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Assessment of academic stress: measurement invariance by sex

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Abstract

Context and relevance. In recent years, academic stress among high school students has been regarded as a significant risk factor for their well-being and academic achievement, while in the Russian context there is a noted shortage of modern, psychometrically validated methods for its assessment. **Objective.** The aim of this study is to validate the Russian version of the LASRS-2 for students in grade 11, including confirmation of its factor structure, assessment of reliability, and evaluation of convergent validity. **Hypothesis.** The Russian version of the LASRS-2 demonstrates validity, reliability, and measurement invariance by gender for students in grade 11. **Methods and materials.** The data from 976 eleventh graders were used, aged 16 to 18 years ($M = 17$, $SD = 0.35$), 75.7% females. For convergent validity testing, E. Diener's Life Satisfaction Scale and Physical Wellbeing Index were employed. Analysis was conducted using R (version 4.5.1) with the lavaan package. **Results.** Evidence of validity for the Russian version of the LASRS-2 was obtained, along with strict invariance, allowing comparison between male and female students. **Conclusion.** The Russian version of the LASRS-2 is a valid tool for measuring affective, cognitive, behavioral, and physiological academic stress among students in grade 11. The instrument can be utilized for research and monitoring purposes.

Keywords: academic stress, high school students, LASRS-2, psychometric properties, validity, measurement invariance

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Измерение учебного стресса: проверка измерительной инвариантности по полу

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Резюме

Контекст и актуальность. Учебный стресс старшеклассников рассматривается как существенный фактор риска для их благополучия и успеваемости, при этом в российской практике отмечается недостаток современных психометрически проверенных методов его диагностики. **Цель.** Валидизация русской версии Шкалы учебного стресса Лакаева-2 на выборке учащихся 11 классов, включающая подтверждение ее факторной структуры, оценку надежности и конвергентной валидности. **Гипотеза.** Русская версия Шкалы учебного стресса Лакаева-2 демонстрирует валидность, надежность и измерительную инвариантность по полу для учащихся 11 класса. **Методы и материалы.** Для анализа психометрических характеристик опросника использовались результаты, полученные от 976 одиннадцатиклассников в возрасте от 16 до 18 лет ($M = 17$, $SD = 0,35$), 75,7% — девушки. Для проверки конвергентной валидности использовалась Шкала удовлетворенности жизнью Э. Динера, а также Индекс субъективного физического благополучия. Анализ был выполнен при помощи R (версия 4.5.1), пакет lavaan. **Результаты.** Были получены свидетельства валидности русской версии Опросника учебного стресса и установлена строгая инвариантность, что позволяет использовать инструмент для сравнения девушек и юношей в 11 классе. **Выводы.** Опросник является валидным инструментом измерения аффективных, когнитивных, поведенческих и физиологических проявлений учебного стресса для учащихся 11 класса. Инструмент может быть использован в исследовательских и мониторинговых целях.

Ключевые слова: учебный стресс, старшеклассники, опросник LASRS-2, психометрические характеристики, валидность, измерительная инвариантность

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Introduction

Academic stress is a form of psychological stress that manifests in the educational environment. Although a moderate level

of arousal can be motivating, chronic and excessive academic stress often leads to reduced concentration, memory problems, and a decline in academic performance

(McArdle et al., 2014). Students experiencing high levels of stress may face burnout, which negatively affects their motivation to learn and their performance (Salmela-Aro, Upadaya, 2014). Prolonged academic stress is a significant risk factor for the development of various mental health problems, including anxiety disorders, depression, insomnia, and even suicidal ideation among adolescents (Liu et al., 2020). In Russia studying in the grade 11 is characterized by an intense pace, a large volume of material to be mastered, and constant competition among students driven by preparation for the Unified State Exam (USE) (Symaniuk et al., 2019). Because successful mastery of the curriculum is critical for future university admission, the period of preparation for the USE is considered the most stress-inducing and one that requires particular attention (Sagilyan, 2020). When addressing academic stress, it is also important to take sex-related characteristics into account, since female students display higher levels of academic stress and trait anxiety during schooling (Bao, Han, 2025). However, there is a shortage of validated Russian-language instruments for measuring academic stress, which limits opportunities for its investigation and for planning corresponding data-driven interventions. The present study aims to address this gap by presenting the results of the validation of the Russian version of the Lakaev Academic Stress Response Scale-2 (LASRS-2) for schoolchildren in a sample of eleventh-grade students, with particular attention to testing measurement invariance across male and female students.

In recent years, the topic of students' academic stress has been gaining increasing relevance in contemporary psychological science. Numerous studies indicate a substantial increase in the stress burden experienced by schoolchildren and uni-

versity students, associated with more complex curricula, intense competition, and heightened demands for academic achievement (Fomina, Filippova, Burmistrova-Savenkova, Morosanova, 2024; Muradymova, Bochaver, 2025; Semina, Fedorova, 2023; Symaniuk, Okonechnikova, Malova, 2019; Pavlenko, Bochaver, 2020; Barbayannis et al., 2022; Ibda et al., 2023; Lisnyj et al., 2023; Pascoe, Hetrick, Parker, 2020; Wuthrich, Jagiello, Azzi, 2020). Researchers note that academic stress can manifest at any stage of education; however, upper-secondary school students and first-year university students are the most vulnerable, owing to the need for self-determination, preparation for final assessments, and adaptation to new educational conditions (Putwain, Jansen in de Wal, van Alphen, 2023; Slimmen et al., 2022; Linden, Stuart, 2020; Graves et al., 2021; Córdova et al., 2023).

The assessment of academic stress is one of the pressing problems in educational psychology. Most current methods for diagnosing academic stress are aimed at ranking and identifying life situations capable of causing stress. Examples include the Perception of Academic Stress Scale (PAS; Bedewy, Gabriel, 2015), the College Student Stress Scale (CSSS; Feldt, 2008), the University Stress Scale (USS; Stallman, Hurst, 2016), the Academic Stress Scale (ASS; Oluwafemi, Agbolade, 2017), the Academic Stress Scale (ASS; Kohn, Frazer, 1986), the Student-life Stress Inventory (SSI-R; Gadzella et al., 2012), the Acculturative Stress Scale for International Students (ASSIS; Sandhu, Asrabadi, 1994), and the Academic Stress Inventory (ASI; Lin, Chen, 2009). These instruments make it possible to identify stress factors that can negatively affect students' emotional state. A focus on identifying stressors also predominates among adapted and newly developed

Russian-language instruments for assessing academic stress: the Perceived Stress Scale (PSS; Zolotareva, 2023), designed to assess perceived stress in adults; the Brief Questionnaire of Acute and Chronic Stress (OChS; Morosanova, Zinchenko, 2024); the Questionnaire of Crisis Events and Experiences for Students (Manukyan, 2011); and the Questionnaire of Everyday Stressors for Students (Buzina, Petrash, 2025). In recent years, instruments oriented toward adolescent samples have also been developed and validated: the Questionnaire of Everyday Stressors for Adolescents (Golovei, Galasheva, 2024), which assesses stress tension across nine domains of adolescents' lives, and the Russian-language version of the Perceived Stress Scale for Children (PSS-C; Kharlamenkova et al., 2024), designed to diagnose stress in adolescents aged 11 to 16. However, the aforementioned instruments measure the overall level of perceived stress or everyday stressors but do not allow differentiation of the various components of the stress response (affective, cognitive, behavioral, and physiological), which makes the validation of the multicomponent Lakaev Academic Stress Response Scale-2 (LASRS-2) particularly relevant.

All of the instruments described above are predominantly aimed at identifying factors of academic stress, while the characteristics of the stress response itself, as well as the degree of severity of this state, remain unexamined. In implementing high-quality response measures, it is important to understand not only the factors of academic stress but also its current level of severity. In particular, it may be informative to understand at which level — affective, behavioral, cognitive, or physiological — stress symptoms are most strongly expressed (Crosswell, Lockwood, 2020; Yaribeygi, 2017).

An instrument that makes this possible is the Russian version of the Lakaev Academic Stress Response Scale-2 (LASRS-2), developed to measure university students' responses to academic stress (Lakaev, 2022). In 2024, the instrument was modified and adapted for schoolchildren by researchers at the Institute of Education at HSE University (National Research University Higher School of Economics). The translation and back-translation were carried out by T.N. Kanonire and V.A. Manina. During adaptation for schoolchildren in grades 7–9, the following changes were made: item No. 2 from the original questionnaire (“I used alcohol, drugs, or socializing to avoid anxiety/stress”) was replaced with item 8 of the Russian-language version (“I hung out on my phone to relieve stress”), because the item concerning alcohol and drug use was deemed unacceptable for the adolescent sample and was replaced with socially acceptable behavior of a similar nature. Item No. 21 of the original version (“I was distracted in class”) was removed from the cognitive manifestations scale, since the scale already contained an item with a similar meaning for adolescents — “I found it difficult to concentrate during the lesson”. The order of the items was changed and grouped according to the specific scales, without additional random shuffling. It is this version that was used in the present study.

The aim of the present study is to validate the Russian version of the Lakaev Academic Stress Response Scale-2 (LASRS-2) in a sample of students in grade 11, including confirmation of its factor structure and gaining evidence of its reliability and convergent validity. Additionally, the measurement invariance of the instrument across sex is tested to make it possible to be confident that female and male students with an equal level of academic

stress will receive equal scores, i.e., that the assessment will be conducted fairly. Given the evidence of sex differences in the perceived level of stress (Khanekhesi, Basavarajappa, 2012; Bao, Han, 2025), testing measurement invariance appears particularly important and will allow for valid comparisons of the results of male and female students.

Materials and methods

Sample and procedure. The study involved 976 respondents aged 16 to 18 years ($M = 17$, $SD = 0,35$), of whom 24,3% were male and 75,7% were female. All respondents were grade 11 students from eight federal districts of the Russian Federation (Central, Northwestern, Southern, North Caucasian, Volga, Ural, Siberian, and Far Eastern). The study was conducted in 2025 among students who studied on an online educational platform for USE preparation. Participation in the study was voluntary. The sex ratio is attributable to the statistical distribution of users of the educational platform on which the study was conducted, where female students predominantly account for 60% of users. The dataset has been deposited in RusPsyDATA (Russian Repository of Research Data and Tools in Psychology and Education). The data collection process was carried out in accordance with the ethical standards established by the Russian Psychological Society.

Measures. The main instrument used was the Russian version of the Lakaev Academic Stress Response Scale-2 (LASRS-2) for schoolchildren. The Russian version of the instrument comprises 24 items and includes four scales: "Affective Reactions" ($k = 7$), "Behavioral Reactions" ($k = 6$), "Cognitive Manifestations" ($k = 6$), and "Physiological Reactions" ($k = 5$). Respondents were asked to rate

how often each of the listed experiences had occurred to them over the past two weeks, using the following response categories on a five-point Likert scale: "not at all", "once or twice", "about half of the time", "most of the time", and "all of the time". The original instrument allows for the calculation of scores by scales as well as building of an overall integral indicator of academic stress.

To assess construct validity, the Satisfaction With Life Scale (SWLS; Diener et al., 1985; adapted by E.N. Osin and D.A. Leontiev, 2020) was used, along with the Subjective Physical Well-Being Index for students from the Survey of Subjective Well-Being in School (Kanonire, Uglanova, Kulikova, 2022), which represents the sum of scores on two items: "Over the past week, how often did you feel full of energy?" and "How do you rate your health?", both rated on a five-point Likert scale.

Data analysis. At the preliminary stage, descriptive statistics were calculated for all items and scales, including the mean and standard deviation for the overall sample and for sex-based subsamples. The normality of the distribution of variables was assessed using visual analysis (Q–Q plots, histograms) and the formal Shapiro–Wilk statistical test.

It should be noted that, at the preliminary stage of adaptation, an exploratory factor analysis (EFA) was conducted, which confirmed the four-factor structure expected on the basis of the original model. At the next stage, confirmatory factor analysis (CFA; Brown, 2015) was used to test the fit of the empirical data to the theoretically expected factor structure of the questionnaire. Because of non-normally distributed responses, the robust maximum likelihood method (MLR) was used, which provides robust standard errors and corrected test statistics (Satorra, Bentler, 1994). Three

alternative models were tested and compared: 1) a one-factor model, in which all items serve as indicators of a single general latent factor, “academic stress”; 2) a four-factor model with correlated factors corresponding to the affective, behavioral, physiological, and cognitive manifestation scales; and 3) a second-order hierarchical model, in which the four first-order factors (scales) serve as indicators for a general second-order latent factor, “academic stress”. All of the above models were estimated separately for the full sample as well as for the male and female subsamples.

Model fit to the data was evaluated using a set of fit indices (Kline, 2010):

- CFI (Comparative Fit Index) and TLI (Tucker–Lewis Index): values $> 0,90$ are considered acceptable, and values $> 0,95$ are considered good.

- RMSEA (Root Mean Square Error of Approximation) with a 90% confidence interval: values $< 0,08$ indicate acceptable, and values $< 0,05$ indicate good approximation error.

- SRMR (Standardized Root Mean Square Residual): values $< 0,08$ are considered satisfactory.

To improve the fit of the theoretical model to the empirical data, an iterative process was used, involving analysis of modification indices, which makes it possible to identify unaccounted-for sources of covariation between the residuals of substantively related items. The subsequent addition of covariances between these residuals allows the model fit to be improved.

Reliability (internal consistency) is a necessary condition for measurement validity. In the present study, reliability was assessed using two coefficients: Cronbach’s α , traditional indicator calculated on the basis of the correlation between raw scores (Cronbach, 1951), and McDonald’s ω , an indicator calculated on the basis of standardized

factor loadings within the CFA framework (Viladrich et al., 2017). The ω coefficient is considered preferable for multidimensional scales, as it is less sensitive to violations of the tau-equivalence assumption. A value above 0,7 is considered satisfactory for both coefficients. High values indicate that respondents’ scores are robust to measurement error and that the indicators measure the same latent construct.

The convergent validity of the questionnaire was assessed using correlational analysis. In line with theoretical expectations, statistically significant negative correlations of moderate strength were expected between the academic stress scales and indicators of life satisfaction and subjective physical well-being.

Testing of the measurement invariance of the questionnaire across sex was carried out using multi-group confirmatory factor analysis (MGCFA), following the step-by-step checklist proposed by van de Schoot et al. (2012). A series of nested models was sequentially evaluated, with constraints progressively imposed on the equality of parameters between the male and female groups:

- Model 1 — Configural invariance: tests the invariance of the factor structure (the number of factors and the pattern of loadings). In this model, all parameters (factor loadings, intercepts, residual variances) were freely estimated in each group. Adequate fit of this model is a necessary condition for proceeding with further analysis.

- Model 2 — Metric invariance: tests the equality of factor loadings between groups. Establishing metric invariance makes it possible to state that the relationship between the latent construct and its indicators is the same across groups, which provides grounds for comparing factor structures and correlations of latent variables.

- **Model 3 — Scalar invariance:** tests the equality of factor loadings and item intercepts. Its establishment is a necessary and sufficient condition for the valid comparison of latent construct means between groups.

- **Model 4 — Strict invariance:** tests the additional equality of item residual variances. This model assumes that the construct is measured with equal reliability at the level of each indicator in both groups.

Comparison of the nested models was carried out using the likelihood ratio test ($\Delta\chi^2$). However, given its sensitivity to large sample sizes ($N > 300$), changes in comparative fit indices (Chen, 2007) were used as the primary criteria: a decrease of $\Delta CFI \leq -0,010$ combined with an increase of $\Delta RMSEA \geq 0,015$ was considered evidence of a violation of invariance. If full metric or scalar invariance was not achieved, a search for partial measurement invariance (Byrne, Shavelson, Muthén, 1989) was planned, by sequentially releasing constraints on those parameters (loadings or intercepts) that contributed most to the change in the likelihood ratio test ($\Delta\chi^2$).

All calculations were performed in the R statistical environment (version 4.5.1) using the RStudio integrated development environment and the specialized lavaan package (Rossee, 2012).

Results

Descriptive statistics. Analysis of descriptive statistics (Appendix B) revealed systematic differences between the male and female groups. However, interpreting these differences as true group differences in the level of the latent construct requires prior evidence of the instrument's measurement invariance. Analysis of skewness and kurtosis indices, confirmed by the results of the Shapiro–Wilk test, indicates a deviation from normality in the distribution of most variables. Accordingly, the robust maximum likelihood method (MLR) was chosen for model parameterization in the CFA.

Confirmatory factor analysis. Before evaluating the main models, and in order to improve their fit to the data, covariances between the residuals of three pairs of items were added to the model on the basis of substantive analysis and modification indices: items 5 and 6 (a shared theme of emotional exhaustion), items 15 and 18 (manifestations of academic procrastination), and items 11 and 12 (social isolation as a coping strategy). Further analysis of modification indices did not reveal a need for additional changes that would fundamentally alter the model structure (e.g., cross-loadings).

Table 1

CFA model fit indices

Model		χ^2 (df)	CFI	TLI	RMSEA (CI 90%)	SRMR
Single factor	Full sample	1730 (249)	0,831	0,813	0,078 [0,075 — 0,081]	0,065
	Males	614 (249)	0,818	0,798	0,079 [0,072 — 0,086]	0,075
	Females	1443 (249)	0,818	0,799	0,081 [0,077 — 0,084]	0,069
Four-factors	Full sample	960 (243)	0,918	0,907	0,055 [0,052 — 0,058]	0,050
	Males	454 (243)	0,894	0,880	0,061 [0,053 — 0,068]	0,067
	Females	816 (243)	0,913	0,901	0,056 [0,053 — 0,061]	0,052
Second-order	Full sample	976 (245)	0,917	0,906	0,055 [0,052 — 0,059]	0,051
	Males	454 (245)	0,895	0,882	0,06 [0,052 — 0,068]	0,068
	Females	Did not converge				

Comparison of the alternative models (Table 1) provides unequivocal support for the four-factor structure of the questionnaire. The one-factor model demonstrated unsatisfactory fit to the data, which confirms the theoretical assumption that academic stress is a multicomponent construct.

The models comprising four factors showed good fit to the empirical data. At the same time, the second-order hierarchical model, which postulates the existence of a general latent factor, could not be identified in the female subsample, which is likely attributable to the high correlation between the first-order factors combined with the limited sample size. It should be noted that, although the fit indices of the four-factor model reach the threshold of acceptability, they do not reach the threshold of excellent fit, particularly in the male subsample. This may be explained both by the smaller size of this subsample and by substantive features of how academic stress manifests among male students.

In the samples where the hierarchical model could be estimated, its fit indices were practically identical to those of the simple four-factor model. Moreover, the likelihood ratio test did not reveal statistically

significant differences between these models for the male subsample ($\Delta\chi^2(2) = 1,08$, $p = 0,5843$), which indicates the presence of a general latent construct of “academic stress” underlying all four components, at least in this group. Thus, calculating an overall score for the questionnaire appears methodologically justified; however, for more fine-grained diagnostics, it is recommended to use scale-specific scores for the individual scales.

The figure presents all standardized estimated parameters (item loadings and correlations between factors) from the four correlated-factor model for the full sample. All parameters are statistically significant at the $p < 0,05$ level.

Analysis of factor loadings showed that the affective and cognitive manifestation factors are more homogeneous: loadings range from approximately 0,6 to 0,8, with a mean of 0,7. At the same time, the behavioral reactions factor shows a greater spread of loadings (from 0,36 to 0,62, mean = 0,53), which may be explained by a greater influence of the contextual characteristics of the items comprising this factor.

Internal consistency. The results of the reliability calculations for all scales are presented in Table 2.

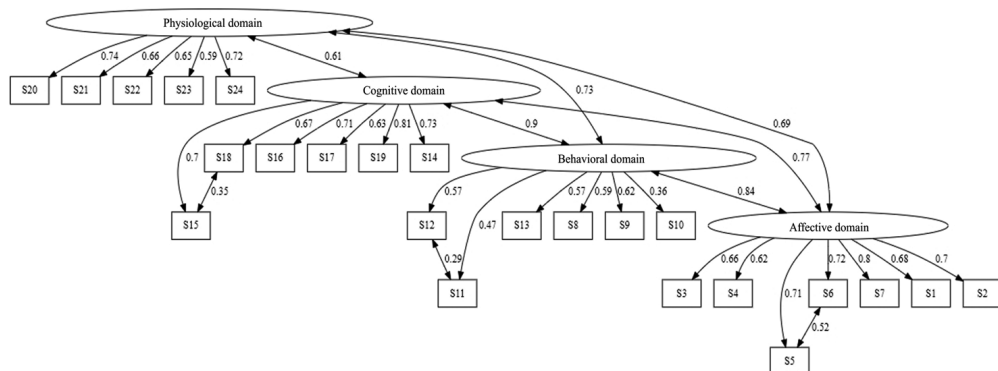


Fig. CFA model

Table 2

Internal consistency indices for LASRS–2

Scale	α Кронбаха	ω Макдональда
Academic stress (k = 24)	0,93	0,86
Affective domain (k = 7)	0,87	0,86
Behavioral domain (k = 6)	0,71	0,68
Cognitive domain (k = 6)	0,87	0,84
Physiological domain (k = 5)	0,80	0,81

Note: ω was taken from the single-factor model for the academic stress scale and from the four-factor model for the remaining scales.

Most of the obtained values exceed the generally accepted criterion of 0,70, indicating good internal consistency for all scales of the instrument. The McDonald's ω value for the behavioral reactions scale is somewhat below the generally accepted criterion, indicating its relatively lower reliability compared with the other scales.

Construct validity. Pearson correlation coefficients between the raw scores on the questionnaire's scales, as well as their correlations with the two external instruments, are presented in Table 3. All correlations are significant at the $p < 0,05$ level.

The observed pattern of correlations fully corresponds to theoretical expectations: the scales of the questionnaire under consideration show moderate negative associations with the subjective physical well-being index and the Diener Satisfaction With Life Scale, as well as, as expected,

high positive correlations among themselves, which provides evidence in favor of the instrument's convergent validity.

Measurement invariance. To test the measurement invariance of the questionnaire across sex, a series of nested models was sequentially evaluated (Table 4). Although the likelihood ratio test ($\Delta\chi^2$) shows statistically significant differences between all successive models ($p < 0,001$), which is expected given the large sample size, analysis of changes in comparative fit indices (ΔCFI and $\Delta RMSEA$) provides more substantively meaningful information. The deterioration in fit as constraints were progressively imposed did not exceed the established critical values ($\Delta CFI \leq -0,010$, $\Delta RMSEA \geq 0,015$). The most notable, yet still acceptable, deterioration was observed at the transition to scalar invariance ($\Delta CFI = -0,006$). On this basis, it can be

Table 3

Pearson correlations between academic stress scales, life satisfaction, and physical well-being in school

	1	2	3	4	5	6
1. Subjective physical well-being index	1					
2. Diener life satisfaction scale	0,49	1				
3. Academic stress	-0,63	-0,47	1			
4. Affective domain	-0,55	-0,37	0,88	1		
5. Behavioral domain	-0,54	-0,44	0,85	0,65	1	
6. Cognitive domain	-0,50	-0,41	0,85	0,64	0,67	1
7. Physiological domain	-0,53	-0,36	0,76	0,58	0,57	0,50

concluded that strict measurement invariance holds, which allows for valid comparisons of both latent means and variances between groups.

As an additional analysis, a procedure for establishing partial invariance was carried out in order to precisely identify potential sources of non-invariance. Analysis of the contribution of individual parameters to the change in χ^2 (Table 5) showed that, to

achieve full metric invariance, it was sufficient to release the constraint on the factor loading of only one item, item 23 ("I had no appetite"), and that, to achieve full scalar invariance, it was necessary to release the intercepts of seven items (7, 19, 4, 21, 17, 11, 9). This indicates that these items may have certain interpretive peculiarities with respect to students' sex, without violating the overall invariance of the instrument.

Table 4

CFA models for testing measurement invariance

Model	χ^2 (df)	P of test $\Delta\chi^2$	CFI	Δ CFI	RMSEA	Δ RMSEA
Model 1	1261 (486)		0,910		0,062	
Model 2	1302 (506)	< 0,001	0,908	−0,002	0,061	−0,001
Model 3	1378 (526)	< 0,001	0,902	−0,006	0,062	0,001
Model 4	1420 (550)	< 0,001	0,899	−0,003	0,062	0

Table 5

Identification of the most non-invariant items

Item	$\Delta\chi^2$ for releasing loading equality constraint	$\Delta\chi^2$ for releasing intercept equality constraint
1	0,00	3,43
2	0,21	6,76
3	2,31	1,71
4	0,00	8,33
5	0,11	2,17
6	0,68	1,36
7	3,87	21,91
8	0,08	1,44
9	2,04	4,87
10	0,21	5,71
11	0,34	2,95
12	0,34	0,11
13	0,11	2,72
14	0,40	4,12
15	0,08	1,02
16	0,15	0,18
17	0,04	2,33
18	0,33	4,70
19	0,02	14,34
20	14,69	0,81
21	7,36	5,41

Item	$\Delta\chi^2$ for releasing loading equality constraint	$\Delta\chi^2$ for releasing intercept equality constraint
22	4,60	0,58
23	17,32	0,25
24	1,47	0,02

Thus, the results of the analysis confirm that the academic stress questionnaire's measurement invariance across sex holds. Establishing invariance makes it possible to assert that the observed differences in respondents' answers reflect true differences in the level of the latent construct rather than being an artifact of measurement.

To quantify these differences, the parameters of the strict invariance model, in which all item parameters were constrained to be equal between groups, were analyzed. In this model, the distribution of the latent factors in the female group was fixed as the reference (mean = 0, variance = 1), while the distribution parameters in the male group were estimated freely. The estimated parameters for the male group are presented in Table 6.

Analysis of the model parameters shows that male students exhibit statistically significantly lower mean levels of the latent construct across all four factors ($p < 0,05$). The largest difference is observed for the affective reactions factor. With respect to variances, the analysis indicates lower variability among male students for the affective reactions component, and especially for the physiological reactions component. At

the same time, variability in the behavioral reactions and cognitive manifestations components is somewhat higher among male students than among female students.

Discussion

The aim of the present study was to examine the psychometric quality of the Russian version of the Academic Stress Questionnaire LASRS-2 for students in grade 11. The results of the study confirm the validity and reliability of the Russian version of the instrument.

The four-factor structure of the questionnaire was confirmed, consistent with the original version. The one-factor model demonstrated unsatisfactory fit to the data, which is consistent with the theoretical view of academic stress as a multicomponent construct. The results of testing the second-order hierarchical model indicate that calculating an overall score for the questionnaire is methodologically justified for male students, although the use of scales' scores is recommended for more precise diagnostics. It should be noted that the hierarchical model could not be identified in the female subsample, which is likely attributable to the high correlation between the

Table 6

Factor score distribution parameters for males under strict invariance model

Factor	Mean	Variance
Affective domain	-0,67	0,88
Behavioral domain	-0,54	1,09
Cognitive domain	-0,42	1,07
Physiological domain	-0,54	0,67

Note: parameters estimated relative to the female group, where mean = 0 and variance = 1.

first-order factors combined with the limited sample size. Future studies should test the hypothesis of whether an overall score can be calculated for female students using a sample that is more heterogeneous in age.

Analysis of internal consistency showed that most of the scales possess good reliability. The exception was the behavioral reactions scale, where the reliability value for one of the coefficients was somewhat below the generally accepted criterion. This is consistent with the factor analysis findings, where the behavioral reactions factor likewise showed the greatest spread of factor loadings, which may be explained by a greater influence of the contextual characteristics of the items comprising this factor. However, even in this case, the behavioral reactions scale can be used for research purposes. Future studies could focus on examining additional behavioral indicators of stress among upper-secondary school students.

The convergent validity of the questionnaire was confirmed: all scales show moderate negative associations with external criteria such as subjective physical well-being and life satisfaction. This is a theoretically expected result, since a high level of stress should be associated with a lower level of well-being (Goksu, 2023; Lian et al., 2023). In addition, the scales of the LASRS-2 Russian version show the expected strong positive correlations with one another, which confirms their relationship to a single academic stress construct.

The results of previous studies indicate the presence of sex differences in the level of academic stress (Khanehkeshi, Basavarajappa, 2012; Bao, Han, 2025), and therefore an important objective of the present work was to test measurement invariance across sex. The results showed that strict invariance holds, which allows the instrument to be used to compare the results of male and female students.

The study also examined sources of potential non-invariance, which may be useful for an in-depth investigation of the phenomenon of academic stress among upper-secondary school students. Several items were identified that may have a somewhat different interpretation among male and female students, although this does not affect the instrument's ability to assess them fairly. For example, item 7 is the item with the largest sex-related component ("I had so much schoolwork that I wanted to cry"), which is related to certain accepted social norms of behavior for male and female students.

Additionally, a comparison of academic stress indicators between female and male students was carried out across all scales. The results obtained show differences in all manifestations of academic stress in favor of male students: they display lower scores, which is consistent with the findings of other studies (e.g., Karkouli et al., 2024; Mahirah et al., 2025).

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Limitations. The main limitations of this study lie in the sampling domain. Future studies should examine the questionnaire's validity in a more age-diverse sample of girls and boys, covering at least the full span of upper secondary school. In addition, students enrolled in an exam-preparation platform may differ from the broader population of 11th-grade students in certain individual characteristics. Another important issue concerns the questionnaire's potential use for individual assessment: at present, such use is not possible, as it requires standardization and should be addressed in subsequent studies.

Conclusion

The results of the study presented in this article demonstrate that the Russian version of the Lakaev Academic Stress

Response Scale-2 is a valid and reliable instrument for assessing academic stress among students in grade 11. The questionnaire can be used for research and monitoring purposes, also comparing male and

female students. Although the calculation of an overall academic stress score is justified for male students, it is recommended that both female and male students' results be reported using scale scores.

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Appendix

Appendix A. Academic Stress Scale

Affective domain	
Item 1	I felt overwhelmed by schoolwork.
Item 2	There was so much going on that I couldn't think straight.
Item 3	I felt worried about coping with my studies.
Item 4	I felt angry that too much was being demanded of me.
Item 5	School left me emotionally drained.
Item 6	I felt stressed because of school.

Item 7	I had so much schoolwork that I wanted to cry.
Behavioral domain	
Item 8	I hung out on my phone to relieve stress.
Item 9	I wanted to sleep all the time.
Item 10	I skipped individual classes without a valid reason.
Item 11	I yelled at family members or friends.
Item 12	I withdrew from friends or family.
Item 13	I had major problems sleeping.
Cognitive domain	
Item 14	I found it difficult to concentrate during the lesson.
Item 15	I felt lazy when it came to schoolwork.
Item 16	My emotions got in the way of my studying.
Item 17	I found it difficult to recall material I had studied.
Item 18	I found excuses to put off completing an assignment.
Item 19	I had no energy to study.
Physiological domain	
Item 20	I couldn't breathe properly.
Item 21	I felt discomfort in my stomach.
Item 22	I had headaches.
Item 23	I had no appetite.
Item 24	I felt my heart pounding, even though I hadn't been exercising.

Appendix B. Descriptive Statistics for Items and Scales

Item / Scale	M (SD)			Skewness	Kurtosis
	Full sample	Males	Females		
1	3,31 (1,10)	3,02 (1,06)	3,41 (1,09)	−0,11	−0,71
2	2,67 (1,08)	2,4 (1,01)	2,76 (1,09)	0,49	−0,40
3	3,42 (1,24)	2,95 (1,23)	3,57 (1,21)	−0,23	−1,06
4	2,62 (1,34)	2,36 (1,28)	2,70 (1,34)	0,41	−1,01
5	3,47 (1,37)	3,05 (1,44)	3,60 (1,32)	−0,38	−1,11
6	3,07 (1,35)	2,57 (1,36)	3,23 (1,31)	0,01	−1,19
7	2,70 (1,40)	1,96 (1,25)	2,94 (1,36)	0,32	−1,18
8	3,36 (1,22)	3,13 (1,26)	3,44 (1,20)	−0,18	−0,91
9	3,66 (1,21)	3,26 (1,27)	3,79 (1,16)	−0,42	−0,93
10	2,45 (1,32)	2,41 (1,32)	2,46 (1,33)	0,67	−0,67
11	1,91 (1,01)	1,64 (0,89)	1,99 (1,03)	1,26	1,34
12	2,18 (1,16)	1,88 (1,06)	2,28 (1,18)	0,83	−0,14
13	2,75 (1,41)	2,53 (1,39)	2,82 (1,42)	0,29	−1,21
14	2,73 (1,15)	2,54 (1,14)	2,78 (1,14)	0,41	−0,59
15	3,11 (1,17)	2,93 (1,19)	3,16 (1,16)	0,15	−0,89

Item / Scale	M (SD)			Skewness	Kurtosis
	Full sample	Males	Females		
16	2,45 (1,27)	2,2 (1,27)	2,53 (1,26)	0,63	–0,64
17	2,69 (1,10)	2,42 (1,05)	2,78 (1,10)	0,55	–0,33
18	2,90 (1,23)	2,77 (1,17)	2,94 (1,25)	0,3	–0,92
19	3,15 (1,21)	2,73 (1,22)	3,29 (1,17)	0,06	–0,97
20	1,59 (0,96)	1,33 (0,76)	1,68 (1,00)	1,74	2,56
21	1,93 (1,10)	1,54 (0,88)	2,06 (1,13)	1,15	0,62
22	2,71 (1,18)	2,43 (1,11)	2,80 (1,18)	0,47	–0,65
23	2,01 (1,18)	1,74 (1,15)	2,10 (1,17)	1,01	0,05
24	2,02 (1,15)	1,68 (1,03)	2,13 (1,17)	1,05	0,30
Affective domain	21,26 (6,73)	18,31 (6,37)	22,21 (6,57)	0,05	–0,84
Behavioral domain	16,31 (4,72)	14,85 (4,72)	16,78 (4,62)	0,27	–0,22
Cognitive domain	17,03 (5,53)	15,59 (5,54)	17,5 (5,44)	0,34	–0,54
Physiological domain	10,27 (4,15)	8,71 (3,70)	10,76 (4,16)	0,94	0,35
Academic stress	64,88 (17,79)	57,46 (17,19)	67,25 (17,33)	0,22	–0,47

Appendix C. Russian Version of the Lakaev Academic Stress Response Scale for School Students

Instructions: Indicate how often each of the following happened to you over the past two weeks. Response categories: not at all, once or twice, about half of the time, most of the time, all of the time.

1. I felt overwhelmed by schoolwork.
2. There was so much going on that I couldn't think straight.
3. I felt worried about coping with my studies.
4. I felt angry that too much was being demanded of me.
5. School left me emotionally drained.
6. I felt stressed because of school.
7. I had so much schoolwork that I wanted to cry.
8. I hung out on my phone to relieve stress.
9. I wanted to sleep all the time.
10. I skipped individual classes without a valid reason.
11. I yelled at family members or friends.
12. I withdrew from friends or family.
13. I had major problems sleeping.
14. I found it difficult to concentrate during the lesson.
15. I felt lazy when it came to schoolwork.
16. My emotions got in the way of my studying.
17. I found it difficult to recall material I had studied.
18. I found excuses to put off completing an assignment.
19. I had no energy to study.
20. I couldn't breathe properly.
21. I felt discomfort in my stomach.
22. I had headaches.

23. I had no appetite.

24. I felt my heart pounding, even though I hadn't been exercising.

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