive items, moderate positive skewness is not inherently problematic. However, SP6 showed marked skewness and weak item–rest correlations, and SP4R showed a low mean and similarly weak correlations, signaling potential measurement issues. These indicators motivated testing the factor structure with and without these items to determine whether an eight-item version improves psychometric consistency while retaining content validity.

The results indicate good internal consistency (Table 3a) for both PSS-8 subscales and adequate convergence of indicators around latent variables. For the Coping subscale, Cronbach's α coefficient is 0.802 and the composite reliability (rho_c) is 0.808. For Distress, Cronbach's α is 0.864, while rho_c is 0.865. All values exceed the usual threshold of 0.70, indicating satisfactory item homogeneity and a low level of random error in measurement. The average variance extracted (AVE) is 0.579 for Coping and 0.561 for Distress; both are above 0.50, showing that each construct, on average, explains more than half of the variance of its indicators. The Fornell–Larcker criterion (Table 3b) is also met, with the square root of the AVE being higher in absolute terms than the correlation between factors ($r = -0.26$): 0.761 for Coping and 0.749 for Distress. This shows good discrimination between the two subscales, with the negative correlation aligning conceptually with higher effectiveness accompanying lower distress. Overall, the PSS-8 demonstrates reliable convergent indicators and a clear two-dimensional structure.

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SP4R	*2.37*	0.0636	2.24	2.49	2.0	1.18	0.656	0.132	-0.344	0.263
SP5R	2.96	0.0594	2.84	3.08	3.0	1.10	0.161	0.132	-0.641	0.263
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Table no. 3. *Reliability, convergent (a) and discriminant (b) validity for PSS-8*

a. Reliability and convergent validity			b. Fornell-Larcker criterion		
	Coping	Distress		Coping	Distress
Cronbach's alpha (standardized)	0.802	0.864	Coping	0.761	
Cronbach's alpha (unstandardized)	0.802	0.864	Distress	-0.26	0.749
Composite reliability (rho_c)	0.808	0.865			
Average variance extracted (AVE)	0.579	0.561			

4.2. Dimensionality. Exploratory factor analysis

Using the pilot sample (N1 = 168), the scale's latent structure was verified through EFA with principal axis extraction and oblimin rotation, consistently revealing two factors. Scree plot and parallel analysis supported this two-dimensional solution: negatively worded items loaded on a distress factor, while positively worded items (after recoding) reflected perceived coping effectiveness. Across analyses, SP6 and SP4R showed weak, unstable loadings and low communalities, supporting the move to an 8-item version that preserves conceptual coherence and aligns with validated PSS-8 adaptations.

Based on this exploratory solution, confirmatory factor specifications were tested using an independent sample for validation (N_2= 174). The unifactorial model had an unsatisfactory fit (RMSEA = .231, CFI = .673), indicating the impossibility of reducing the variability of the items to a single general factor. The two-factor correlated model proved optimal, providing a good fit and the most parsimonious comparative solution (CFI = .944, TLI = .917, RMSEA = .099, SRMR = .052), with the lowest AIC and BIC criteria values. The standardized loadings were robust: distress items loaded between approximately .91 and 1.27, and recoded items between .70 and 1.00 on the coping factor. However, SP6 remained the weakest item in the distress subscale, and SP4R the weakest in the positive subscale, confirming the EFA diagnosis.

The two-factor model, with items loading on both a general and specific factors, showed acceptable fit (CFI = .932, RMSEA = .100) but was overparametrized, and the general factor was weak. Uneven and sometimes non-significant loadings suggest that specific factors capture most shared variance, limiting the value of the ten-item total score.

The second-order model, which places distress and coping as first-order factors linked to a higher-order factor, had a weaker fit than the two-factor correlated model (CFI = .921, RMSEA = .114), and the fit penalties and lack of interpretive benefits suggested that this hierarchy did not add additional value to the analyzed dataset.

EFA and CFA confirm a correlated two-factor structure of the PSS-10 - Distress and Self-Efficacy - showing that a single total score is insufficient. Items SP6 and SP4R perform poorly and weaken model fit, supporting the use of an eight-item version. Reporting the subscales separately clarifies employees' stress levels and supports a valid tool.

4.3. Measurement invariance

The findings support using the PSS-8 as a stable instrument across gender and residential environment, allowing direct latent-mean comparisons without further adjustments. For comparisons between education and non-education groups, partial invariance is advised: analyses should begin with a scalar model and then free one or two problematic loadings - typically recoded items - the ΔCFI threshold returns to ≤ .01 (Putnick & Bornstein, 2016), after which latent means may be compared with explicit mention of partial invariance. Overall, the PSS-8 shows strict invariance for gender and residence, but not for occupational field, where mean differences may reflect both true variance and measurement effects. This distinction is crucial for interventions; for example, when comparing teachers with other professions, organizations should rely on the Distress and Coping subscales and apply only minimal, statistically supported parameter relaxations or report results within a partial-invariance framework.

4.3.1. Gender

The configurational model was accepted with a satisfactory fit (CFI = .907, RMSEA = .093), indicating that women and men share the same two-dimensional structure of the PSS-8 scale. Enforcing equality of factor loadings did not significantly affect model fit (CFI = .906, ΔCFI = −.002; RMSEA = .087, ΔRMSEA = −.006), and the χ^2 difference was not significant (p = .245). The same stability was observed when testing the equality of intercepts (CFI = .908, ΔCFI = +.003; RMSEA = .081, ΔRMSEA = −.007; p = .848) and residuals (CFI = .905, ΔCFI = −.004; RMSEA = .076, ΔRMSEA = −.004; p = .125). In the final stage, the model with equal latent means recorded adequate index values (CFI = .904, ΔCFI = −.001; RMSEA = .076, ΔRMSEA = −.001; p = .231). In conclusion, the PSS-8 scale shows strict invariance across genders, thus

providing a solid methodological basis for valid comparisons of latent means between women and men, without the risk of confusion between real differences and measurement artifacts.

4.3.2. Residence

The configurational structure of the PSS-8 model was stable and satisfactory (CFI = .934, RMSEA = .078), indicating a common configuration for urban and rural respondents. Enforcing equal factor loadings (metric model) maintained model fit (CFI = .933, ΔCFI = −.001; RMSEA = .073, ΔRMSEA = −.005; p = .339), highlighting comparable factor loadings between the two groups. At the scalar level, the results confirmed the homogeneity of the intercepts (CFI = .934, ΔCFI = .001; RMSEA = .067, ΔRMSEA = −.005; p = .636). Strict invariance was further supported, with indices (CFI = .936, ΔCFI = .002; RMSEA = .062, ΔRMSEA = −.006; p = .665), and the model with equal latent means showed good fit values (CFI = .936, ΔCFI = 0; RMSEA = .061, ΔRMSEA = −.001; p = .376). The results show that the PSS-8 functions equivalently for urban and rural respondents, allowing valid latent-mean comparisons between the two groups.

4.3.3. Professional domain

When comparing the education and research versus non-education groups, the configurational model was adequate, with CFI = .931 and RMSEA = .080, indicating that the same two-factor structure correctly describes the data in both domains (Table 3). However, at the metric model level, a decrease in fit was observed, at the acceptable threshold, with CFI = .920 and ΔCFI = −.011, and the χ^2 difference was significant (p = .004), signaling differences in at least one factor loading between groups. The scalar model returned a fit close to the initial configuration (CFI = .919, ΔCFI = −.001; RMSEA = .075, ΔRMSEA = −.004; p = .301), suggesting the homogeneity of the intercepts conditioned on the equality of the loadings. In contrast, the strict model showed a substantial decrease in fit indices (CFI = .901, ΔCFI = −.018; RMSEA = .077, ΔRMSEA = .002), with a significant difference in χ^2 ($p < .001$). The model with equality of latent means showed a fit below the desired threshold (CFI = .897, ΔCFI = −.004; RMSEA = .078; p = .030). In short, occupational groups do not meet metric or strict invariance, so mean comparisons between education and non-education groups are not valid unless partial invariance adjustments are used.

Table no. 4. *Measurement Invariance Model Fit Indices Across Groups: Gender (a); Residence (b); Professional domain (c)*

	M1 configural	M2 weak	M3 strong	M4 strict	M4B strict + means
Degrees of freedom	38	44	50	58	60
Df difference	38	6	6	8	2
Chi-square	150.825	158,732	161,412	174,044	176,977
Chisqr difference	150,825	7,907	2.68	12,633	2.93
P value	0	0	0.848	0.125	0.231
AIC	250.825	246,732	237,412	234,044	232,977
BIC	442,565	415,463	383,134	349,089	340,352
CFI	0.907	0.906	0.908	0.905	0.904
CFI difference	0.907	-0.002	0.003	-0.004	-0.001
RMSEA	0.093	0.087	0.081	0.076	0.076
RMSEA difference	0.093	-0.006	-0.007	-0.004	-0.001

a. Gender

	M1 configural	M2 weak	M3 strong	M4 strict	M4B strict + means
Degrees of freedom	38	44	50	58	60
Df difference	38	6	6	8	2
Chi-square	116.32	123.129	127.431	133.27	135.229
Chisqr difference	116.32	6.81	4.302	5.84	1.958
P value	0	0.339	0.636	0.665	0
AIC	216.3	211.129	203,431	193,271	191,229
BIC	408.06	379,861	349,154	308,315	298,604

CFI	0.934	0.933	0.934	0.936	0.936
CFI difference	0.93	-0.001	0.	0.002	0
RMSEA	0.078	0.073	0.067	0.062	0.061
RMSEA difference	0.	-0.005	-	-0.006	-0.001

b. Residence

	M1 configural	M2 weak	M3 strong	M4 strict	M4B strict + means
Degrees of freedom	38	44	50	58	60
Df difference	38	6	6	8	2
Chi-square	120,562	139,982	147,207	176,673	183,693
Chisqr difference	120,562	19.4	7,225	29,466	7.02
P value	0	0	0	0	0
AIC	220.562	227,982	223,207	236,673	239,693
BIC	412,302	396,714	368,93	351,718	347,068
CFI	0.931	0.92	0.919	0.901	0.897
CFI difference	0.93	-0.011	-	-0.018	-0.004
RMSEA	0	0.	0.07	0.07	0.078
RMSEA difference	0	0	-0.004	0.002	0

Professional domain

Parsimony indicators support the previous interpretations. For the gender and residence environment variables, both the Akaike criterion (AIC) and the Bayesian information criterion (BIC) showed steady decreases as we moved from the configural model to the more restricted strict and equal means models. This indicates that the more parsimonious models describe the data at least as well, using fewer parameters.

In contrast, for the occupational domain, the AIC and BIC values increased significantly in the strict and strict + equal means models, reflecting the empirical cost of the constraints imposed, which are not supported by the data. This increase highlights a decrease in the quality of the fit and indicates the need to relax some constraints in order to obtain valid models in this group.

5. Discussion

5.1. Factorial structure, invariance, and applicability of the PSS-8

This study shows that, in a contemporary Romanian occupational sample, the Perceived Stress Scale is best represented by two correlated factors, perceived helplessness and perceived self-efficacy. The two-factor solution outperformed the unifactor, second-order, and bifactor alternatives and remained stable after removing two weak items. Interesting, Nielson & Dammeyes (2019) similarly excluded item SP6, "*How often during the past month, have you experienced that you could not cope with everything you had to do?*", thus emphasizing the relevance of eliminating items that do not clearly contribute to the factorial consistency and interpretative clarity of the scale in the specific context studied.

The PSS-8 preserves the instrument's conceptual scope while offering clearer factorial structure, making it useful for quick organizational assessments. It shows full invariance across gender and residence, allowing meaningful group comparisons, and partial invariance across professional domains, consistent with differing role demands. Well-centered descriptive indices support the use of robust ordinal estimators and indicate that observed variance reflects genuine individual differences rather than measurement artifacts.

5.2. Theoretical applicability of the PSS-8

The analyses indicate a structure with two correlated factors: perceived weakness and self-efficacy in the face of stress, which provides a better fit than unifactorial, second-order, or bifactorial models. This configuration is consistent with the majority of trends in the literature over the last decade, according to which the Perceived Stress Scale (PSS) is most often defined as a two-dimensional scale, but the total score remains useful when the general factor is sufficiently strong (Harris et al., 2023; Ruisoto et al., 2020).

The results obtained extend previous validations carried out on students in Romania, applying the same two-dimensional logic in the occupational environment, with high loads on the factors of perceived helplessness and self-efficacy, an aspect also confirmed in the first Romanian version of the PSS (Dumitrescu, 2014).

Invariance tests support comparability between genders and between urban and rural environments. The configurational, metric, and scalar models maintained similar fit indices, indicating the same significance, the same loadings, and comparable intercepts of items in the two categories. The stability of this pattern has been frequently reported in studies that tested the invariance of the PSS in various community or clinical samples, including in different cultural contexts (Jatic et al., 2023; Jiang et al., 2023).

For the occupational domain, configural invariance emerged, but parameter variations suggest that role demands and organizational pressures influence perceived control and unpredictability (Michaelides et al., 2016; Nielsen & Dammeyer, 2019). The findings are consistent with the hypothesis that the PSS has a stable and interpretable structure among Romanian employees, and that the well-calibrated short version is suitable for organizational use.

The descriptive analysis highlights mean located centrally on the scale, homogeneous standard deviations, and low positive asymmetries, with kurtosis values close to zero. This profile, frequently encountered in community studies, recommends the use of robust estimates for ordinal items and indicates that the variation reflects authentic differences in the perception of unpredictability and daily control, consistently correlated with mental health and psychological functioning (Lee, 2012). The moderate psychometric performance of positively worded items prior to recoding is consistent with methodological cautions regarding wording-induced variance and findings that specific factors may partially capture methodological effects, which is why shortened versions or bifactor models have sometimes been preferred in recent validations (Ruisoto et al., 2020).

5.3. Practical applicability of the PSS-8

For educational institutions and organizations, the PSS-8 offers a concise and reliable instrument for repeated monitoring, evaluation of stress management programs, and tracking of psychosocial climate. It ensures precise comparisons between women and men, as well as between urban and rural areas (Schneider et al., 2020). When comparing occupational groups, caution is advised and analyses should include item-level checks, as parameters may vary with task demands and role pressures (Nielsen et al., 2016). In practice, routine reports should present the two subscales, while the total score can serve as a synthetic screening index, guiding interventions toward reducing perceived helplessness or enhancing self-efficacy (Ruisoto et al., 2020).

5.4.Relevance of the results for the Romanian context

This research extends the scope of prior studies conducted on a Romanian student population by encompassing a sample of employees and introducing a systematic verification process to assess invariance across three distinct sociodemographic domains. The existence of clear documentation of a correlated bifactorial structure and a defensible short form provides an applicable framework for responsible use in Romanian organisations (Dumitrescu, 2014). The conclusions drawn in this study are consistent with those reported in the international literature, which identifies the predominance of the two-dimensional model and legitimises the reporting of both the total score and the subscales, with local parameters that are useful for benchmarking and programme evaluation (Michaelides et al., 2016; Ruisoto et al., 2020).

6. Limitations and future directions

The limitations of the study derive from its cross-sectional design and online recruitment, which prevent the assessment of temporal stability and sensitivity to change, although the equivalence of web formats is supported by previous research on the short PSS (Herrero & Meneses, 2006). The gender imbalance reflects the structure of some local occupational sectors, limiting the strict generalization of the results. However, structural convergence with multicultural validations and replication of invariance patterns strengthens the validity of the conclusions (Nielsen & Dammeyer, 2019).

Future directions include longitudinal validations to estimate the stability and sensitivity of the PSS-8 to interventions and organizational changes, which are necessary for the use of indicators in occupational health programs. Another direction involves bifactorial analysis and general factor dominance indicators to determine the conditions under which the global score adds value to the subscales, according to methodological recommendations (Michaelides et al., 2016; Nielsen & Dammeyer, 2019). Finally, correlating the PSS-8 with organizational and health outcomes, such as absenteeism, intention to leave, sleep quality, or social support, would strengthen criterion validity and support decisions in human resources and applied psychology (Schneider et al., 2020).

7. Conclusions

Teachers are exposed to multiple sources of occupational stress such as heavy workloads, administrative tasks, curricular pressures, external evaluations, high societal expectations and many more. Therefore, the PSS-8 proves to be a valuable

tool for evaluating teachers' perceived stress, providing an empirical basis for the constant monitoring of their well-being. Systematic application of the scale would allow schools and educational authorities to identify critical levels of stress and thus plan specific interventions. However, future research should explore the predictive validity of the PSS-8 in relation to burnout and performance outcomes, taking into account psychosocial factors to shed light on the mechanisms by which stress impacts employee well-being and efficiency. Future research should also examine the extent to which the PSS-8 has predictive validity in relation to indicators specific to the teaching profession, such as job satisfaction, career retention, and pedagogical effectiveness. By creating focused interventions that would enhance both the quality of teachers' professional lives and students' educational outcomes, such an understanding could serve as a strong foundation for organizational and educational policies that support teachers' mental health and performance. Therefore, it has been shown that improving school climate and instructional quality, which are proven measures to reduce stress, can strengthen teachers' self-efficacy and well-being, ultimately benefiting student outcomes (Mennes et al., 2024). Interventions should also target mental disorders among teachers (Desouky & Allam, 2017).

In practice, PSS-8 might not just be a means of evaluation, but it can be integrated into a modern strategy of organizational innovation in education, with the aim of supporting the well-being of teachers and increasing the attractiveness of the profession. Innovative directions for supporting teachers include the development of digital platforms for anonymous self-assessment of stress using PSS-8, personalized e-learning programs for stress management and resilience, psychological support and coaching hubs within school networks, and pilot initiatives to test interventions such as mindfulness, peer mentoring, and flexible administrative practices, with their impact monitored via PSS-8.

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