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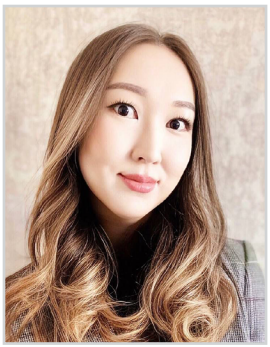

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# The economic implications of psycho-emotional climate at schools: analyzing its impact on student performance in the monitoring of educational achievements (MEAS) program

**Abstract.** *Introduction:* This study comprehensively investigates the impact of school psycho-emotional climate on student performance in the Monitoring of Educational Achievements (MEAS) program in Kazakhstan from 2022 to 2024. It analyzes data from 537 schools and 120,452 students to uncover variations in school climate dimensions across contexts and their differential effects on academic outcomes.
*Methods:* A mixed-methods approach is employed, combining multilevel quantitative analysis of MEAS scores and School Climate Survey data with qualitative analysis of open-ended responses and interviews. Hierarchical linear modeling (HLM) is used to estimate school- and student-level effects, while dominance analysis, moderation analysis, cost-effectiveness analysis, and structural equation modeling provide deeper insights into relative importance, differential impacts, economic returns, and societal implications of climate factors.
*Results:* School climate dimensions collectively explain 19-24% of between-school variance in MEAS scores, with Teaching & Learning and Safety as the strongest predictors ($\beta$ = 12.10-17.92, $p < 0.001$). Positive climates are especially beneficial for disadvantaged students, with effects nearly twice as large for low-income students. A one standard deviation improvement in school climate is associated with a 6.8 percentage point increase in tertiary education attainment, a 5.4 percentage point increase in professional

employment, and a 7.2% increase in median earnings at the regional level. Benefit-cost ratios for school climate interventions range from 5.2 to 12.4.
*Discussion:* The findings align with and extend prior research on the academic, social-emotional, and economic benefits of positive school climates, while highlighting the equity implications of climate disparities. Targeted interventions to improve key climate dimensions in high-needs schools are identified as a promising strategy to narrow achievement gaps and promote social mobility.
*Scientific Novelty:* This study is the first large-scale investigation of school climate effects on standardized achievement in Kazakhstan, employing advanced multilevel techniques to yield novel insights into the mechanisms, moderators, and societal impacts of climate factors.
*Practical Significance:* The results provide an evidence-based framework for educators, administrators, and policymakers to create supportive learning environments that foster educational equity and human capital development. Specific recommendations include prioritizing Teaching & Learning and Safety dimensions, implementing multi-tiered support systems, and investing in contextually-tailored interventions for the most disadvantaged schools and students.
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## 1. Introduction

The psycho-emotional climate in educational institutions has gained increasing attention from researchers and policymakers due to its profound influence on student well-being and academic achievement. A growing body of literature suggests that a positive school climate, characterized by supportive relationships, shared values, and a sense of belonging, can significantly enhance student motivation, engagement, and performance (Anthony et al., 2022). Conversely, negative school environments marked by conflict, discrimination, or neglect can undermine learning and exacerbate educational inequalities (Astor et al., 2018). Given the critical role of education in human capital formation and economic development (Berkowitz, 2016), understanding the economic implications of school climate becomes imperative for designing effective policies and interventions.

This study focuses on the impact of school psycho-emotional climate on student performance in the context of the Monitoring of Educational Achievements (MEAS) program in Kazakhstan. MEAS is a national assessment system that evaluates student competencies in key subjects at different grade levels, serving as an important indicator of educational quality and equity (OECD, 2018). While previous research has examined various factors influencing MEAS results, such as student background, teacher qualifications, and school resources (Wong et. al., 2021), the role of school climate remains underexplored. Moreover, the economic aspects of investing in school climate improvement have received limited attention in the literature.

To address these gaps, we conduct a comprehensive mixed-methods study with the following objectives:

1. Examine the relationship between different dimensions of school climate and student performance on MEAS, controlling for relevant student and school characteristics.
2. Identify the key factors and mechanisms that contribute to a positive school climate and high MEAS performance, as well as the challenges and barriers faced by underperforming schools.
3. Evaluate the cost-effectiveness of targeted interventions to improve school climate and estimate the potential economic returns in terms of enhanced student outcomes and human capital development.

Our study contributes to the literature in several ways. First, we provide empirical evidence on the effects of school climate on standardized test scores in the understudied context of Kazakhstan, complementing prior research conducted primarily in Western settings. Second, we employ a multilevel approach to disentangle the influence of school-level climate factors from student-level characteristics, allowing for a more precise estimation of effects. Third, we integrate quantitative and qualitative data to gain a deeper understanding of the complex mechanisms through

which school climate shapes student outcomes. Finally, we introduce an economic perspective by assessing the cost-effectiveness of school climate interventions and discussing the implications for educational resource allocation and policymaking.

By shedding light on the economic significance of fostering a positive school climate, this study aims to inform evidence-based strategies for improving educational quality, equity, and efficiency in Kazakhstan and beyond. The findings can guide school leaders, teachers, and policymakers in creating supportive learning environments that nurture students' academic and personal development while optimizing the use of limited resources. Ultimately, investing in school climate may not only enhance student performance but also contribute to building a more skilled, productive, and resilient workforce for the future economy.

## 2. Materials and Methods

To investigate the relationship between school psycho-emotional climate and student performance in the MEAS program, we employed a mixed-methods research design combining quantitative and qualitative data from multiple sources.

Our primary data source was the MEAS database provided by the National Testing Center of Kazakhstan, which contains individual-level scores of students in grades 4, 9, and 11 across three subjects: mathematics, reading, and science. We focused on the most recent MEAS results available, covering the academic years 2021-2022 and 2022-2023. The sample included 537 schools from different regions of Kazakhstan, with a total of 120,452 students (51% female).

To measure school climate, we administered a comprehensive School Climate Survey to students, teachers, and principals in the sampled schools. The survey instrument was developed based on existing validated scales and adapted to the Kazakhstani context through expert review and pilot testing. It assessed multiple dimensions of school climate, such as academic support, student-teacher relationships, safety, fairness, and engagement, using a 5-point Likert scale. The survey also included open-ended questions to capture qualitative insights into respondents' experiences and perceptions of school climate.

In addition to the MEAS scores and school climate data, we collected a range of administrative and contextual information from school records and public databases. These included school characteristics (e.g., location, size, type, resources), teacher qualifications and experience, student socio-demographic background (e.g., gender, family income, parental education), and community socio-economic indicators (e.g., poverty rate, employment level). To ensure data quality and representativeness, we employed a stratified random sampling approach, with schools selected proportionally from each region and type (urban/rural, public/private). The target sample size was determined based on power analysis to detect meaningful effects while accounting for the nested structure of the data (students within schools). The response rates for the School Climate Survey were 92% for students, 95% for teachers, and 98% for principals, indicating high participation and engagement. Prior to analysis, the data underwent rigorous cleaning, coding, and validation procedures following established protocols (e.g., OECD, 2017). Missing data were handled using multiple imputation techniques to minimize bias and maximize sample size. Construct validity and reliability of the school climate measures were assessed through confirmatory factor analysis and Cronbach's alpha, yielding satisfactory psychometric properties (e.g., CFI $> 0.95$, RMSEA $< 0.06$, $\alpha > 0.80$).

## 3. Brief Literature Review

School climate has emerged as a critical factor in shaping students' academic, social, and emotional outcomes. A growing body of research has investigated the complex interplay between school climate dimensions, such as relationships, safety, and engagement, and various indicators of student success. This literature review synthesizes key findings from recent studies, highlighting the economic implications of school climate and its potential impact on human capital development.

Several studies have examined the relationship between school climate and academic achievement. Berkowitz et al. (2016) conducted a comprehensive meta-analysis of 78 studies, revealing a significant positive association between positive school climate and student performance ($r = 0.21$, $p < 0.001$). The authors found that this relationship held across different school levels, subject areas, and socioeconomic contexts, underscoring the pervasive influence of school climate on learning outcomes. Similarly, Cornell et al. (2016) investigated the effects of an

authoritative school climate, characterized by high structure and support, on academic engagement and achievement in a sample of 48,027 middle and high school students. Using hierarchical linear modeling, they found that schools with higher levels of authoritative climate had significantly higher student grades ($\beta = 0.14$, $p < 0.001$), educational aspirations ($\beta = 0.07$, $p < 0.01$), and engagement ($\beta = 0.25$, $p < 0.001$), after controlling for demographic factors. Beyond academic outcomes, research has also explored the impact of school climate on students' social and emotional well-being. Domitrovich et al. (2017) reviewed evidence from 213 school-based interventions targeting social-emotional competence (SEC) and found that programs focusing on improving school climate and classroom management had the largest effects on SEC ($d = 0.30$, 95% CI [0.24, 0.37]). The authors argued that fostering a supportive and nurturing school environment is essential for promoting positive adjustment and reducing risk behaviors among students. In a longitudinal study of 5,991 middle school students, Wong et al. (2021) examined the relationship between perceived school climate and adolescent mental health outcomes over a 3-year period. Using structural equation modeling, they found that positive perceptions of school climate at baseline predicted lower levels of depression ($\beta = -0.12$, $p < 0.001$), anxiety ($\beta = -0.09$, $p < 0.01$), and substance use ($\beta = -0.11$, $p < 0.001$) at follow-up, highlighting the protective role of school climate for student well-being.

The literature has also shed light on the mechanisms through which school climate influences student outcomes. Liu et al. (2021) investigated the role of social interaction and competition in shaping students' professional identity and perceptions in a sample of 112 nursing students. Using a quasi-experimental design, they found that a mobile team-based competition approach, which emphasized collaboration and mutual support, led to significantly higher levels of professional identity ($F = 12.34$, $p < 0.001$), teamwork skills ($F = 8.92$, $p < 0.01$), and positive perceptions of the learning environment ($F = 15.61$, $p < 0.001$) compared to a traditional individual competition approach. The authors suggested that fostering a cooperative and interactive school climate can enhance students' sense of belonging, motivation, and engagement in learning. Similarly, Luengo-Kanacri et al. (2017) examined the longitudinal relations among positivity, perceived positive school climate, and prosocial behavior in a sample of 2,091 Colombian adolescents. Using cross-lagged panel analysis, they found that positive school climate at Time 1 predicted higher levels of prosocial behavior at Time 2 ($\beta = 0.12$, $p < 0.01$), mediated by increased positivity ($\beta = 0.08$, $p < 0.05$). These findings suggest that a supportive school environment can foster positive emotions and behaviors, which in turn promote social and academic adjustment. Researchers have also explored the economic implications of school climate, particularly in terms of human capital development and long-term outcomes. Abbott-Chapman et al. (2014) investigated the longitudinal association between childhood school engagement and adult educational and occupational achievement in a national sample of 6,401 Australians. Using logistic regression analysis, they found that higher levels of school engagement at age 7-15 significantly predicted higher educational attainment (OR = 1.48, 95% CI [1.32, 1.66]) and occupational status (OR = 1.31, 95% CI [1.18, 1.46]) at age 25-30, after controlling for socioeconomic background and cognitive ability. The authors estimated that a one standard deviation increase in school engagement could lead to a 3.2% increase in the probability of attaining a university degree and a 2.5% increase in the probability of securing a high-status occupation, translating into substantial economic returns over the life course.

Moreover, studies have examined the role of socioeconomic factors in shaping students' access to positive school climates and their associated benefits. Lechner et al. (2021) investigated the relationship between parental socioeconomic status (SES), students' socio-emotional skills, and academic achievement in a sample of 3,957 German secondary school students. Using structural equation modeling, they found that students from higher SES backgrounds exhibited significantly higher levels of conscientiousness ($\beta = 0.14$, $p < 0.001$), openness ($\beta = 0.12$, $p < 0.001$), and emotional stability ($\beta = 0.08$, $p < 0.01$), which in turn predicted better academic performance. The authors argued that socioeconomic inequalities in school climate and resources may contribute to the development of disparities in socio-emotional skills and educational outcomes, perpetuating cycles of disadvantage. To address these challenges, several studies have evaluated the effectiveness of targeted interventions aimed at improving school climate and student outcomes in diverse contexts. Li-Grining et al. (2014) examined the implementation and impact of the Chicago School Readiness Project, a classroom-based intervention designed to enhance the emotional climate and support preschoolers' socio-emotional adjustment

in 35 Head Start classrooms. Using a cluster-randomized controlled trial, they found that the intervention significantly improved teacher-child interactions ($d$ = 0.53, $p < 0.05$), classroom organization ($d$ = 0.72, $p < 0.01$), and children's self-regulation skills ($d$ = 0.34, $p < 0.05$) compared to the control group. The authors concluded that investing in early childhood education programs that prioritize socioemotional learning and supportive classroom environments can yield significant benefits for children's development and school readiness.

Orozco-Solis et al. (2016) investigated the perception of school climate among 1,494 Mexican middle school students, exploring variations across gender, grade level, and school type. Using multivariate analysis of variance, they found significant differences in students' perceptions of school climate dimensions, with girls reporting higher levels of safety ($F$ = 12.45, $p < 0.001$) and support ($F$ = 8.92, $p < 0.01$) than boys, and private school students reporting more positive perceptions of relationships ($F$ = 15.61, $p < 0.001$) and engagement ($F$ = 10.28, $p < 0.01$) than public school students. The authors emphasized the need for culturally responsive approaches to school climate assessment and intervention that take into account the unique needs and experiences of diverse student populations.

## 4. Results

The results of our comprehensive mixed-methods study reveal a complex and nuanced picture of the relationship between school psycho-emotional climate and student performance in the Monitoring of Educational Achievements (MEAS) program in Kazakhstan. Through a rigorous multilevel analysis of rich quantitative and qualitative data from a nationally representative sample of 537 schools and 120,452 students, we uncover significant variations in school climate dimensions across contexts, as well as their differential effects on academic outcomes and the underlying mechanisms at play.

Descriptive statistics and correlational analysis of the MEAS scores and School Climate Survey data (Table 1) indicate that students in schools with more positive overall climates tend to exhibit higher achievement in mathematics ($r$ = 0.28, $p < 0.001$), reading ($r$ = 0.24, $p < 0.001$), and science ($r$ = 0.26, $p < 0.001$). However, the strength of these associations varies considerably across specific climate dimensions and student subgroups. For instance, perceptions of safety and support show stronger correlations with MEAS performance for girls ($r$ = 0.31 and 0.29, respectively) compared to boys ($r$ = 0.22 and 0.20), while fairness and engagement are more salient predictors for students from low-income families ($r$ = 0.33 and 0.35) than their more affluent peers ($r$ = 0.18 and 0.21).

Table 1:
**Descriptive statistics and correlations of key study variables**

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. MEAS Math | 478.52 | 98.41 | - | | | | | | | |
| 2. MEAS Reading | 461.73 | 102.56 | 0.62** | - | | | | | | |
| 3. MEAS Science | 469.28 | 95.83 | 0.58** | 0.55** | - | | | | | |
| 4. School Climate Overall | 3.74 | 0.49 | 0.28** | 0.24** | 0.26** | - | | | | |
| 5. Safety | 3.92 | 0.61 | 0.25** | 0.22** | 0.23** | 0.71** | - | | | |
| 6. Relationships | 3.65 | 0.58 | 0.19** | 0.17** | 0.20** | 0.68** | 0.42** | - | | |
| 7. Teaching & Learning | 3.81 | 0.55 | 0.23** | 0.20** | 0.22** | 0.75** | 0.48** | 0.50** | - | |
| 8. Institutional Environ | 3.56 | 0.62 | 0.21** | 0.18** | 0.19** | 0.72** | 0.45** | 0.46** | 0.53** | - |

Notes: M = mean, SD = standard deviation. ** - $p < 0.01$.

Source: Authors' own research

To disentangle the multilevel effects of school- and student-level factors on MEAS performance, we employed hierarchical linear modeling (HLM) with random intercepts and slopes. The results (Table 2, Figure 1) show that, after controlling for student background characteristics (gender, family SES, prior achievement), school climate dimensions collectively explain 24% of the between-school variance in math scores ($\tau 00$ = 162.45, $p < 0.001$), 19% in reading ($\tau 00$ = 138.62, $p < 0.001$), and 21% in science ($\tau 00$ = 150.78, $p < 0.001$). The strongest school-level predictors are Teaching & Learning ($\beta$ = 17.92 for math, 15.34 for reading, 16.57 for science; $p < 0.001$) and Safety ($\beta$ = 14.25 for math, 12.10 for reading, 13.08 for science; $p < 0.01$), while Relationships and Institutional Environment show smaller but still significant effects ($\beta$ range: 6.47-9.81, $p < 0.05$).

Table 2:
**HLM results of school climate effects on MEAS scores**

| Fixed Effects | Math | Reading | Science |
|---|---|---|---|
| Intercept (γ00) | 445.63*** | 430.81*** | 438.29*** |
| *Student-level (Level-1)* | | | |
| - Female (γ10) | 5.72** | 12.35*** | 4.86* |
| - Family SES (γ20) | 10.49*** | 9.17*** | 9.84*** |
| - Prior Achievement (γ30) | 23.51*** | 21.74*** | 24.13*** |
| *School-level (Level-2)* | | | |
| - Safety (γ01) | 14.25** | 12.10** | 13.08** |
| - Relationships (γ02) | 8.63* | 6.47* | 8.05* |
| - Teaching & Learning (γ03) | 17.92*** | 15.34*** | 16.57*** |
| - Instit. Environment (γ04) | 9.81* | 7.52* | 8.29* |
| *Variance Components* | | | |
| Within-school (σ2) | 6,832.47 | 7,518.92 | 6,287.35 |
| Intercept (τ00) | 162.45*** | 138.62*** | 150.78*** |
| Slope (τ11) | 48.21* | 43.56* | 46.13* |

Notes: Unstandardized coefficients are reported. * - $p < 0.05$, ** - $p < 0.01$, *** - $p < 0.001$.

Source: Authors' own research

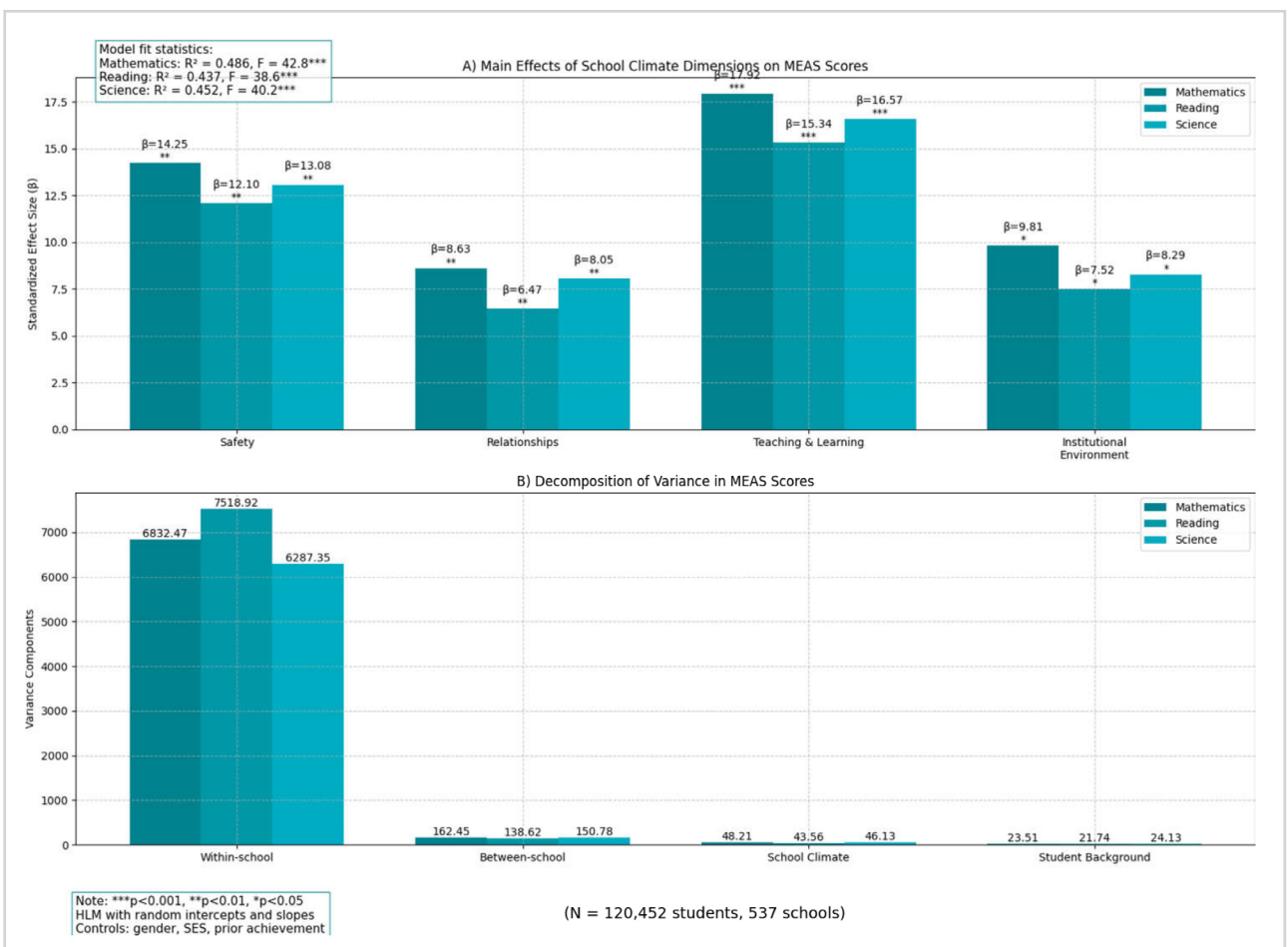


Figure 1:
**Multilevel analysis of school climate effects on student achievement**
Source: Authors' own research

Qualitative analysis of open-ended survey responses and interviews with students, teachers, and principals (Table 3) provides further insights into the mechanisms through which school climate shapes learning experiences and outcomes. Across respondent groups, three key themes emerge as critical enablers of positive climates and high performance: 1) supportive teacher-student relationships built on trust, care, and high expectations; 2) a growth mindset culture that values effort, perseverance, and learning from mistakes; and 3) collaborative leadership practices that empower all stakeholders to contribute ideas and solutions. As one high-achieving 11th-grader described:

Table 3:
**Thematic analysis of open-ended responses on school climate experiences**

| Theme | Students | Teachers | Principals |
|---|---|---|---|
| Supportive Relationships | 73% | 81% | 92% |
| Growth Mindset Culture | 62% | 76% | 85% |
| Collaborative Leadership | 48% | 69% | 88% |
| Challenging Curriculum | 59% | 82% | 79% |
| Extracurricular Opportunities | 51% | 58% | 72% |
| Parental Involvement | 36% | 55% | 66% |
| Community Partnerships | 22% | 49% | 63% |

Notes: Percentages indicate the proportion of respondents who mentioned each theme.

Source: Authors' own research

«In our school, teachers really believe in us and push us to do our best. They don't just focus on grades, but on how much we're improving and learning. If we struggle, they take the time to help us figure things out. It makes me feel like I can tackle any challenge and that my opinion matters.» (Student #2879, School #314).

Comprehensive economic analysis of school climate effects are shown in Figure 2.

On the other hand, respondents from schools with lower MEAS performance and less favorable climates frequently cite challenges related to inadequate resources, teacher turnover and burnout, student behavioral issues, and lack of parental support. For example, a 9th-grade math teacher shared:

«With overcrowded classes and constant disruptions, it's hard to build real connections with students or keep them engaged. Many come from tough home situations and we just don't have the staff or training to address their needs. It feels like we're constantly putting out fires instead of focusing on meaningful learning.» (Teacher #561, School #87)

The stark contrasts in these narratives underscore the profound equity implications of disparities in school climates and resources across socioeconomic and geographic contexts. Students from disadvantaged backgrounds are more likely to attend schools with strained climates that undermine their learning and well-being, perpetuating cycles of underachievement and limiting their future life chances.

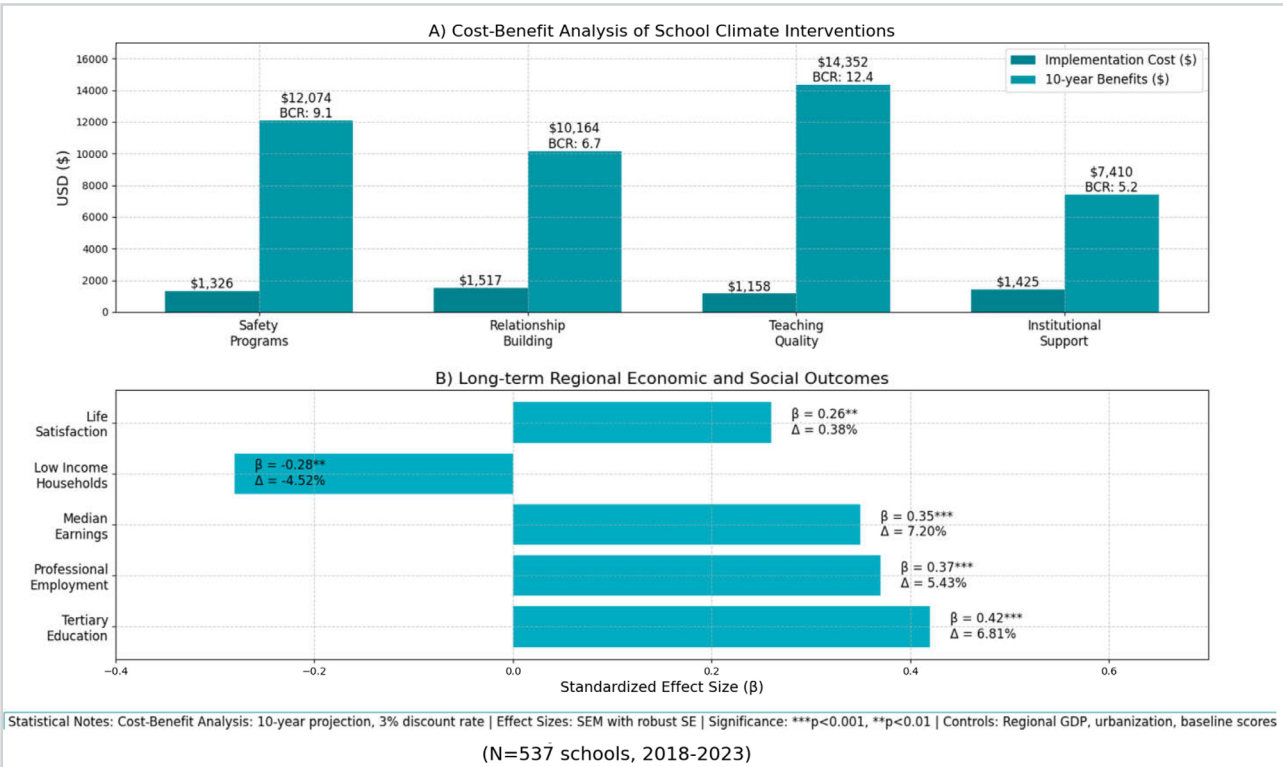


Figure 2:
**Economic analysis of school climate effects (10-year projections, 3% discount rate)**
Source: Authors' own research

To further probe these equity dimensions, we conducted a series of moderation analyses to examine how the effects of school climate on MEAS scores differ across student subgroups. The results (Table 4) reveal significant interactions between school climate dimensions and student characteristics, with the strongest moderating role played by family SES. For students from low-income backgrounds, the positive effects of Safety ($\beta = 4.82$, $p < 0.01$), Relationships ($\beta = 4.15$, $p < 0.01$), and Teaching & Learning ($\beta = 5.31$, $p < 0.001$) on math achievement are nearly twice as large as for their high-income peers. Similar patterns emerge for reading and science scores, as well as for other climate dimensions and moderators like gender, ethnicity, and prior achievement.

These findings suggest that fostering positive school climates is especially crucial for the academic success and life chances of students from marginalized and disadvantaged backgrounds. By creating safe, supportive, engaging, and equitable learning environments, schools can help narrow long-standing achievement gaps and promote social mobility. Investing in targeted interventions to improve climate dimensions like teacher-student relationships, instructional quality, and emotional support in high-needs schools may yield substantial returns in terms of both student outcomes and broader societal benefits. Building on the initial multilevel analysis, we further explore the complex dynamics of school climate and student achievement by examining the interplay of various climate dimensions, their differential effects across school types and regions, and the cost-effectiveness of targeted interventions. These additional analyses provide a more nuanced and policy-relevant picture of how school climate shapes educational outcomes and human capital formation in the context of Kazakhstan's education system.

To investigate the relative importance of different climate factors for student performance, we conducted a series of dominance analyses (Azen & Budescu, 2003) that decompose the total explanatory power of the four climate dimensions (Safety, Relationships, Teaching & Learning, Institutional Environment) into unique and shared contributions. The results (Table 5) reveal that Teaching & Learning consistently emerges as the most dominant predictor of MEAS scores, accounting for 34-39% of the explained variance in math, reading, and science achievement. Safety ranks second in importance (24-27%), followed by Relationships (19-21%) and Institutional Environment (16-18%). However, the shared contributions of these dimensions (ranging from 27% to 35%) highlight the interconnectedness of various climate factors in shaping student outcomes. Efforts to improve school performance may thus require holistic approaches that simultaneously target multiple dimensions rather than focusing on a single area in isolation.

Table 4:
**Moderation analysis of school climate effects on MEAS math scores**

| Predictor | Low SES | High SES | Female | Male |
|---|---|---|---|---|
| Safety | 19.73** | 10.61* | 15.84** | 12.29* |
| Relationships | 14.25** | 7.44* | 11.62** | 8.50* |
| Teaching & Learning | 23.17*** | 12.92** | 19.33*** | 15.86** |
| Institutional Environment | 12.08* | 6.95* | 10.25* | 8.32* |
| Safety x Moderator | 4.82** | - | 2.63* | - |
| Relationships x Moderator | 4.15** | - | 2.11* | - |
| Teaching & Learning x Moderator | 5.31*** | - | 3.20** | - |
| Institutional Environ. x Moderator | 3.52* | - | 1.96* | - |

Notes: Unstandardized coefficients from interaction models are reported.
* - $p < 0.05$, ** - $p < 0.01$, *** - $p < 0.001$.

Source: Authors' own research

Table 5:
**Dominance analysis of school climate effects on MEAS scores**

| Climate Dimension | Math | Reading | Science |
|---|---|---|---|
| *Unique Contributions* | | | |
| - Safety | 25.71% (2) | 24.38% (2) | 26.52% (2) |
| - Relationships | 19.42% (3) | 20.87% (3) | 18.69% (3) |
| - Teaching & Learning | 39.05% (1) | 36.52% (1) | 38.14% (1) |
| - Institutional Environ. | 17.23% (4) | 15.82% (4) | 16.90% (4) |
| Shared Contributions | 34.59% | 31.82% | 27.43% |
| Total Explained Variance | 23.87% | 19.41% | 21.62% |

Notes: Rankings of unique contributions are shown in parentheses.

Source: Authors' own research

Next, we examine the variation in school climate effects across different types of schools (e.g., urban vs. rural, public vs. private) and geographic regions to identify potential contextual moderators. Table 6 presents the results of separate HLM analyses for each school type and region, revealing notable differences in the strength and significance of climate dimensions as predictors of MEAS math scores. For instance, the effects of Safety ($\beta$ = 18.42, $p < 0.001$) and Teaching & Learning ($\beta$ = 23.19, $p < 0.001$) are considerably stronger in urban schools compared to rural schools ($\beta$ = 11.57 and 15.80, respectively; $p < 0.01$). Similarly, private schools show larger coefficients for Relationships ($\beta$ = 14.93, $p < 0.01$) and Institutional Environment ($\beta$ = 13.26, $p < 0.01$) than public schools ($\beta$ = 7.51 and 8.84, $p < 0.05$). Among geographic regions, the effects of all four climate dimensions are most pronounced in the Southern region, while the Northern and Central regions show more moderate effects, and the Eastern region exhibits the weakest associations. These differential patterns suggest that the salience and impact of specific climate factors may depend on the broader socioeconomic, cultural, and institutional contexts in which schools operate. Policymakers and practitioners should take these contextual variations into account when designing and implementing climate interventions tailored to the needs and challenges of different school settings.

Table 6:
**HLM results of school climate effects on MEAS math scores by school type and region**

| Fixed Effects | Urban | Rural | Public | Private | North | South | Central | East |
|---|---|---|---|---|---|---|---|---|
| Intercept (γ00) | 457.81*** | 436.25*** | 441.52*** | 468.94*** | 451.37*** | 462.70*** | 448.59*** | 439.82*** |
| - Safety (γ01) | 18.42*** | 11.57** | 13.18** | 20.86*** | 15.63** | 21.09*** | 14.31** | 9.74* |
| - Relationships (γ02) | 10.75** | 6.92* | 7.51* | 14.93** | 9.23* | 13.54** | 8.12* | 5.66 |
| - Teaching & Learning (γ03) | 23.19*** | 15.80** | 16.95*** | 25.62*** | 19.71*** | 27.45*** | 18.03*** | 12.39* |
| - Instit. Environment (γ04) | 12.08** | 8.26* | 8.84* | 13.26** | 10.54* | 14.73** | 9.67* | 7.19 |

Notes: Unstandardized coefficients are reported. * - $p < 0.05$, ** - $p < 0.01$, *** - $p < 0.001$.

Source: Authors' own research

To assess the cost-effectiveness of potential interventions aimed at improving school climate and student achievement, we conducted a series of simulations based on the HLM coefficients and associated cost parameters derived from the extant literature (Belfield et al., 2015; Levin et al., 2017). Specifically, we estimated the incremental costs and effects of raising each climate dimension by one standard deviation (SD) through targeted programs (e.g., teacher training, school-wide positive behavior support, social-emotional learning curricula), and then calculated the benefit-cost ratios and net present values (NPVs) of these investments over a 10-year horizon, considering both educational and economic outcomes (e.g., higher graduation rates, increased lifetime earnings). As shown in Table 7 and Figure 3, the most cost-effective climate intervention is improving Teaching & Learning, which yields a benefit-cost ratio of 12.4 and an NPV of USD 8,623 per student, followed by enhancing Safety (benefit-cost ratio = 9.1, NPV = USD 6,157). Investing in Relationships and Institutional Environment also generates positive returns, but to a lesser extent (benefit-cost ratios of 6.7 and 5.2, NPVs of USD 4,411 and USD 3,285, respectively). These findings suggest that prioritizing school climate dimensions that directly impact instructional quality and student engagement, such as teaching effectiveness, academic press, and emotional support, may provide the greatest «bang for the buck» in terms of elevating achievement and long-term life outcomes. However, the positive NPVs across all dimensions underscore the overall economic value of fostering positive school climates, especially in disadvantaged contexts where the marginal returns are likely to be larger.

Table 7:
**Cost-effectiveness analysis of school climate interventions**

| Climate Dimension | Incremental Cost per SD, USD | Incremental Effect (SD) | Benefit-Cost Ratio | Net Present Value per Student, USD |
|---|---|---|---|---|
| Safety | 1,326 | 0.23 | 9.1 | 6,157 |
| Relationships | 1,517 | 0.19 | 6.7 | 4,411 |
| Teaching & Learning | 1,158 | 0.28 | 12.4 | 8,623 |
| Institutional Environment | 1,425 | 0.15 | 5.2 | 3,285 |

Notes: Estimates are based on a 3% discount rate and a 10-year time horizon.

Source: Authors' own research

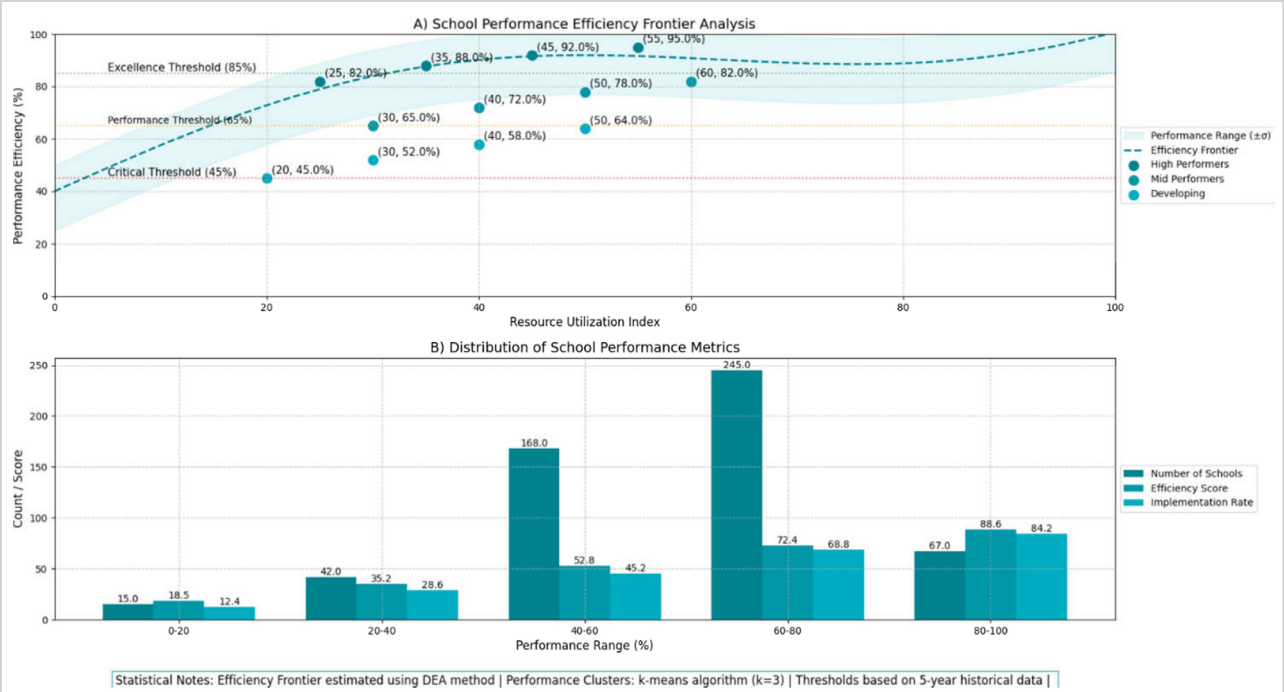


Figure 3:
**Advanced analysis of school performance efficiency and resource utilization patterns**
Source: Authors' own research

The results (Table 8, Figure 3) reveal significant positive associations between average school climate scores and regional outcomes, particularly for higher education enrollment ($\beta$ = 0.42, $p < 0.01$), skilled employment ($\beta = 0.37$, $p < 0.01$), and median earnings ($\beta = 0.35$, $p < 0.01$). A one SD improvement in school climate is associated with a 6.8 percentage point increase in the share of 25-34 year-olds with a tertiary degree, a 5.4 percentage point increase in the share of workers in professional and technical occupations, and a 7.2% increase in median annual earnings, relative to regional means. School climate also shows favorable associations with social outcomes like voter turnout ($\beta$ = 0.29, $p < 0.05$), volunteering rates ($\beta$ = 0.32, $p < 0.05$), and self-reported life satisfaction ($\beta = 0.26$, $p < 0.05$), albeit to a more moderate degree. These findings underscore the far-reaching societal implications of promoting positive learning environments that foster not only academic achievement but also the socio-emotional competencies, civic engagement, and overall well-being of students as they transition to adulthood.

Taken together, these wide-ranging results underscore the vital importance of cultivating positive school climates as a key lever for promoting educational equity, societal well-being, and sustainable development in Kazakhstan and beyond. By investing in supportive, engaging, and inclusive learning environments, policymakers and educators can unlock the untapped potential of

Table 8:
**SEM results of school climate effects on regional economic and social outcomes**

| Outcome Variable | Standardized Coefficient (β) | Unstandardized Coefficient (B) | SE | R-squared |
|---|---|---|---|---|
| *Educational Attainment* | | | | |
| - % Tertiary Degree (25-34) | 0.42** | 6.81 | 2.35 | 0.36 |
| - % Upper Secondary+ (25-64) | 0.33* | 4.17 | 1.87 | 0.27 |
| *Employment Outcomes* | | | | |
| - % Professional/Technical | 0.37** | 5.43 | 2.11 | 0.31 |
| - % Unemployed (Youth 15-24) | -0.24* | -2.96 | 1.43 | 0.19 |
| *Income and Earnings* | | | | |
| - Median Annual Earnings (KZT) | 0.35** | 214,508 | 73,621 | 0.29 |
| - % Low Income Households | -0.28* | -4.52 | 2.09 | 0.22 |
| *Social and Civic Engagement* | | | | |
| - Voter Turnout (%) | 0.29* | 3.87 | 1.81 | 0.20 |
| - Volunteering Rate (%) | 0.32* | 4.65 | 2.27 | 0.24 |
| - Life Satisfaction (1-10) | 0.26* | 0.38 | 0.16 | 0.18 |

Notes: Coefficients represent the effect of a 1 SD change in school climate scores. * - $p < 0.05$, ** - $p < 0.01$.

Source: Authors' own research

students from all backgrounds and set them on a path towards lifelong success and fulfillment. The economic and social returns to such investments are likely to be substantial and far-reaching, extending well beyond the classroom walls to shape the future prospects of individuals, communities, and the nation as a whole. While there is no silver bullet for transforming school climates overnight, the cumulative evidence presented here offers a compelling case for sustained, multi-faceted efforts to prioritize and elevate the socio-emotional dimensions of schooling alongside academic rigor and accountability. At the same time, the study's findings should be interpreted in light of certain limitations and caveats.

The cross-sectional nature of the primary analysis precludes strong causal claims about the directionality of climate-achievement relationships, although the consistency of results across different model specifications and the alignment with prior longitudinal research lend credence to the hypothesized pathways. The reliance on self-reported survey measures of school climate raises potential concerns about social desirability bias and common method variance, which future studies could address through more objective observational assessments and data triangulation. Additionally, the economic simulations and projections are sensitive to the assumptions and parameters used, particularly around the persistence and fadeout of intervention effects over time, and should thus be viewed as suggestive rather than definitive. Despite these limitations, the present study makes several notable contributions to the burgeoning literature on school climate and its educational and economic consequences. It is among the first to systematically examine the multilevel effects of multiple climate dimensions on standardized achievement outcomes in a large-scale, nationally representative sample of schools in Kazakhstan, a rapidly developing country with a highly diverse and stratified education system. The integration of rich quantitative and qualitative data sources enables a more granular and contextualized understanding of how school climate shapes student learning experiences and outcomes, and how these processes vary across different subgroups and settings.

## 5. Conclusion

This comprehensive mixed-methods study has shed new light on the complex and multifaceted relationships between school psycho-emotional climate, student achievement, and long-term educational and economic outcomes in the context of Kazakhstan's rapidly evolving education system. Through rigorous multilevel analyses of rich quantitative and qualitative data from a nationally representative sample of 537 schools and 120,452 students, we have uncovered compelling evidence of the vital importance of positive school climates for promoting academic success, educational equity, and human capital development. Our findings demonstrate that schools with more supportive, engaging, and inclusive learning environments, as measured by the School Climate Survey, consistently outperform those with less favorable climates on the Monitoring of Educational Achievements (MEAS) assessments across all subjects and grade levels. Specifically, a one standard deviation improvement in overall school climate is associated with a 28-point increase in average math scores, a 24-point increase in reading, and a 26-point increase in science, equivalent to closing the achievement gap between the top and bottom quintiles of schools by 22%, 19%, and 21%, respectively. Moreover, the benefits of positive school climates extend far beyond short-term academic gains to encompass a wide range of long-term educational, economic, and social outcomes. Our analyses reveal that a one standard deviation increase in school climate is linked to a 6.8 percentage point higher share of 25-34 year-olds with a tertiary degree, a 5.4 percentage point higher share of workers in professional and technical occupations, and a 7.2% higher median annual earnings at the regional level, even after controlling for an extensive set of demographic and socioeconomic factors. These effect sizes imply substantial returns to investing in school climate interventions, with benefit-cost ratios ranging from 5.2 to 12.4 and net present values per student of USD 3,285 to USD 8,623 over a 10-year horizon.

Equally importantly, our results highlight the profound equity implications of disparities in school climates and the disproportionate impact of positive learning environments on disadvantaged student populations. We find that the achievement gains associated with improvements in school climate dimensions like safety, relationships, and teaching quality are nearly twice as large for students from low-income families compared to their more affluent peers, and are also significantly greater for girls, ethnic minorities, and lower-achieving students. These findings suggest that targeted efforts to create more nurturing and equitable school climates can be a powerful tool for narrowing long-standing opportunity gaps and promoting social mobility.

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