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# Adaptation and validation of the school climate measure among Polish-speaking adolescents

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***Keywords*:**
school climate,
scale development,
self-report,
psychometric tool,
adolescents

## Abstract

**Research objectives (aims) and problem(s):** The main objective of the present study was to assess the performance of a Polish adaptation of the School Climate Measure (SCM) among a sample of Polish adolescents (N = 451).

**Research methods:** Reliability analyses, confirmatory factor analysis, sex and cultural measurement invariance analyses, as well as convergent and discriminant validity analyses were performed using the adapted 10-domain version of the SCM.

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**Process of argumentation:** The School Climate Measure (SCM; Zullig et al., 2015) was developed to assess middle and high school students' subjective perceptions of their school climate.

**Research findings and their impact on the development of educational sciences:** The 10-factor model demonstrated acceptable fit: $\chi^2(774) = 1428.73$, $p < .001$, RMSEA = .052, 95% CI [.048, .056], CFI = .944, TLI = .938, SRMR = .053. We also achieved strict sex measurement invariance, allowing for valid comparisons between male and female students in Poland. However, comparisons with American samples should be made with caution, as only weak factorial cultural invariance was confirmed. Reliability indices for all scales were satisfactory: Cronbach's $\alpha \geq .81$, Tarkkonen's $\rho \geq .71$, McDonald's $\omega \geq .81$. The Polish version of the SCM demonstrated good convergent validity with students' average grades and good discriminant validity, as evidenced by a lack of correlation between subscale scores and the time taken to complete the survey. The SCM can help identify challenges in Polish schools and support efforts to promote a positive school climate that promotes students' holistic development and well-being.

**Conclusions and/or recommendations:** The Polish adaptation of the SCM is recommended for use with Polish adolescents for both research and practical applications.

## Introduction

### 1. School climate

According to Bronfenbrenner's ecological systems theory, an individual's development is influenced by proximal and distal environments. One of the most significant contexts for adolescents is the school environment (Bronfenbrenner & Morris, 1998), which affects young people on multiple levels: socially and personally. Each educational institution has its own distinctive atmosphere, shaped by its values, characteristics, and interpersonal relationships. This atmosphere is often described using concepts such as cohesion, "friction," competition among students, and the overall sense of satisfaction within the class (Loukas et al., 2006).

Zullig et al. (2014) define school climate as a subjective student experience. It is associated with feelings of safety and the overall experience of school life. School climate encompasses all the norms, goals, and values that prevail in a school (Cohen et al., 2009; Zullig et al., 2014).

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Cohen et al. (2009) emphasize that school climate goes beyond the individual student's experience. It pertains to the community involved in youth development, its functioning, and the shared understanding of life within a social group. The quality of students' lives at school is a subject of growing interest to researchers and practitioners alike, as it is correlated with significant issues such as the risk of aggression or depression among students (Clark et al., 2022). Additionally, it is linked to students' mental well-being, emotional problems, and behavior (Loukas et al., 2006).

## 2. School climate measures

Methods used to assess school climate typically rely on self-report measures. One such tool is the Delaware School Climate Survey (Bear et al., 2011), which includes five subscales that evaluate various aspects of students' school experiences, such as relationships with teachers, peer interactions, adherence to school rules, overall affinity for the school, and feelings of safety.

In another study conducted by McGuire and colleagues (2010), school climate was examined by asking students about their relationships with teachers and their sense of safety on the school premises. Similarly, the School Climate Inventory developed by Brand et al. (2003) addresses elements like safety, teacher support, peer relationships, and school regulations. However, this inventory expands upon earlier models by incorporating additional scales that measure factors such as school support for diversity, student involvement in school decision-making, and the school's level of innovation.

Among these tools, the School Climate Measure (SCM) developed by Zullig et al. (2014) was selected for its comprehensive portrayal of school climate and its robust, consistently replicated psychometric properties among both middle and high school students. In this context, school climate refers to students' subjective experiences, particularly their sense of safety and overall perception of school life.

The SCM comprises 10 domains:

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– Positive Student–Teacher Relationships assesses the extent to which teachers show interest in students' concerns, invest time, offer help, and demonstrate empathy.
– Order and Discipline gauges students' perception of the fair and consistent application of school rules.
– Opportunities for Positive Student Engagement measures perceptions of equal opportunities for success.
– Physical Environment evaluates the school's cleanliness and overall orderliness.
– Academic Support assesses the clarity of academic expectations, understanding of homework, and whether equal expectations are applied to all students.
– Parental Involvement examines the communication between parents and teachers, parental participation in school activities, and involvement in curriculum discussions.
– School Connectedness assesses students' enthusiasm for and interest in attending school.
– Perceived Exclusion/Privilege gauges students' awareness of fairness and adherence to school regulations.
– Social Environment assesses students' satisfaction with peer relationships.
– Academic Satisfaction with Learning measures students' contentment with tests and homework assignments (Zullig et al., 2014).

## 3. School Climate Model

Teachers who are able to create a positive classroom climate, characterized by the cultivation of positive relationships, tend to strengthen students' sense of competence and their desire to learn (Sointu, Savolainen, Lappalainen, & Lambert, 2017). Moreover, the more positively students perceive the school climate, the more their academic achievement improves (Reyes et al., 2012). The domains of the School Climate Measure (SCM) are correlated with factors such as school satisfaction (Zullig et al., 2011), academic achievement (Daily et al., 2019), and students' overall quality of life (Zullig et al., 2018).

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In the Polish literature, there is a lack of measurement tools specifically addressing the concept of school climate. Therefore, this study reports on the adaptation and preliminary psychometric evaluation of the 10-domain version of the SCM in a sample of Polish adolescents. Among the many tools for measuring school climate discussed in the literature, we chose the SCM due to its numerous advantages. A comprehensive, systematic, and evaluative review of 37 selected school climate measures found that the SCM is highly rated (Gonzálvez, Bacon, & Kearney, 2023). Zullig, Matthews-Ewald, and Huebner (2021) noted that the SCM is a psychometrically sound tool for measuring school climate and is available free of charge.

Other advantages of the SCM include its ease of use, accessibility, broad domain coverage, and multidimensional structure. A unidimensional total school climate score can be computed by combining all domain items. At the same time, separate scores can be calculated for each of the 10 domains, which function independently in the assessment of school climate. The SCM provides a holistic view of students' perceptions of the school environment. Raw scores, and especially the profile of domain scores, can be useful in designing programs that promote a positive school atmosphere.

The original version of the School Climate Measure (SCM) was developed by Zullig, Koopman, Patton, and Ubbes in 2010 through a systematic process. Initial steps involved reviewing existing self-report tools for assessing school climate. The resulting questionnaire included 39 items measuring eight domains: 1) Positive Student-Teacher Relationships, 2) School Connectedness, 3) Academic Support, 4) Order and Discipline, 5) School Physical Environment, 6) School Social Environment, 7) Perceived Exclusion/Privilege, and 8) Academic Satisfaction. Items were rated using a Likert-type scale ranging from 1 = "strongly disagree" to 5 = "strongly agree" (Zullig, Matthews-Ewald, & Huebner, 2021).

Subsequently, five studies were conducted to evaluate the psychometric properties of the SCM. The first study included 2,049 middle and high school students from public schools and employed both exploratory and confirmatory factor analyses on a randomly divided sample. These analyses confirmed the eight-factor structure of the measure (Zullig et al., 2010).

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The second study (Zullig et al., 2014) replicated the scale's structure and examined its correlations with safety-related variables in the context of the Youth Risk Behavior Surveillance System and with students' average grade point average (GPA). Notably, strong relationships were found between academic support and a range of safety-related factors, as well as between positive perceptions of school climate and a sense of safety.

In the third study (Zullig et al., 2015), the original eight domains were expanded to ten with the addition of Student Engagement and Parental Involvement. The rationale for adding the Student Engagement domain was based on Audas and Willms' (2001) definition of engagement as the extent to which students believe they can freely and equally participate in academic and non-academic activities without feeling excluded due to their differences. Factor analysis confirmed the presence of ten distinct factors, and several original SCM items were removed in favor of items representing the newly developed domains, increasing the total number of items from 39 to 42.

The fourth study (Daily et al., 2018) evaluated the psychometric properties of the SCM among junior high school students. Confirmatory factor analysis validated all ten factors, and reliability analyses indicated that students with higher academic achievement and school satisfaction perceived the school climate more positively. The fifth study focused on establishing the convergent and discriminant validity of the SCM. As expected, the SCM showed significant correlations with measures of school satisfaction, overall life satisfaction, and health-related quality of life. Notably, the strongest correlations were observed with measures of adolescent school satisfaction (Zullig, Ward, Huebner, & Daily, 2018).

## Method

### Polish translation of the SCM

The original SCM (Zullig et al., 2015) was translated into Polish in accordance with guidelines for the cultural adaptation of psychological tests (Hornowska & Paluchowski, 2004). First, two research assistants proficient

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in both English and Polish independently translated the scale into Polish. The Research Team found the translations to be highly similar. Minor discrepancies were discussed and resolved to produce a final version, which was then verified through back-translation.

The Polish version of the SCM retained the structure of the original, consisting of ten factors or subscales: Positive Student–Teacher Relationships, School Connectedness, Academic Support, Order and Discipline, School Physical Environment, School Social Environment, Perceived Exclusion/Privilege, Academic Satisfaction, Parental Involvement, and Opportunities for Student Engagement (see Table 1).

**Table 1. The School Climate Measure**

| Factors of the School Climate Measure | No. of items | Example item |
|---|---|---|
| 1. Positive Student-Teacher Relationships (PSTR) | 8 | *Teachers understand my problems.* |
| 2. School Connectedness (SC) | 4 | *My schoolwork is exciting* |
| 3. Academic Support (ASu) | 4 | *I believe that teachers expect all students to learn.* |
| 4. Order and Discipline (OD) | 6 | *School rules are enforced consistently and fairly.* |
| 5. School Physical Environment (SPE) | 4 | *My school is neat and clean.* |
| 6. School Social Environment (SSE) | 2 | *I am happy with the kinds of students who go to my school.* |
| 7. Perceived Exclusion/Privilege (PEP) | 3 | *At my school, the same students get chosen every time to take part in after-school or special activities.* |
| 8. Academic Satisfaction (ASa) | 2 | *I am happy about the amount of homework I have.* |
| 9. Parental Involvement (PI) | 3 | *My parents are involved in school activities.* |
| 10. Opportunities for Student Engagement (OSE) | 6 | *Students "different" in any way are treated with respect.* |

### Participants

The sample consisted of 451 respondents (with no missing data). The participants were students from Polish schools (52% female), aged between 14 and 16 years. Of the respondents, 54% lived in cities, 23% in towns, and 24% in rural areas. A total of 97% of students assessed their health as at least good. Sixty percent reported being satisfied with life,

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while 30% reported being somewhat satisfied. On average, students reported spending 2.42 hours per day (SD = 0.65) on learning. Regarding parental education, higher education was reported for 42% of mothers and 36% of fathers, and a university degree for 46% of mothers and 35% of fathers. Most parents were actively employed (84% of mothers, 93% of fathers).

### Procedure

The responses were collected using an online survey. Participation in the study was voluntary and unpaid. The research was funded by university grant number 1/6-20-19-05-2-0200.

### Data Analysis

A variety of psychometric analyses were performed to confirm the structure of the measure. These included item-item correlation analysis using Pearson's *r*; reliability analysis using Cronbach's alpha, Tarkkonen's rho, and McDonald's omega; Confirmatory Factor Analysis (CFA); measurement invariance (MI) analyses; and validity analyses.

All statistical analyses were conducted using R (R Core Team, 2022) and RStudio (RStudio Team, 2022). The following R packages were used (listed alphabetically): corrplot (Wei & Simko, 2021), dplyr (Wickham et al., 2022b), haven (Wickham et al., 2022a), Hmisc (Harrell & Dupont, 2022), lavaan (Rosseel, 2012), mvnTest (Pya et al., 2016), PerformanceAnalytics (Peterson et al., 2020), psych (Revelle, 2022), RColorBrewer (Neuwirth, 2022), and semTools (Jorgensen et al., 2022). The dataset and all corresponding scripts, including the analyses presented in the results section, are publicly available in the following repository: https://osf.io/anvwk/?view_only=4a54213e86d04c55b62ca871ae02eb00
Initially, we calculated the correlation coefficients among the subscales included in the SCM, as presented in Table 2.

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**Table 2. Correlation matrix between SCM subscales**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| **1. PSTR** | - | | | | | | | | |
| **2. SC** | .84** | - | | | | | | | |
| 3. **ASu** | .65** | .62** | - | | | | | | |
| **4. OD** | .79** | .78** | .73** | - | | | | | |
| **5. SPE** | .44** | .43** | .60** | .56** | - | | | | |
| **6. SSE** | .51** | .51** | .56** | .61** | .58** | - | | | |
| **7. PEP** | -.18** | -.17** | -.08 | -.09 | .03 | -.13** | - | | |
| **8. ASa** | .61** | .64** | .48** | .55** | .28** | .43** | -.29** | - | |
| **9. PI** | .55** | .55** | .35** | .49** | .30** | .35** | -.33** | .54** | - |
| **10. OSE** | .75** | .74** | .71** | .82** | .64** | .65** | -.04 | .56** | .49** |

*Note. PSTR = Positive Student–Teacher Relationships; SC = School Connectedness; ASu = Academic Support; OD = Order and Discipline; SPE = School Physical Environment; SSE = School Social Environment; PEP = Perceived Exclusion/Privilege; ASa = Academic Satisfaction; PI = Parental Involvement; OSE = Opportunities for Student Engagement*
**** $p < .001$ ** $p < .01$ * $p < .05$*

During the second stage, we conducted psychometric assessments of the reliability of each scale within the SCM. The reliability indices used for this evaluation were Cronbach's alpha (Cronbach, 1951), Tarkkonens rho (Vehkalathi et al., 2006), and the Omega total coefficient (McDonald, 1999). In addition, we examined the overall reliability of the entire measure, as illustrated in Table 3.

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**Table 3. Reliability indices for the SCM subscales**

| Subscale | α 95% CI [LB, UB] | Tarkkonen's rho (*ρ*) | McDonald's omega (ω) |
|---|---|---|---|
| **Positive Student-Teacher Relationships (PSTR)** | .95 [.94, .96] | .91 | .95 |
| **School Connectedness (SC)** | .92 [.90, .93] | .86 | .92 |
| **Academic Support (ASu)** | .85 [.83, .87] | .73 | .85 |
| **Order and Discipline (OD)** | .93 [.92, .94] | .89 | .94 |
| **School Physical Environment (SPE)** | .94 [.93, .95] | .91 | .95 |
| **School Social Environment (SSE)** | .85 [.82, .88] | .73 | .85 |
| **Perceived Exclusion/Privilege (PEP)** | .81 [.78, .84] | .71 | .81 |
| **Opportunities for Student Engagement (OSE)** | .93 [.91, .94] | .87 | .93 |
| **Academic Satisfaction (ASa)** | .90 [.88, .91] | .80 | .90 |
| **Parental Involvement (PI)** | .82 [.78, .84] | .75 | .83 |

*Note. α = Cronbach's alpha coefficient; CI = confidence interval; LB = lower bound; UB = upper bound. The 95% confidence interval bounds were estimated based on the Duhachek criterion.*

The reliability analysis was guided by predefined goodness-of-fit criteria: Cronbach's alpha was set at > .80 (Nunnally & Bernstein, 1994), Tarkkonen's rho at > .71 (Laakasuo et al., 2022), and McDonald's omega at > .70 (Hair et al., 2014). The reliability values for all scales met the specified thresholds, with Cronbach's alpha ranging from .81 to .95, Tarkkonen's rho from .71 to .91, and McDonald's omega from .81 to .95, indicating satisfactory reliability across the board.

In the next phase, we rigorously assessed the congruence of our model with the observed data using classical Confirmatory Factor Analysis (CFA). The selection of an appropriate estimator was contingent upon the evaluation of the multivariate normality assumption. To test this assumption, we applied the Henze–Zirkler Test for Multivariate Normality (Henze & Zirkler, 1990) and the Mardia Test for Skewness and Kurtosis (Mardia, 1970). Since both tests indicated violations of the normality assumption ($p < .001$), we employed the Maximum Likelihood with Robust Standard Errors (MLR) estimator, which is recommended for non-normally distributed data (Muthén & Muthén, 2012).

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The model fit was assessed using several established fit indices: the chi-square test and its ratio to degrees of freedom ($\chi^2$/df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR). Acceptable model fit was defined as: $\chi^2$/df < 3 (Kline, 2023); CFI and TLI ≥ .90 (Browne & Cudeck, 1992; Hu & Bentler, 1999); RMSEA and SRMR < .08 (Hu & Bentler, 1999; Kline, 2023). Indicators of good model fit were: $\chi^2$/df < 2 (Kline, 2023), CFI ≥ .95 (Hu & Bentler, 1999; Rutkowski & Svetina, 2014), and RMSEA and SRMR < .05.

All model fit indices were reported using robust estimations. Convergence was achieved after 122 iterations. The fit indices showed acceptable model fit: $\chi^2(774) = 1428.73$, $p < .001$; $\chi^2$/df = 1.85; RMSEA = .052, 95% CI [.048, .056]; CFI = .944; TLI = .938; SRMR = .053. Additionally, the standard errors for SCM item factor loadings were within acceptable limits (see Table 4).

**Table 4. Standardized factor loadings for the 10-factor model of the SCM**

| SCM Items | SCM Factors | |
|---|---|---|
| | Loading | SE |
| Positive Student-Teacher Relationships (PSTR) | | |
| PSTR 1 | .81 | .05 |
| PSTR 2 | .77 | .05 |
| PSTR 3 | .82 | .06 |
| PSTR 4 | .85 | .05 |
| PSTR 5 | .85 | .05 |
| PSTR 6 | .87 | .05 |
| PSTR 7 | .90 | .04 |
| PSTR 8 | .88 | .04 |
| School Connectedness (SC) | | |
| SC 1 | .83 | .04 |
| SC 2 | .85 | .05 |
| SC 3 | .91 | .04 |
| SC 4 | .84 | .05 |

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| SCM Items | SCM Factors | |
|---|---|---|
| | Loading | SE |
| Academic Support (ASu) | | |
| ASu 1 | .73 | .06 |
| ASu 2 | .79 | .08 |
| ASu 3 | .77 | .08 |
| ASu 4 | .79 | .07 |
| Order and Discipline (OD) | | |
| OD 1 | .79 | .05 |
| OD 2 | .83 | .04 |
| OD 3 | .89 | .05 |
| OD 4 | .88 | .04 |
| OD 5 | .74 | .05 |
| OD 6 | .90 | .04 |
| School Physical Environment (SPE) | | |
| SPE 1 | .84 | .04 |
| SPE 2 | .92 | .06 |
| SPE 3 | .90 | .06 |
| SPE 4 | .95 | .06 |
| School Social Environment (SSE) | | |
| SSE 1 | .89 | .07 |
| SSE 2 | .84 | .07 |
| Perceived Exclusion/Privilege (PEP) | | |
| PEP 1 | .70 | .09 |
| PEP 2 | .86 | .13 |
| PEP 3 | .75 | .13 |
| Opportunities for Student Engagement (OSE) | | |
| OSE 1 | .80 | .05 |
| OSE 2 | .84 | .05 |
| OSE 3 | .88 | .06 |
| OSE 4 | .88 | .06 |
| OSE 5 | .78 | .07 |
| OSE 6 | .75 | .07 |

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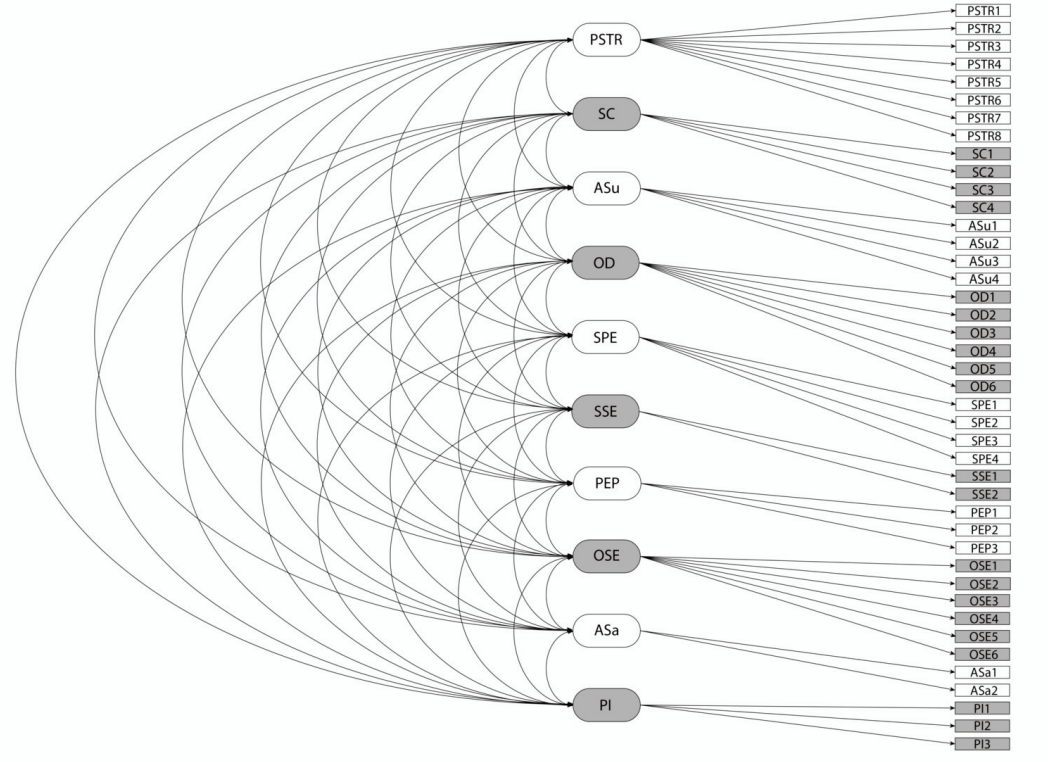
| SCM Items | SCM Factors | |
|---|---|---|
| | Loading | SE |
| Academic Satisfaction (ASa) | | |
| ASa 1 | .92 | .04 |
| ASa 2 | .88 | .04 |
| Parental Involvement (PI) | | |
| PI 1 | .66 | .08 |
| PI 2 | .83 | .13 |
| PI 3 | .86 | .13 |




*Note. PSTR = Positive Student–Teacher Relationships; SC = School Connectedness; ASu = Academic Support; OD = Order and Discipline; SPE = School Physical Environment; SSE = School Social Environment; PEP = Perceived Exclusion/Privilege; ASa = Academic Satisfaction; PI = Parental Involvement; OSE = Opportunities for Student Engagement*

For the sex measurement invariance analysis, we selected male and female participants from the Polish sample. For the cultural measurement invariance analysis, we used both our dataset (Polish sample) and

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a dataset provided by Prof. Zullig (American sample), one of the authors of the method, corresponding to the research findings presented in Zullig et al. (2015).

We assessed the fit of each step in the measurement invariance procedure (configural, metric, scalar, and strict) using the chi-square test and several fit indices: CFI, TLI, RMSEA, and SRMR. However, since the chi-square statistic is known to be sensitive to minor deviations from the model, which may not be practically meaningful (Chen, 2007; Cheung & Rensvold, 2002; Putnick & Bornstein, 2016; Rutkowski & Svetina, 2014), fit indices are considered more appropriate for evaluating model fit in measurement invariance analyses (Rutkowski & Svetina, 2014).

At each step of the measurement invariance analysis, we defined acceptable model fit according to the following thresholds: CFI and TLI ≥ .90 (Browne & Cudeck, 1992; Hu & Bentler, 1999), and RMSEA and SRMR < .08 (Brown, 2015; Hu & Bentler, 1999; Kline, 2023).

To test for metric, scalar, and strict invariance, we used ΔCFI, ΔRMSEA, and ΔSRMR cutoff values. Due to the small size of the male and female groups (N < 300) and the unequal sizes of the Polish and U.S. samples, we followed the recommendations of Chen (2007) for small or unequal group sizes:

- For metric invariance: ΔCFI ≤ .005, ΔRMSEA ≤ .01, and ΔSRMR ≤ .025
- For scalar and strict invariance: ΔCFI ≤ .005, ΔRMSEA ≤ .01, and ΔSRMR ≤ .005

Our approach assumed that meeting at least two out of the three criteria (ΔCFI, ΔRMSEA, ΔSRMR) was essential for establishing measurement invariance at each stage of the analysis. In the analysis of sex measurement invariance, we first conducted a Confirmatory Factor Analysis (CFA) for the 10-factor model separately for men and women to validate model fit within each subgroup of the Polish sample. We then performed a standard measurement invariance analysis on the full Polish sample, beginning with the configural invariance stage.

The 10-factor model demonstrated acceptable fit for both the male and female groups, meeting the criteria of CFI and TLI ≥ .90 and

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RMSEA and SRMR ≤ .08 (refer to Table 5). In the subsequent analysis of sex measurement invariance, the configural, metric, scalar, and strict models also satisfied the criteria for acceptable fit (CFI and TLI ≥ .90; RMSEA and SRMR ≤ .08). For the metric assessment, all cutoff criteria were successfully met: ΔCFI ≤ .005, ΔRMSEA ≤ .01, and ΔSRMR ≤ .025. At the scalar and strict levels of sex measurement invariance, all cutoff criteria were again met: ΔCFI ≤ .005, ΔRMSEA ≤ .01, and ΔSRMR ≤ .005. Based on these evaluations, we confirmed strict sex measurement invariance. This suggests that the residual variances of observed scores not attributed to the latent factors are consistent across male and female groups.

Cultural measurement invariance analyses were conducted using the U.S. and Polish samples (see Table 6). The U.S. sample data were sourced from Zullig et al. (2015), where detailed findings are reported. The 10-factor model showed acceptable fit in both the U.S. and Polish groups, meeting the criteria of CFI and TLI ≥ .90 and RMSEA and SRMR ≤ .08. In the analysis of cultural measurement invariance between the U.S. and Polish groups, only the configural, metric, and scalar models reached acceptable fit according to the specified criteria (CFI and TLI ≥ .90; RMSEA and SRMR ≤ .08). For the metric assessment, all three cutoff criteria were met: ΔCFI ≤ .005, ΔRMSEA ≤ .01, and ΔSRMR ≤ .025. At the scalar level, only one of the three criteria was satisfied: ΔRMSEA ≤ .01. We refrained from interpreting the strict level of invariance due to the model not meeting acceptable fit criteria (i.e., CFI and TLI < .90) and because the scalar level itself did not meet the required thresholds.

However, considering the overall model fit and the cutoff criteria, we confirmed metric cultural measurement invariance between the U.S. and Polish groups. This indicates that the 10-factor model demonstrates weak equivalence in terms of factor loadings between the cultural groups being compared.

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## Table 5. Psychometric indicators for sex measurement invariance analysis

| Model | $\chi^2$ | *df* | $\chi^2/df$ | *p* | RMSEA | CFI | TLI | SRMR | Model comparison | $\Delta\chi^2$ | $\Delta df$ | *Pr* $(>\chi^2)$ | ΔRMSEA | ΔCFI | ΔSRMR | Decision |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Male** | 1222.6 | 8 | 774 | 1.58 | <.001 | .061 | .922 | .913 | .059 | | | | | | | - |
| **Female** | 1348.0 | 6 | 774 | 1.74 | <.001 | .064 | .923 | .914 | .059 | | | | | | | - |
| **(1) Config.** | 2572.44 | 1548 | 1.66 | <.001 | .062 | .922 | .913 | .059 | | | | | | | | - |
| **(2) Metric** | 2592.98 | 1580 | 1.64 | <.001 | .061 | .923 | .916 | .061 | (1) - (2) | 18.87 | 32 | .968 | -.001 | .001 | .002 | Accept |
| **(3) Scalar** | 2641.97 | 1612 | 1.64 | <.001 | .061 | .922 | .917 | .061 | (2) - (3) | 47.84 | 32 | .036 | 0 | -.001 | 0 | Accept |
| **(4) Strict** | 2661.64 | 1654 | 1.61 | <.001 | .060 | .923 | .920 | .061 | (3) - (4) | 37.86 | 42 | .653 | -.001 | .001 | 0 | Accept |

*Estimator: MLR. Note. Config. = configural; $\Delta\chi^2$, $\Delta df$, $Pr(>\chi^2)$, ΔRMSEA, ΔCFI, and ΔSRMR denote the change in the chi-square value, degrees of freedom, the significance of these changes, and changes in RMSEA, CFI, and SRMR, respectively.*

## Table 6. Psychometric indicators for culture measurement invariance analysis

| Model | $\chi^2$ | *df* | $\chi^2/df$ | *p* | RMSEA | CFI | TLI | SRMR | Model comparison | $\Delta\chi^2$ | $\Delta df$ | *Pr* $(>\chi^2)$ | ΔRMSEA | ΔCFI | ΔSRMR | Decision |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Poland** | 1428.7 | 3 | 774 | 1.85 | <.00 | 1 | .052 | .944 | .938 | .053 | | | | | | - |
| **USA** | 1656.2 | 1 | 774 | 2.14 | <.00 | 1 | .033 | .954 | .948 | .036 | | | | | | - |
| **(1) Config.** | 3068.23 | 1548 | 1.98 | <.001 | .039 | .950 | .944 | .040 | | | | | | | | - |
| **(2) Metric** | 3235.38 | 1580 | 2.05 | <.001 | .040 | .945 | .940 | .044 | (1) -(2) | 177.35 | 32 | <.001 | .001 | -.004 | .004 | Accept |
| **(3) Scalar** | 4198.24 | 1612 | 2.60 | <.001 | .050 | .915 | .909 | .053 | (2) -(3) | 1059.3 | 32 | <.001 | .009 | -.031 | .010 | Reject |
| **(4) Strict** | 6443.73 | 1654 | 3.90 | <.001 | .067 | .840 | .833 | .057 | (3) -(4) | 1483 | 42 | <.001 | .017 | -.075 | .003 | Reject |

*Estimator: MLR. Note. Config. = configural; $\Delta\chi^2$, $\Delta df$, $Pr(>\chi^2)$, ΔRMSEA, ΔCFI, and ΔSRMR denote the change in the chi-square value, degrees of freedom, the significance of these changes, and the changes in RMSEA, CFI, and SRMR, respectively.*

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In the final step of the analysis, we attempted to validate the SCM by examining convergent validity using students' average grades from the last semester prior to study participation and discriminant validity using the time taken to complete the online survey (refer to Table 7).

**Table 7. Correlation matrix for the convergent (average grades) and discriminant (survey finish time) validity of the SCM**

| Variable | SCM subscales | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PSTR | SC | ASu | OD | SPE | SSE | PEP | ASa | PI | OSE |
| Average grades | .26** | .29** | .26** | .23** | .18** | .18** | .18** | .24** | .24** | .16** |
| Survey finish time | -.001 | -.03 | -.01 | -.03 | .02 | -.03 | -.01 | -.02 | -.01 | -.02 |

*Note. PSTR = Positive Student–Teacher Relationships; SC = School Connectedness; ASu = Academic Support; OD = Order and Discipline; SPE = School Physical Environment; SSE = School Social Environment; PEP = Perceived Exclusion/Privilege; ASa = Academic Satisfaction; PI = Parental Involvement; OSE = Opportunities for Student Engagement*
**** p < .001 ** p < .01 * p < .05 (two-tailed)*

For all SCM scales, significant positive correlations were observed with students' average grades. The strength of these associations predominantly ranged from low to moderate ($r$ = .16–.30). Scores on all SCM scales showed no correlation with survey finish time.

In essence, these findings support the conclusion that the Polish adaptation of the SCM demonstrates reasonably strong convergent construct validity, evidenced by the positive correlations between SCM scale scores and students' average grades from the last semester before study participation. Additionally, the SCM exhibits discriminant validity, as indicated by the consistently non-significant correlation coefficients between SCM subscale scores and the time needed to complete the online survey.

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## General Discussion

The present article scrutinizes the adaptation and validation of the School Climate Measure (Zullig et al., 2015) in a sample of Polish students, with a broader discussion of the context, methodology, findings, implications, and limitations of the study.

The Polish educational landscape is undergoing transformation and facing complex challenges (Buchcic & Grodzińska-Jurczak, 2004; Jakubowski, 2021; Ocetkiewicz et al., 2017). The school environment occupies a central place in students' lives, significantly influencing their academic experiences and overall development. Particularly during adolescence, school becomes the primary setting for knowledge acquisition and personal growth. Understanding the nuanced factors that contribute to a positive school climate and stimulate students' enthusiasm for learning is a critical endeavor that has thus far received limited attention in Polish educational research.

Polish education is marked by a unique set of challenges and opportunities. The educational system has evolved significantly over the years, adapting to social, economic, and cultural changes (Buchcic & Grodzińska-Jurczak, 2004; Jakubowski, 2021; Ocetkiewicz et al., 2017). These adaptations have often necessitated closer examination of the school climate, given its profound influence on students' academic performance, mental well-being, and future prospects (Gwiazdowska-Stańczak, 2021a, 2021b).

To address the lack of tools in the Polish educational context for comprehensively assessing school climate, we undertook the adaptation of the School Climate Measure (SCM). Drawing inspiration from the American original, our research proceeded through several rigorous stages. First, we conducted reliability analyses for each of the ten scales that comprise the measure. This involved calculating Cronbach's alpha coefficients to assess internal consistency. These analyses provided a solid foundation for evaluating the reliability of the adapted instrument.

Next, we performed a Confirmatory Factor Analysis (CFA) using the Maximum Likelihood with Robust Standard Errors estimator (MLR), as

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the data did not meet the assumptions of multivariate normality (Muthén & Muthén, 2012). The goodness-of-fit criteria supported the suitability of the original 10-factor model for capturing the multifaceted nature of school climate among Polish students.

We also recognized the importance of examining measurement invariance across both sex (female and male students in Poland) and cultural context (Poland vs. the United States). The original 10-factor SCM model demonstrated strict measurement invariance between Polish female and male students. However, cultural measurement invariance between Polish and American students was found to be weak. These differences in psychometric equivalence may result from contextual differences between the educational systems in the two countries, with the Polish system being comparatively less stable.

The results of the invariance analyses suggest that mean comparisons between Polish male and female students on the SCM's latent factors are valid. However, comparisons between Polish and American students should be made with caution. Unequal sample sizes and differing educational contexts may limit the interpretability of cross-cultural comparisons. While metric invariance was supported, the absence of scalar and strict invariance restricts the extent to which cross-cultural comparisons can be meaningfully interpreted. Therefore, any conclusions about cultural differences should be drawn carefully and with full awareness of these limitations.

The final stage of assessing the quality of the Polish SCM adaptation involved evaluating its construct validity through both convergent and discriminant validity analyses. As expected, the SCM scales correlated positively with students' average grades from the last semester before participation and showed no correlation with the time required to complete the online survey. These findings confirm the robust convergent and discriminant validity of the Polish adaptation, respectively, evidencing its high methodological integrity.

While our research yielded promising results, it is important to acknowledge certain limitations. First, although our sample size was substantial, a larger sample would have strengthened the generalizability

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of our findings. Additionally, the process of translating survey items from the original language into Polish introduces the possibility that subtle linguistic nuances may have influenced how respondents interpreted the items.

The adapted SCM, designed specifically for the Polish educational context, emerges as a valuable tool for understanding the complex dynamics of the school environment. Its usefulness extends beyond academic research into practical applications. For educators and school psychologists, this adapted instrument provides a means to gain deeper insight into students' school-related experiences. It can serve as a diagnostic tool for identifying specific areas of concern within the school climate, thereby enabling targeted interventions to enhance students' overall well-being.

In terms of future research directions, there is a wealth of unexplored terrain. Subsequent studies could delve into the intricate relationship between school climate and academic achievement. Additionally, investigations into the effects of school climate on students' psychological well-being, socio-emotional development, and long-term life outcomes are warranted.

In conclusion, the adaptation and validation of the School Climate Measure for the Polish context represent a significant contribution to the field of educational psychology. This adapted instrument is not only recommended for scientific research in Poland, but also holds substantial promise for practical applications in education. By identifying and addressing school-related challenges, it helps create a more supportive and effective learning environment – ultimately promoting students' holistic development and well-being, which in turn has the potential to shape the future of our society.

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