

# Assessing the validity and reliability of the Pennsylvania school climate survey for elementary school students

Regional Educational Laboratory Mid-Atlantic

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# Disclaimer

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Technical appendix, see <https://ies.ed.gov/ncee/rel/Products/Region/midatlantic/Publication/107768>



# Our partnership



# Partnering with PDE to support social and emotional wellness



## Building an evidence base for statewide strategy

- Develop logic model describing statewide initiatives to support social and emotional wellness
- Design planning guide to support Intermediate Unit Leads to plan, monitor, and assess programming with school districts in their regions



## Making school climate survey data useful

- Reassess psychometrics of elementary climate survey
- Establish approach to scoring and aggregating information from the surveys, including thresholds
- Assess climate perceptions during pandemic



## Improving the usefulness of school safety data

- Present information about the historical purpose of PDE's Safe Schools data
- Engage stakeholders in community conversations about the data most useful to collect and why



*This slide deck is part of this stream of work*

## Pennsylvania school climate survey

- PDE's Office for Safe Schools (OSS) administers a school climate survey to help schools across the state foster supportive learning environments that promote social and emotional wellness for their students.
- The survey is offered to students, teachers, and noninstructional staff in schools across Pennsylvania.
- Schools **choose to participate**.
- OSS provides each school with a (school-level) score report.
- School leaders can use school-level results about their school's climate to assess the quality of their learning environment and, if needed, make necessary adjustments to create a more supportive environment.

# Pennsylvania school climate survey covers three domains

Domain	What the domain measures	Example item
<b>1. Social-emotional learning</b>	The respondents' perceptions of students' social and problem-solving skills	"I think before I act" (elementary school students)
<b>2. Student support and academic engagement</b>	The respondents' perceptions of how much students are listened to, cared about, and helped by teachers and other adults in the school	"My teachers really care about me" (all respondents)
<b>3. Safe and respectful school climate</b>	The respondents' perceptions of students' and teachers' physical and emotional safety	"Most students in my school treat each other with respect" (elementary school students)

Source: [www.paschoolclimate.pa.gov/home](http://www.paschoolclimate.pa.gov/home)

## PDE has worked with REL Mid-Atlantic on several school climate survey projects

- [Prior projects](#) in partnership with PDE (2019, 2021)
  - Assessed the validity and reliability of the survey's domain scales and calculated response rates
  - Adjusted items/domains and established each scale's construct and discriminant validity for the staff, middle, and high school surveys; suggested revisions to the elementary school survey
- Current project: Making school climate survey data more useful and actionable
  1. Reassess validity and reliability of elementary survey
  2. Assess relationships between COVID-19 pandemic and school climate
  3. Develop/update school reports to be more useful and easier for PDE to produce; analyze variation in school climate across different groups of students, types of schools, and time

# Reassessing the validity and reliability of the elementary school climate survey

# Background and motivation

- A prior REL study (Amos & Xue, 2021) suggested PDE make significant **revisions** to the elementary school student survey to improve reliability:
  - Add items to the *social-emotional learning* domain
  - Change response options from a 3-point scale to a 4-point scale (“not like me at all” “not much like me” “somewhat like me” “very much like me”)
- PDE implemented these revisions in the elementary school climate survey starting in school year 2019/20.
  - Items in the *social-emotional learning* domain are all new (they come from the social-emotional competency scale on the [Delaware School Survey](#))
- The current study seeks to reassess the validity and reliability of the revised elementary student survey using a similar approach to that of Amos and Xue (2021).
- Confirming the validity and reliability of the elementary school climate survey will improve its usefulness as a measure of school environments and increase educators’ confidence in the measure, better supporting data-informed approaches to improving school learning environments.

# Research questions

## Question 1: Validity

- a) To what extent is the elementary school climate survey **valid**?
- b) How does the validity of the elementary school climate survey compare with the validity of the middle and high school climate surveys?

## Question 2: Reliability

- a) To what extent is the elementary school climate survey **reliable**?
- b) How does the reliability of the elementary school climate survey compare with the reliability of the middle and high school climate surveys?



## Data source: PDE school climate survey, 2021/22

- The study uses responses from elementary school students to assess validity and reliability of domain scales.
  - Uses data from middle and high school students to compare the validity and reliability of the elementary school survey scales to the middle and high school survey scales in the same year
- A new version of the elementary survey was offered beginning in 2019/20. This analysis uses only 2021/22 responses because it is the first year of fully (or almost fully) in-person instruction (least disrupted by COVID-19).
- The student population of interest for this study is all students in schools who participated in the 2021/22 administration of the survey.

Sample	Elementary school student survey	Middle school student survey	High school student survey
Number of respondents	22,077	22,011	29,781
Number of schools	127	70	73

# Methodology

## Question 1 (validity): Confirmatory factor analysis (CFA)

- CFA can be used to assess construct validity—how well the set of survey items in each domain relates to the latent construct of the domain (for example, how safe or respectful the school is for the *safe and respectful school climate* domain).
- The study team used CFA to fit a model and assessed three types of results:
  - **Overall model fit statistics** summarize whether a structural equation model fits the data well.
  - **Standardized factor loading estimates** indicate the strength of the associations between each survey item and the underlying latent construct.
    - If all factor loadings are greater than 0.70, this is good evidence for convergent validity, meaning the items are closely related to the underlying latent construct (Kline, 2016).
    - Factor loadings less than 0.40 suggest weaker associations with the latent construct (Stevens, 2012).
  - **Correlations between latent factors** provide evidence of discriminant validity, or the extent to which the three domains capture different underlying constructs.

## Question 1 (validity): Used CFAs to assess elementary school climate scale validity and compare it to middle and high school scales

1. Ran initial models with items grouped in the three domains established in the prior study
    - Social-emotional learning
    - Student support and academic engagement
    - Safe and respectful school climate
  2. Revised models to improve overall model fit and confirm construct validity by
    - Dropping survey items with less than 0.40 factor loadings across all school years
    - Adding correlations between the error terms based on modification indices
  3. Calculated correlations between latent factors to confirm discriminant validity
  4. Compared model fit for the elementary students' scales to model fit for the middle and high students' scales
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## Criteria to assess model fit

Acceptable fit consideration	Criterion	Source
Overall model fit	$\geq 0.90$ Comparative fit index	Bentler, 1990; Brown, 2015
	$\geq 0.90$ Tucker-Lewis index	Brown, 2015; Tucker & Lewis, 1973
	$< 0.05\text{--}0.08$ Root mean square error of approximation	MacCallum et al., 1996; Steiger & Lind, 1980
Relationship between items	Factor loading $\geq 0.40$ for each item	Stevens, 2012
Relationship between latent factors	Correlation $\leq 0.85$ between latent factors	Henseler et al., 2015; Kline, 2016

## Question 2 (reliability): Used Cronbach's alpha to assess reliability

- Cronbach's alpha measures internal consistency of a scale (how closely items on a scale are related to one another)
  - Compares the shared variance (covariance) among the items in a scale to the amount of overall variance; a higher variance suggests that the items are closely related.
- Acceptable reliability criterion: Cronbach's alpha  $\geq 0.70$

# Findings

Final elementary school student model demonstrated acceptable fit on all three criteria, like the middle and high school models.

Statistic	Criterion	Elementary model fit		
		Elementary school student survey (2021/22)	Middle school student survey (2021/22)	High school student survey (2021/22)
Comparative fit index	$\geq 0.90$	0.92	0.92	0.91
Tucker-Lewis index	$\geq 0.90$	0.91	0.91	0.90
Root mean square error of approximation	$< 0.05-0.08$	0.05	0.04	0.05



Correlations between domains are all beneath the criterion ( $\leq 0.85$ ), indicating domains are acceptably differentiated from one another.

		Correlations between:			
		Survey	Domain 1 and 2: Social-emotional learning, and student support and academic engagement	Domain 1 and 3: Social-emotional learning, and safe and respectful school climate	Domain 2 and 3: Student support and academic engagement, and safe and respectful school climate
Elementary	Elementary school student survey		0.59	0.57	0.84
Comparisons	Middle school student survey		0.53	0.78	0.46
	High school student survey		0.47	0.79	0.42

*However, these two domains are close to not meeting the criterion.*

Cronbach's alpha on the elementary survey indicates acceptable reliability for two domains ( $\geq 0.70$ ) but poor reliability for *safe and respectful school climate*.

Domain	Elementary	
	Elementary school (2021/22)	
	No. of items	Cronbach's alpha
Social-emotional learning	16	0.90
Student support and academic engagement	10	0.80
Safe and respectful school climate	4	0.63 <sup>^</sup>

<sup>^</sup> indicates that the alpha falls below the desired threshold of 0.70.

In contrast, the reliability for the *safe and respectful school climate* domain is high for middle and high school students in 2021/22 and in the years covered in the prior memo.

Domain	Elementary		Comparisons			
	Elementary school (2021/22)		Middle school (2021/22)		High school (2021/22)	
	No. of items	Cronbach's alpha	No. of items	Cronbach's alpha	No. of items	Cronbach's alpha
Social-emotional learning	16	0.90	11	0.86	11	0.86
Student support and academic engagement	10	0.80	16	0.89	15	0.89
Safe and respectful school climate	4	0.63 <sup>^</sup>	10	0.86	12	0.89

<sup>^</sup> indicates that the alpha falls below the desired threshold of 0.70.

## Summary of findings: Validity

- Elementary student scales (including the updated *social-emotional learning* domain) demonstrate construct validity and discriminant validity, similar to middle and high school scales established on a prior project (Amos & Xue, 2021):
  - Two items on the *safe and respectful school climate* domain were dropped from our models when establishing validity of scale:
    - Students at my school are bullied.
    - Students at my school are teased, picked on, made fun of, or called names.
  - *Safe and respectful school climate* and *student support and academic engagement* domain scores are highly correlated but just barely meet the accepted threshold for discriminant validity.

## Summary of findings: Reliability

- Two domains demonstrated acceptable reliability based on internal consistency:
  - Changes made to the *social-emotional learning* domain improved its reliability substantially (from 0.62 in 2016/17 and 0.64 in 2017/18 to 0.90 in 2021/22).
  - *Student support and academic engagement* domain experienced modest improvement (from 0.73 in 2016/17 and 0.77 in 2017/18 to 0.80 in 2021/22); this finding may be related to the recommended shift from three to four response options.
- However, the *safe and respectful school climate* domain did not have acceptable internal consistency:
  - The finding may be due to the small number of items in the domain ( $n = 4$ ) that were retained as valid (two fewer than in 2016/17 or 2017/18) and the fact that one item in this set (Eq26trtr) seems related to a different construct (respect) than the others (safety).
  - The elementary domain has a much smaller number of items than this domain on the middle ( $n = 10$ ) or high school ( $n = 12$ ) surveys.

## Recommend revising the elementary school student survey's *safe and respectful school climate domain*

- Recommendation: Replace the domain with a scale from other validated instruments
  - [Delaware School Survey](#) has relevant subscales on the school climate scale that have been shown to be valid and reliable with students in grades 3–5.
  - Other valid and reliable instruments include those produced by organizations such as the [National Center on Safe Supportive Learning Environments School Climate Survey Compendium](#).
    - Look for scales that have been designed for and tested on elementary students
- Other option: Adapt questions from middle and high school domain, rephrasing to make language and content more relevant to elementary school students
  - This approach is riskier because items may not adapt well to younger students.
- Assess this domain's validity and reliability after implementing changes to the domain

# Limitations

- The sample of schools used for this analysis is small and may not be generalizable to all public schools in Pennsylvania.
  - Only about 7 percent of Pennsylvania public schools (excluding charter schools) participated in the 2021/22 school climate survey.
  - Voluntary participation means the schools who took the survey may be more interested in improving their school climate than the general population of schools.
- Because not all students, educators, and noninstructional staff in a school respond to the survey, the results of these analyses may not be representative of all possible respondents within a school.
  - In 2021/22, the average percentage of elementary school students who completed the survey in participating schools was 76 percent.
- This study focuses on one type of validity—construct validity using CFAs.
  - The study did not explore other types of validity, such as predictive validity (the extent that school climate scores predict other outcomes that should theoretically be related to school climate).
- The study used confirmatory factor analysis at the individual student and staff level even though individuals were nested within schools.
  - This is common practice in school climate research.
  - However, it is possible that this assumptions could lead to faulty conclusions about school climate.

# Questions

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# Appendix

Items included in each domain for elementary school students

## No items were removed from *social-emotional learning* domain scale:

I feel responsible for how I act. (Eq1rhpa)
I think about how others feel. (Eq2thof)
I can control how I behave. (Eq3chib)
I am good at solving conflicts with others. (Eq4scwo)
I am good at deciding right from wrong. (Eq5drfw)
I care about how others feel. (Eq6chof)
I think before I act. (Eq7tbact)
I get along well with others. (Eq8gawo)
I make good decisions. (Eq9mgdc)
I respect what others think. (Eq10rwot)
I can control my anger. (Eq11cman)
I am kind to others. (Eq12kto)
I think about the consequences of what I do. (Eq13tconsq)
I try to understand how others think and feel. (Eq14uhof)
I can calm myself when upset. (Eq15cmwu)
I help others. (Eq16hlpo)

No items were removed from *student support and academic engagement* domain scale:

Teachers and other staff in this school are fair to all students. (Eq10fair)
Teachers and other staff in this school are willing to give students help. (Eq11givh)
My teachers really care about me. (Eq43care)
The homework I get from my teachers helps me learn. (Eq47hmwk)
I wish I went to a different school. (Eq51difs)
My teachers notice if I have trouble learning something. (Eq64ntct)
My teachers help me do better on my school work. (Eq65hlpi)
My teachers treat some students better than others. (Eq66trtd)
My teachers give me work that is interesting. (Eq67topc)
I am bored in school. (Eq69ubrd)

## Two items were removed from the *safe and respectful school climate* domain scale:

<del>Students at my school are bullied. (Eq13bly) [removed]</del>
<del>Students at my school are teased, picked on, made fun of, or called names. (Eq15tsed) [removed]</del>
I feel safe outside around the school. (Eq19sfos)
I feel safe in the hallways and bathrooms of the school. (Eq20sfhl)
I feel safe in my classroom. (Eq21sfcs)
Most students in my school treat each other with respect. (Eq26trtr)

# Recommendations for the middle and high school surveys based on CFA results of the 2021/22 surveys

## Middle and high school survey validity

- To generate more useful results in future administrations of the **middle school** survey, the study team recommends the following:
  - Remove four survey items with low validity (factor loadings less than 0.40)
    - One in the *student support and academic engagement* item (see slide 35)
    - Three *safe and respectful school climate* items (see slide 36)
- To generate more useful results in future administrations of the **high school** survey, the study team recommends the following:
  - Remove three survey items with low validity (factor loadings less than 0.40)
    - Two *student support and academic engagement* items (see slide 37)
    - One *safe and respectful school climate* item (see slide 38)



## Recommend removing one item from **middle school** *student support and academic engagement* domain scale

My teachers often connect what I am learning to life outside the classroom. (Mq38cnct)
My teachers encourage students to share their ideas about things we are studying in class. (Mq40shid)
My teachers really care about me. (Mq43care)
My teachers help me make up work after an excused absence. (Mq44mkup)
My teachers often assign homework that helps me learn. (Mq47hmwk)
Adults in this school are often too busy to give students extra help. (Mq49adtb)
Adults in this school apply the same rules to all students equally. (Mq50ruls)
I wish I went to a different school. (Mq51difs)
I can get extra help at school outside of my regular classes. (Mq52exth)
<del>A counselor at this school has helped me plan for life after high school. (Mq53ensl) [removed]</del>
Adults in this school are usually willing to take the time to give students extra help. (Mq55extra)
Teachers notice if I have trouble learning something. (Mq64ntct)
Teachers will help me improve my work if I do poorly on an assignment. (Mq65hlpi)
Teachers treat some students better than others. (Mq66trtd)
In my classes, the topics we are studying are interesting and challenging. (Mq67topc)
This class really makes me think. (Mq68mkth)
I am usually bored in this class. (Mq69ubrd)

## Recommend removing three items from the **middle school *safe and respectful school climate*** domain scale

Students at this school are often bullied. (Mq13bly)
Students at this school are often threatened. (Mq14thrn)
Students at this school are often teased or picked on. (Mq15tsed)
Students at this school are often bullied because of certain characteristics (for example, race, religion, or weight). (Mq16blyc)
<del>I sometimes stay home because I don't feel safe at school. (Mq18sthm) [removed]</del>
<del>How safe do you feel outside around the school? (Mq19sfes) [removed]</del>
How safe do you feel in the hallways and bathrooms of the school? (Mq20sfhl)
<del>How safe do you feel in your classes? (Mq21sfes) [removed]</del>
Students in my school don't really care about each other. (Mq22dntc)
Students in my school like to put others down. (Mq23ptth)
Students in my school don't get along together well. (Mq24dntg)
Students in my school just look out for themselves. (Mq25lkot)
Students in my school treat each other with respect. (Mq26trtr)

## Recommend removing two items from **high school student support and academic engagement** domain scale

My teachers often connect what I am learning to life outside the classroom. (Hq38cnct)
My teachers encourage students to share their ideas about things we are studying in class. (Hq40shid)
My teachers really care about me. (Hq43care)
My teachers help me make up work after an excused absence. (Hq44mkup)
My teachers often assign homework that helps me learn. (Hq47hmwk)
Adults in this school are often too busy to give students extra help. (Hq49adtb)
Adults in this school apply the same rules to all students equally. (Hq50ruls)
I wish I went to a different school. (Hq51difs)
I can get extra help at school outside my regular classes. (Hq52exth)
<del>A counselor at this school has helped me plan for life after high school. (Hq53ensl) [removed]</del>
<del>When students in this school already know the material that is being taught, the teacher gives them more advanced assignments. (Hq54advw) [removed]</del>
Adults in this school are usually willing to take the time to give students extra help. (Hq55extra)
Teachers notice if I have trouble learning something. (Hq64ntct)
Teachers will help me improve my work if I do poorly on an assignment. (Hq65hlpi)
In my classes, the topics we are studying are interesting and challenging. (Hq67topc)
This class really makes me think. (Hq68mkth)
I am usually bored in this class. (Hq69ubrd)

## Recommend removing one item from the **high school** *safe and respectful school climate* domain scale

Students at this school are often bullied. (Hq13bllly)
Students at this school are often threatened. (Hq14thrn)
Students at this school are often teased or picked on. (Hq15tsed)
Students at this school are often bullied because of certain characteristics (for example, race, religion, or weight). (Hq16blyc)
I sometimes stay home because I don't feel safe at school. (Hq18sthm)
<del>How safe do you feel outside around the school? (Hq19sfos) [removed]</del>
How safe do you feel in the hallways and bathrooms of the school? (Hq20sfhl)
How safe do you feel in your classes? (Hq21sfcs)
Students in my school don't really care about each other. (Hq22dntc)
Students in my school like to put others down. (Hq23ptth)
Students in my school don't get along together well. (Hq24dntg)
Students in my school just look out for themselves. (Hq25lkot)
Students in my school treat each other with respect. (Hq26trtr)