Changes in school climate during COVID-19 in a sample of Pennsylvania schools

Regional Educational Laboratory Mid-Atlantic

Whitney Kozakowski
Principal Investigator

Katlyn Lee Milless
Researcher

Sonia Alves
Researcher

Michelle Bennett
Research Analyst

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Improving the usefulness of school safety data

- Present information about the historical purpose of PDE's Safe Schools data
- Engage stakeholders in listening sessions 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 non-instructional staff
- Schools **choose to participate**
- OSS provides each school with a (school-level) score report

Pennsylvania school climate survey covers three domains

Domain	Definition	Example Item
Social emotional learning	The respondents' perceptions of students' social and problem-solving skills	"Students in my school stop and think before doing anything when they get angry" (all respondents)
Safe and respectful school climate	The respondents' perceptions of students' and teachers' physical and emotional safety	"Students in my school treat each other with respect" (all respondents)
Student support and academic engagement	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" (Student respondents) "I really care about my students" (Teacher respondents)

Source: 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 and calculated response rates
  - Adjusted items/domains and established construct validity of staff, middle, and high school surveys. Suggested revisions to the elementary school survey.
  - Developed a summary index of school climate and domain-level indexes (with 2016/17 and 2017/18 data) that can be used to compare schools, monitor progress, and identify schools needing support

- Current project: Making school climate survey data more useful and actionable
  1. Re-assess psychometric properties 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.

School climate during the COVID-19 pandemic

Background

- COVID-19 pandemic brought widespread disruptions both in school (e.g., remote and hybrid learning) and out of school (e.g., increased isolation; anxiety)
  - Declines in students' and school staff members' mental health during the pandemic, especially students from underserved groups (CDC Foundation, 2021; U.S. Department of Education, 2022; U.S. Surgeon General, 2021; Office for Civil Rights, 2021)
  - Academic growth lagged, and gaps by race and school poverty have widened (Lewis et al., 2021)
  - Schools with high percentages of students of color and students living in poverty were more likely to provide remote instruction, suffering larger academic declines (Goldhaber et al., 2022)

- This study explores how school climate scores changed during the pandemic and how learning modality in 2020/21 (remote, hybrid, in-person) relates to school climate.
  - Research literature sparse on how pandemic has affected school climate (as measured by surveys), though school leaders have reported increases in disruptive behavior following the pandemic (NCES, 2022)

- Goal: Identify whether schools need additional support to help school climate scores return to their pre-pandemic levels

Research questions on school climate during COVID-19

1. Did pandemic-related disruptions affect the validity of the school climate survey?
2. Did school climate scores change from before the pandemic to the years during the pandemic?
3. Did school climate scores in 2021/22 vary according to the amount of virtual and hybrid instruction used during the 2020/21 school year?

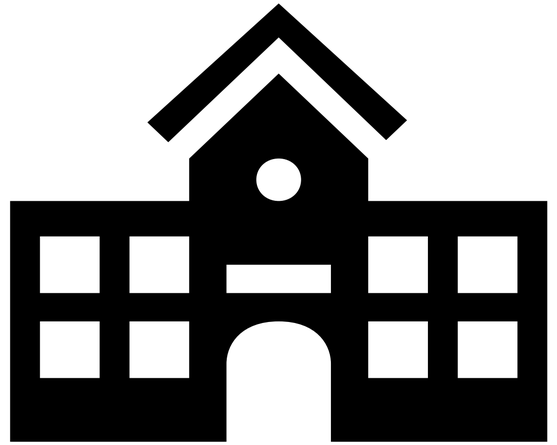
Research Question 1: Did pandemic-related disruptions affect the validity of the school climate survey?

Motivation

- Prior work with PDE validated the scale of the school climate survey with data from 2016/17 and 2017/18, which included a few survey items that assume in-person learning
  - Conducted confirmatory factor analysis (CFA) to establish construct validity
  - Improved overall construct validity by reorganizing and removing survey items and combining two domains
- Must assess construct validity — the extent to which the measure accurately captures the intended construct (school climate) — in additional years (2018/19, 2020/21, and 2021/22) and determine if the COVID-19 pandemic affected the psychometric properties of the school climate survey
  - Confirm items included in each domain are still appropriate
  - Assess whether domain structure has changed during the COVID-affected years (2020/21, 2021/22)
- To demonstrate construct validity, we evaluate convergent validity—how related the survey items are and discriminant validity—the extent to which domains capture different underlying constructs

Data source

- Pennsylvania School Climate Survey from school years 2016/17 to 2021/22, excluding 2019/20
  - School climate survey responses from middle and high school students and elementary, middle, and high school classroom teachers and non-instructional staff
  - 2019/20 survey was dropped from the sample because some schools took the survey before COVID (fall or winter of 2019/20), and some took it during COVID disruptions (spring 2020)



Sample: The number of respondents and schools that completed the school climate survey varied by year

Number of respondents and schools by year and survey type

Sample	Year	MS student survey	HS student survey	Classroom teacher survey	Non-instructional staff survey
Number of respondents	2016/2017	8,265	15,444	2,221	926
	2017/2018	10,860	20,857	4,075	1,851
	2018/2019	16,400	23,602	4,565	1,971
	2020/2021	9,092	12,739	3,047	1,513
	2021/2022	22,011	29,781	6,390	2,752
Number of schools	2016/2017	39	46	94	88
	2017/2018	43	61	181	176
	2018/2019	71	77	214	213
	2020/2021	41	46	126	128
	2021/2022	70	73	262	259

MS = middle school; HS = high school

Note: The reported number of schools represents schools where at least one student, teacher, or non-instructional staff member responded to the survey

Source: PDE School Climate Survey from 2016/17 to 2021/22 school years, excluding 2019/20 school year

- Participation is voluntary; we discuss response rates later in this presentation
- Number of schools is larger for classroom teacher and non-instructional staff surveys because it includes elementary schools

Methods: Confirmatory factor analysis (CFA)

- Defines a statistical model and tests a set of assumptions about the relationships between the survey items and their underlying construct
- Sheds light on construct validity—how well the grouping of survey items in each domain capture the intended constructs (e.g., safe and respectful school climate)
- Produces three types of results:
  - **Overall model fit statistics** summarizing whether a structural equation model fits the data well
  - **Standardized factor loading estimates** indicating the strength of the associations between each survey item and the underlying latent construct
    - If all factor loadings are greater than .70, this is good evidence for convergent validity
    - Factor loadings less than .40 suggest weaker associations with the latent construct
  - **Correlations between latent factors** providing evidence of discriminant validity

Methods: Used confirmatory factor analyses (CFAs) to assess school climate survey validity in the COVID-affected school years

1. Ran models with items grouped in the domains established in the prior study, using a larger sample size of respondents and data (2016/17 to 2021/22 school year, excluding 2019/20)

2. Revised models to improve overall model fit by:
   - Removing survey items with less than 0.40 factor loadings across all school years
   - Adding correlations between the error terms based on modification indices
   - Calculating correlations to assess discriminant validity

3. Assessed if any survey items perform worse than usual during both COVID years (2020/21 and 2021/22) or 2020/21

   (Concerned that items may perform worse during 2020/21 – the year with the most hybrid/remote instruction – or during both COVID years, as some disruptions continued into 2021/22):
   - For non-instructional staff removed two survey items performing poorly in 2020/21 and re-ran the model

Acceptable fit considerations	Criterion
Overall model fit	≥ 0.90 Comparative fit index (CFI) ≥ 0.90 Tucker-Lewis index (TLI) < 0.05 – 0.08 Root mean square error of approximation (RMSEA)
Relationship between items	Factor loading ≥ 0.40 for each item
Relationship between latent factors	Correlation ≤ 0.85 between latent factors

Sources: Bentler, 1990; Brown, 2015; MacCallum, Browne and Sugawara (1996); Steiger & Lind, 1980; Stevens, 2012; Tucker & Lewis, 1973

Methods: The revised models demonstrated acceptable fit across all respondents and school years

Statistic	Suggested	Year	Middle school student survey	High school student survey	Classroom teacher survey	Non-instructional staff survey
CFI	≥ 0.90	2016/17	0.915	0.928	0.916	0.915
		2017/18	0.917	0.918	0.912	0.923
		2018/19	0.923	0.918	0.914	0.907
		2020/21	0.917	0.929	0.916	0.918
		2021/22	0.908	0.910	0.920	0.925
TLI	≥ 0.90	2016/17	0.903	0.917	0.903	0.901
		2017/18	0.907	0.905	0.898	0.910
		2018/19	0.913	0.905	0.900	0.891
		2020/21	0.906	0.918	0.902	0.905
		2021/22	0.896	0.896	0.908	0.913
RMSEA	< 0.05 – 0.08	2016/17	0.043	0.042	0.050	0.054
		2017/18	0.044	0.047	0.052	0.052
		2018/19	0.042	0.045	0.051	0.056
		2020/21	0.045	0.048	0.051	0.052
		2021/22	0.046	0.049	0.052	0.054

Note: Gray shading indicates that threshold is not met, but close to being met.

Findings: COVID-19 pandemic did not change the psychometric properties of the school climate surveys for students and teachers

- **Items dropped from the domains due to poor fit were consistently fitting poorly across all years**
  - Did not observe items only performing poorly during *both* COVID-affected years (2020/21, 2021/22)
  - Did not observe items only performing poorly during 2020/21 (the year with the most hybrid or remote instruction)
    - Exception: Two items on the non-instructional staff survey performed badly only in 2020/21. Dropped these in revised models.

- **For final models in each year, domain structure is the same across all years (2016/17 through 2021/22)**
  - Items included in each domain remained constant across time
  - Overall model fit was consistently acceptable across time
  - Correlations between latent factors provided evidence of discriminant validity
    - Exception: For a few years, the safe and respectful school climate domain on the teacher and non-instructional staff surveys was highly correlated (>0.85) with another domain, but pattern not consistent across all years and varied by domain

Implications, limitations, and future considerations

- Implication:
  - For teachers and students, the school climate survey scales for each domain are valid in the years of interest (2016/17 to 2021/22, excluding 2019/20), even when some students are learning in hybrid or remote environments.

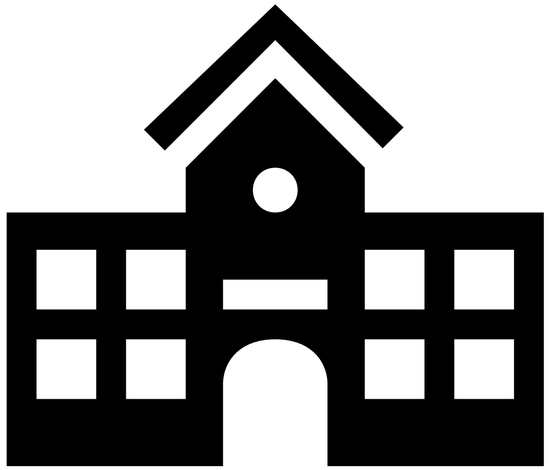
- Limitations:
  - Survey participation was voluntary, leading to variation in schools participating each year. Harder to establish a consistent structure when participating schools shift across years.
  - Analyses focused on establishing construct validity and whether the psychometric properties changed over time and did not assess predictive validity (e.g., the extent to which the measures predict behavioral and academic outcomes) (Drost, 2011)
  - Surveys did not have unique identifiers for each respondent; not possible to remove respondents who may have accidentally taken the survey twice within the same survey window.

- Future considerations for PDE:
  - Consider shortening the survey by dropping items that had low factor loadings (<0.4) across all years
  - Consider adding a unique student identifier to the survey to track which respondents have already taken the survey to better link to existing administrative data

Research Question 2: Did school climate scores change from before the pandemic to the years during the pandemic?

Data sources

- Pennsylvania School Climate Survey from school years 2016/2017 to 2021/2022, excluding 2019/2020
  - School climate survey responses for:
    - middle and high school students
    - classroom teachers and non-instructional staff ("adults" refers to both) from elementary, middle, and high schools
- NCES Common Core of Data: Student demographics and enrollment, school characteristics



Sample

- For the main analysis, we focus on the schools with data in **2018/19, 2020/21, and 2021/22**:
  - Teacher/adult sample: 28 schools
  - Student sample: 18 schools
- Sample sizes small: 68% of schools that took the survey from 2016/17 to 2021/22 (excluding 2019/20) participated for only one year. Only 14% took the survey for three or more years.
- Because of this, we also ran analyses with a larger alternative sample that had data **for 2018/19 and 2021/22:**
  - Teacher/adult sample: 52 schools
  - Student sample: 30 schools
- Also examine changes in a pre-COVID sample **(2016/17, 2017/18, and 2018/19)** to understand how scores typically changed year-to-year before COVID as a baseline reference:
  - Teacher/adult sample: 28 schools
  - Student sample: 29 schools

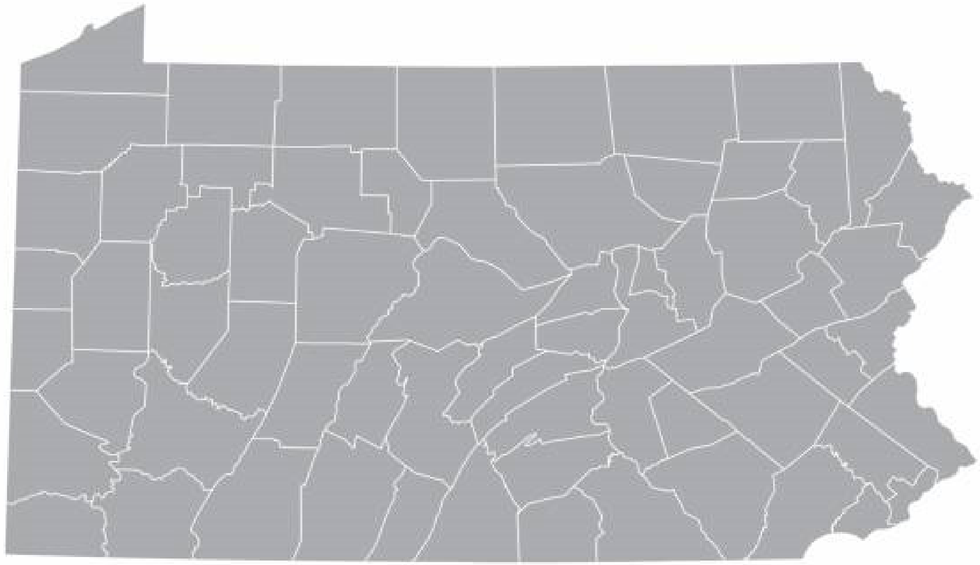
Number of respondents per school required in each year:

- Teachers: At least 5
- Students: At least 25

Sample: Schools in the main analysis sample are somewhat different than other schools in Pennsylvania

Comparing to other schools in the state (in 2018/19), schools in the main analysis sample for research question 2 (for both the student sample and for the teacher/adult sample):

- Had fewer Asian/Pacific Islander and Black students and more White students
- Were less likely to be in an urban setting



Methods: Survey response rates for students and teachers ranged from 0.58 to 0.68 across years

- Response rate = $\frac{\text{number of survey respondents}}{\text{number of eligible respondents in a school}}$

Average school-level response rates by year and respondent type

	2016/17	2017/18	2018/19	2020/21	2021/22
Students	0.62	0.66	0.67	0.60	0.58
Teachers	0.68	0.64	0.63	0.62	0.66

- Nonresponse weights used to address potential bias from student nonresponse in school-year pairs with response rates lower than 0.85 (NCES, 2012).
  - Made weights for intersectional (race/ethnicity and gender) groups of students to address under/over representation of a given intersectional group within a school and year
  - 79% of school-year pairs had rates lower than 0.85
  - Data needed to construct nonresponse weights not available for teachers or staff

Methods: Made school climate indexes and domain scores

- For each domain, year, and respondent type (teachers, students, staff):
  - Used Rasch models to construct Rasch scores, which provide a summary score for how favorable a respondent's responses are to survey items within the same domain
  - Converted scores to scaled scores ranging from 1-99, anchoring the scale in 2016/17

- Constructed school-level index and domain scores separately for students, teachers, and adults (teachers and non-instructional staff), adjusting for nonresponse for students in schools with low response rates:
  - School climate index scores
  - Domain scores:
    - Social emotional learning
    - Safe and respectful school climate
    - Student support and academic engagement

Methods: Tested for differences in school climate

- For each sample, ran repeated measures analysis of variance (RM ANOVAs) and conducted post-hoc tests (with an adjustment for multiple hypothesis testing) to assess whether school climate scores differed between school years
  - For the main analysis sample, compared each year pair (e.g., 2018/19 to 2020/21, 2020/21 to 2021/22, 2018/19 to 2021/22) to test if there were changes in school climate
  - Compared 2018/19 to 2021/22 in a larger sample of schools with data in both years to confirm change similar to the change observed in the main analysis sample
  - Also, compared each year pair in the pre-COVID sample (2016/17, 2017/18, and 2018/19) to understand how much scores tend to vary across years typically

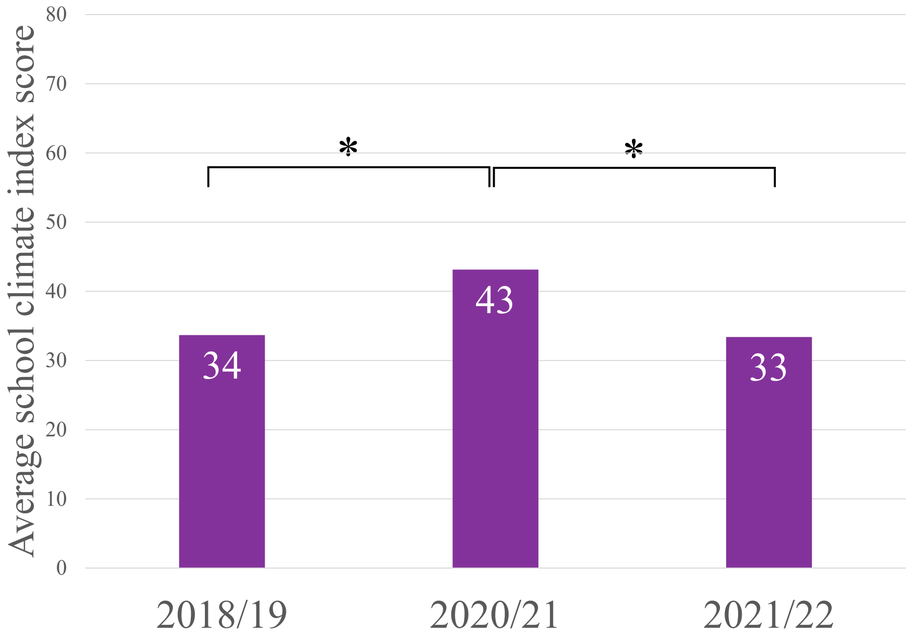
Summary of findings on changes in school climate during COVID in a sample of Pennsylvania schools

- **For both students and teachers, school climate scores were higher overall and in almost all domains in 2020/21 compared to either 2018/19 or 2021/22**, indicating an unexpected positive bump in the year in which students experienced a lot of disruption:
  - In contrast, school climate scores did not change much from year-to-year in the pre-COVID years: 2016/17, 2017/18, and 2018/19 (appendix slides 54-55)
  - Findings for teachers and adults very similar, so focus on reporting results for teachers (appendix slide 53).

- **No evidence of a decline in students' or teachers' perceptions of school climate between 2018/19 and 2021/22**
  - Finding consistent in the larger, alternative sample for students; teachers' perceptions became more favorable from 2018/19 to 2021/22 on the school climate index and two domains (Findings for teachers not significant in the main sample, but are similar in magnitude and significant in the larger sample of schools. See appendix slides 56-59).

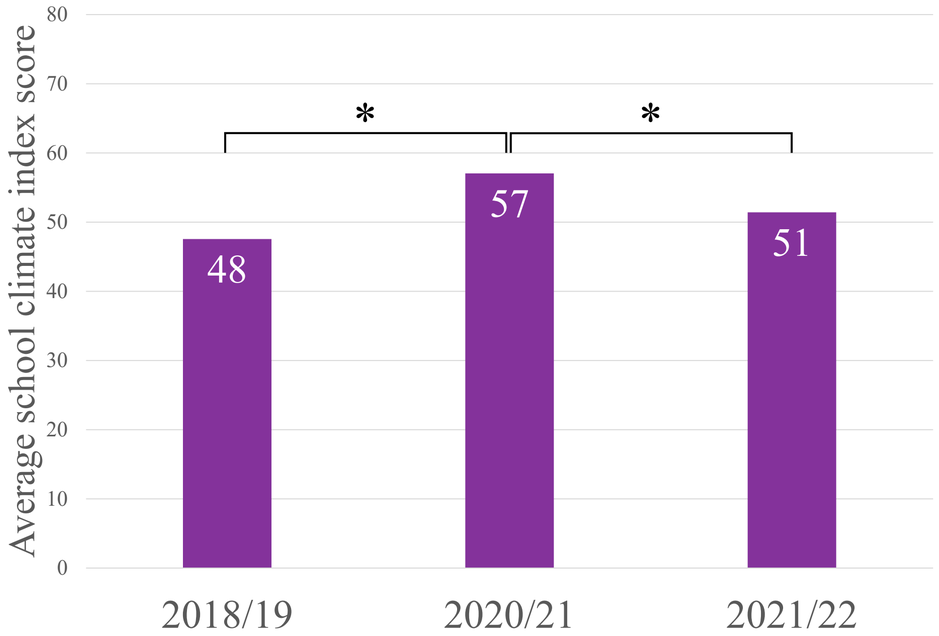
Students' and teachers' perceptions of a positive school climate increased from 2018/19 to 2020/21 and decreased from 2020/21 to 2021/22.

Change in **students'** perceptions of overall school climate



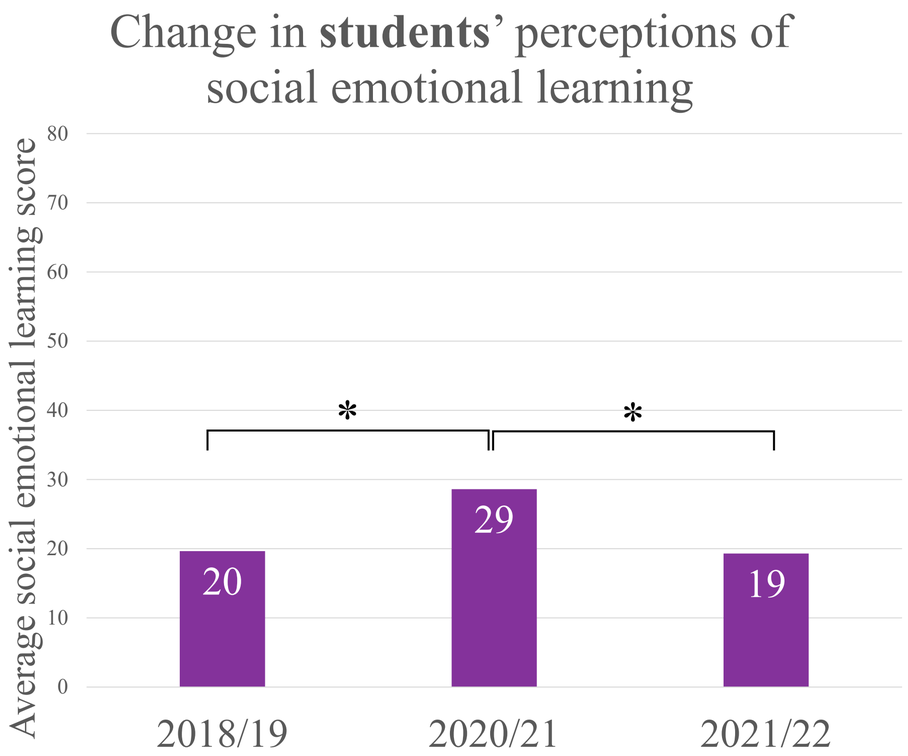
* indicates *p*-values < .05, N = 18 schools

Change in **teachers'** perceptions of overall school climate



* indicates *p*-values < .05, N = 28 schools

Students' and teachers' perceptions of students' social emotional learning increased from 2018/19 to 2020/21 and decreased from 2020/21 to 2021/22.



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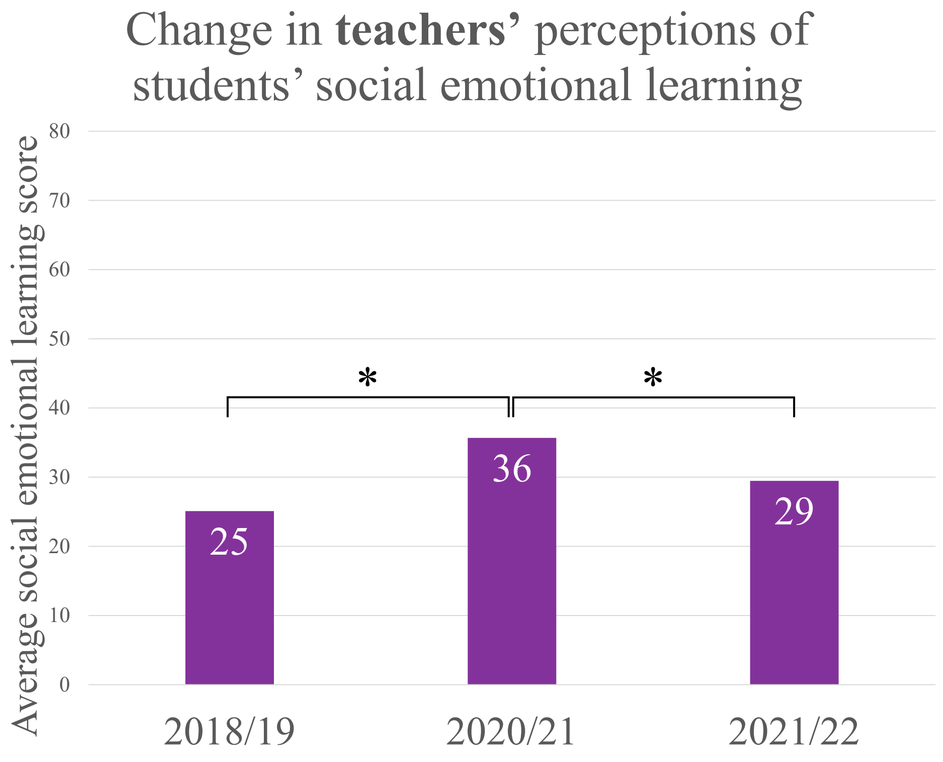
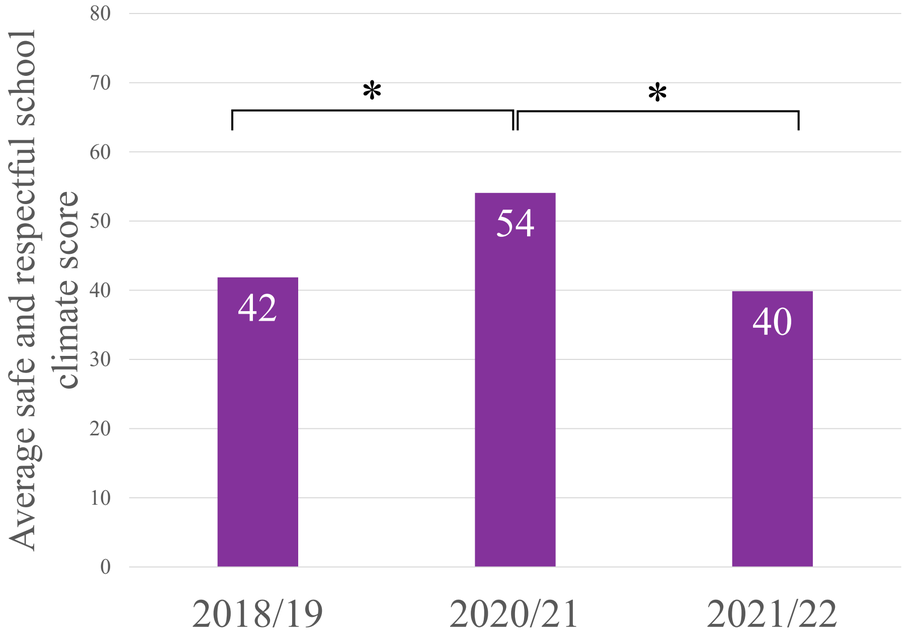


* indicates *p*-values < .05, N = 28 schools

Students' and teachers' perceptions of safe and respectful school climate increased from 2018/19 to 2020/21 and decreased from 2020/21 to 2021/22.

Change in **students'** perceptions of safe and respectful school climate



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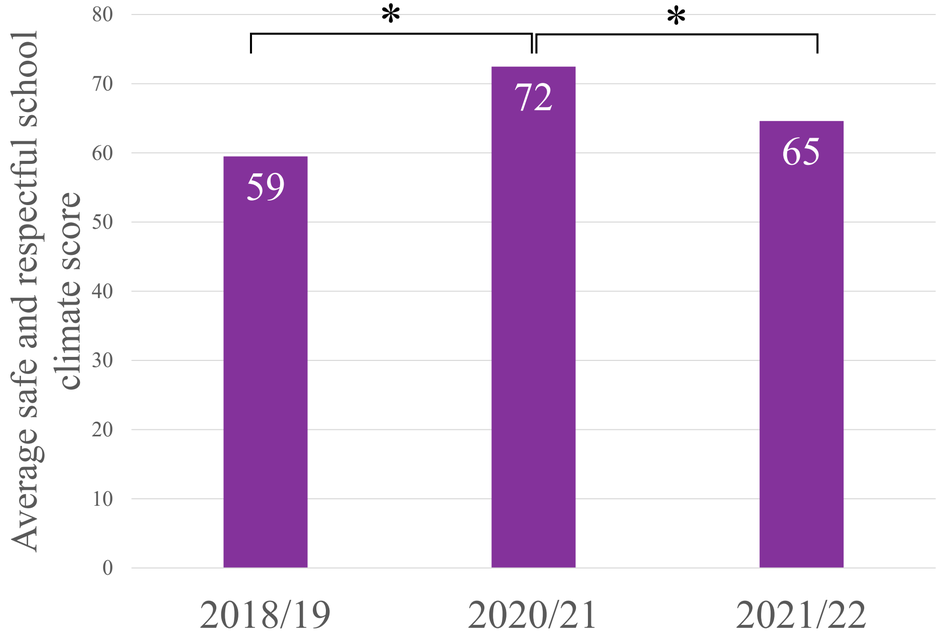
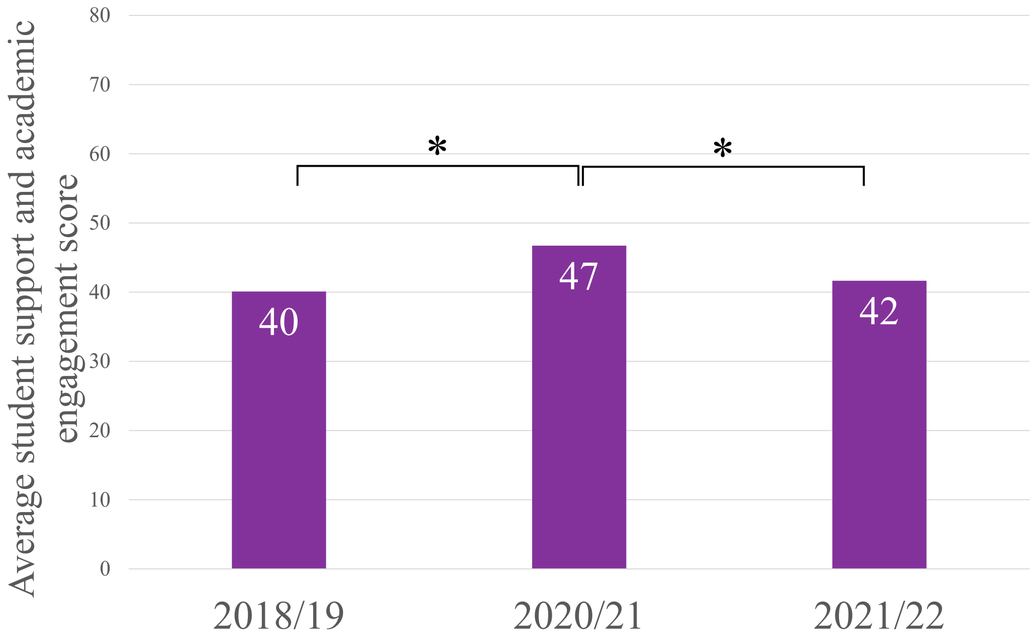
Change in **teachers'** perceptions of safe and respectful school climate



* indicates *p*-values < .05, N = 28 schools

Students' **perceptions of student support and academic engagement** increased from 2018/19 to 2020/21 and decreased from 2020/21 to 2021/22. No evidence of a difference in **teachers' perceptions of student support and academic engagement** between the 2018/19, 2020/21, or 2021/22 school years.

Change in **students'** perceptions of student support and academic engagement



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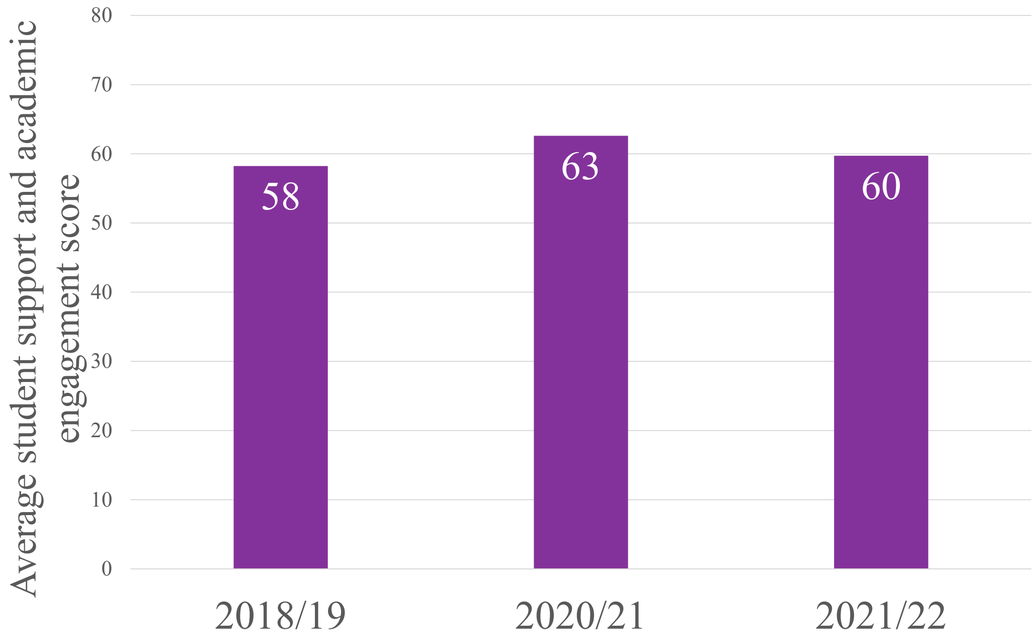
Change in **teachers'** perceptions of student support and academic engagement



* indicates *p*-values < .05, N = 28 schools

Why might perceptions of school climate have been higher in 2020/21 than in 2018/19 and 2021/22?

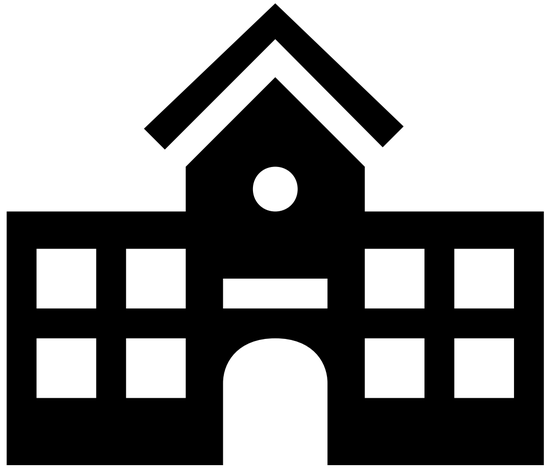
- Possible explanations:
  - In-person learning may make it possible to have more negative experiences at school. Evidence that bullying and youth suicide rates fell during remote learning (Bacher-Hicks, et al, 2022; Vaillancourt, et al, 2021; Hansen, et al, 2022; Center for Disease Control and Prevention, 2023) and disciplinary incidents increased in 2021/22 relative to the prior year (Welsh, 2022).
  - During COVID, schools were encouraged to spend more time on social/emotional wellness and connection. Students may have been more respectful to each other during collective hardship.
  - During hybrid learning, some schools had half the students in school at any given time. Smaller classes in person may have improved social interactions.

- No evidence that students or teachers perceived school climate less favorably after the pandemic compared to before and teachers (as shown in the larger sample of schools) perceived school climate more favorably in 2021/22 than 2018/19.
  - Implies the pandemic did not have lasting negative effects on school climate in this sample of schools and that schools do not need additional support to recover from changes in school climate associated with COVID-19
  - However, the fact that scores rose during a year with a lot of remote and hybrid instruction suggests there is room to make school climate more favorable during in-person instruction.

Research Question 3: Did school climate scores in 2021/22 vary according to the amount of virtual and hybrid instruction used during the 2020/21 school year?

Data source

- Pennsylvania School Climate Survey data for **2018/19** and **2021/22**
  - Using **school climate indexes** and **domain scores** described previously for **teachers and students,** weighted to address nonresponse bias
- Learning modality data was from the **Return to Learn Tracker (R2L)**
  - Developed by American Enterprise Institute
  - Collected weekly data on school districts' use of learning modalities
  - Calculated percent of weeks spent in remote, hybrid, and in-person learning over all of 2020/21 to use in the analysis



Sample

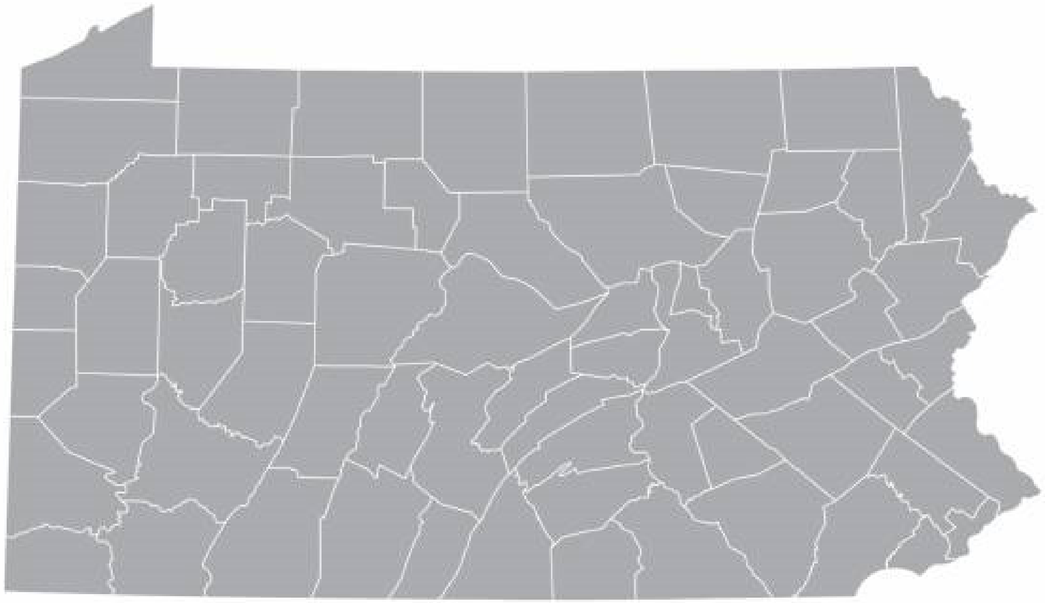
- Schools in the sample included:
  - Schools with school climate data in **2018/19** and **2021/22** and adequate number of respondents in each year
  - Schools with learning modality data in the 2020/21 school year
- Teacher sample: 47 schools, 18 districts
- Student sample: 25 schools, 15 districts

Number of respondents per school required in each year:
- Teachers: At least 5
- Students: At least 25

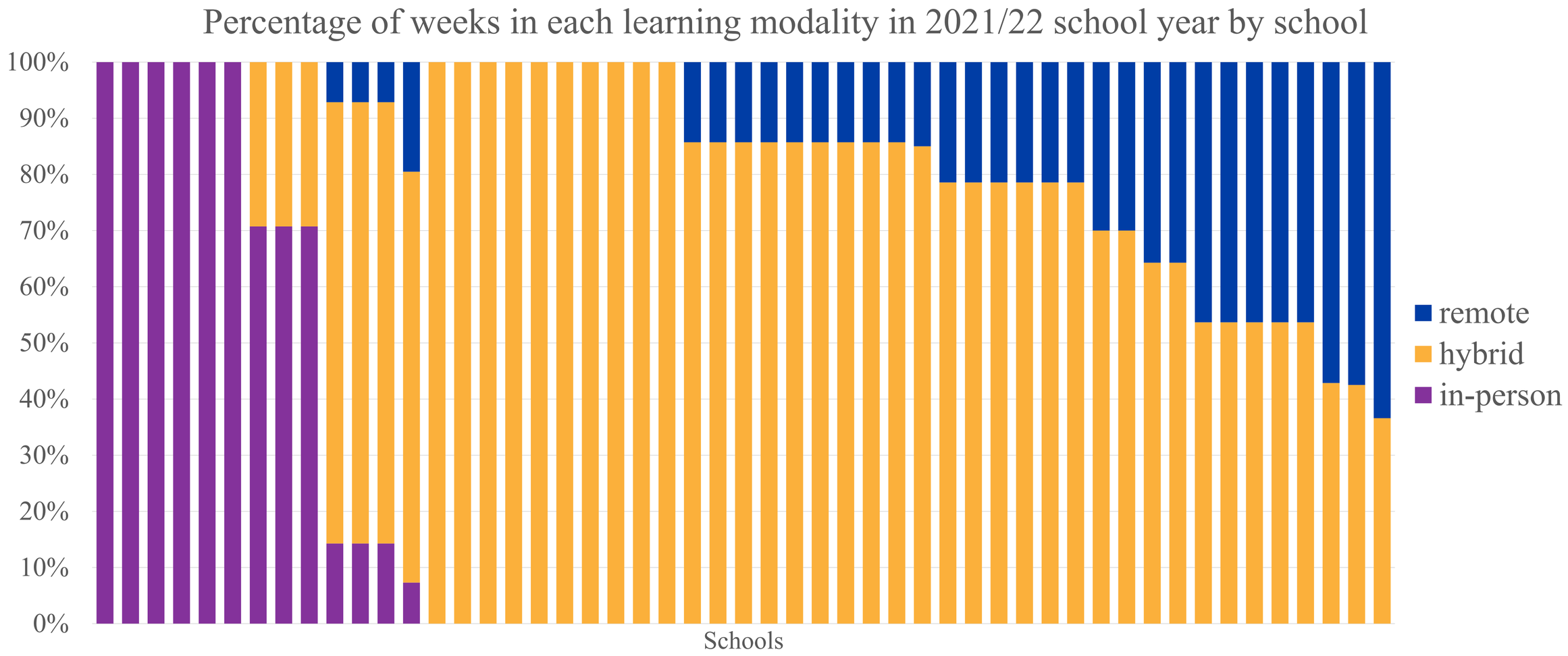
Sample: Schools in the analysis samples are somewhat different than other schools in Pennsylvania

Comparing to other schools in the state (in 2018/19), schools in the main analysis sample for research question 3 (for both the student sample and for the teacher/adult sample):

- Had fewer Asian/Pacific Islander, Black, and Hispanic students
- Had more White students
- Had fewer students eligible for free or reduced-price lunch
- Were less likely to be in an urban setting



Most schools in the analysis samples* spent most of 2020/21 in hybrid learning, but some schools had large shares of in-person or remote



*Sample includes schools in either the student or teacher sample

Methods: Testing the relationship between school climate and modality

- Used regression models to understand the relationship between learning modalities used in 2020/21 and school climate in the subsequent year (2021/22), adjusting for 2018/19 school climate
  - School climate measures include an index and 3 domain scores for students and teachers (Findings for adults very similar to teachers, so only reporting results for teachers)
  - Because learning modality data measured at the district level, we aggregated school climate scores for the schools in the sample to the district level by taking a simple average and then ran regressions at the district level

- Details on regression models can be found in the accompanying technical appendix

Finding: For students and teachers, school climate in 2021/22 was not associated with learning modalities used in 2020/21 in this sample of schools

- Did not find any relationship between learning modality and school climate for either teachers or students for any school climate measure, either in the overall index or in any of the domains.

- Sample size is small, making it difficult to detect relationships; but can rule out a very large relationship between learning modality and school climate scores.
  - Scaled school climate scores range from 1 to 99.
  - Analyses show that increasing the percentage of the year spent in in-person instruction by 10 percentage points is unlikely to move student school climate scores more than +/- 2.7 scaled score points or teacher scores by more than +/- 1.0 scaled score points.

Implications

- The association between school climate in 2021/22 and learning modality in 2020/21 (controlling for school climate in 2018/19) does not appear to be very large, at least among these schools. However, larger sample size is needed to get a more precise estimate. A small or moderate relationship is possible.
- Increasing the number of schools completing surveys in multiple years will allow PDE to conduct more informative analyses on the relationship between school climate and other factors (such as school policies or programs) in the future

Limitations and recommendations

Limitations (1 of 2)

- This analysis of differences in school climate over time is descriptive and **not causal**
  - Results do not show the *effect* of COVID-19 or related policies, such as learning modality, on school climate
- Schools in our analysis samples are small and not representative of schools in the state. Results from these analyses may not apply to all schools in Pennsylvania.
- Because not all respondents in a school take the survey, school climate scores necessarily miss some respondents' views. For students, nonresponse weights help to address this, but cannot account for all potential differences between respondents and non-respondents.

Limitations (2 of 2)

- Learning modality data from R2L were collected at the district, rather than school, level
  - Learning modality can vary within district; for example, in an alternative survey, 31% of districts surveyed reported that students in grades 6-8 were in-person during the first 30 days of school, while only 25% of districts surveyed reported that students in grades 9-12 were in-person.
  - Aggregating learning modality across schools that may have different modalities can introduce measurement error in the learning modality measure, making it harder to detect a relationship between modality and school climate and introducing bias to the estimate.
- Learning modality data's hybrid learning category includes some schools that are predominantly remote and some that are predominantly in-person
  - Makes it harder to understand relationship between remote, hybrid, and in-person instruction when hybrid in some districts may include schools that are mostly remote and in other districts it refers to school that are mostly in-person

Recommendation: Expand participation in the school climate survey

- Increasing the number of schools fielding the survey annually will:
  - Allow PDE to set benchmarks for favorable or less favorable school climate ratings in reports based on a more representative set of schools
  - Allow PDE to make comparisons of school climate in the state over time for schools that take the survey in multiple years
  - Allow individual schools to track their own trends in school climate over time
  - Enable schools and districts to assess the relationship between new policies and school climate perceptions over time

- Increasing response rates within schools will help ensure school climate scores are representative of the school population

To get **more schools to participate,** consider:

- Clearly demonstrating the value of participating (e.g., providing useful reports and more support to interpret them)
- Shifting from voluntary participation to mandatory participation (as in Maryland)
- Keeping participation voluntary but increasing the incentives for participation

Questions

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Appendix A: Additional analyses for Research Question 1

Most initial models demonstrated poor fit across all respondents and school years

Statistic	Suggested	Year	MS survey	HS survey	Classroom teacher survey	Non-instructional staff survey
CFI	≥ 0.90	2016/17	0.769	0.738	0.711	0.719
		2017/18	0.773	0.719	0.708	0.764
		2018/19	0.785	0.725	0.711	0.742
		2020/21	0.793	0.780	0.702	0.740
		2021/22	0.778	0.736	0.751	0.806
TLI	≥ 0.90	2016/17	0.756	0.723	0.695	0.701
		2017/18	0.760	0.703	0.692	0.748
		2018/19	0.773	0.709	0.695	0.726
		2020/21	0.781	0.768	0.686	0.723
		2021/22	0.765	0.721	0.737	0.793
RMSEA	< 0.05 – 0.08	2016/17	0.065	0.076	0.081	0.094
		2017/18	0.066	0.081	0.081	0.086
		2018/19	0.064	0.078	0.081	0.088
		2020/21	0.066	0.080	0.083	0.087
		2021/22	0.066	0.079	0.080	0.082

MS = middle school; HS = high school

Note: Gray shading indicates that threshold is not met.

Removed survey items with less than 0.40 factor loadings for the revised/final models

Respondent	Domain	Survey item
Middle school student survey	SSAE	**Mq53cnsl:** A counselor at this school has helped me plan for life after high school.
	SRSC	**Mq18sthm:** I sometimes stay home because I don't feel safe at school.
		Mq19sfos: How safe do you feel outside around the school?
		Mq21sfcs: How safe do you feel in your classes?
High school student survey	SSAE	**Hq54advw:** When students in this school already know the material that is being taught, the teacher gives them more advanced assignments.
Classroom teacher survey	SSAE	**Sq40shid:** I encourage students to share their ideas about things we are studying in class.
		Sq43care: I really care about my students.
		Sq44mkup: I help my students make up work after an excused absence.
		Sq45fdbk: I give my students feedback on class assignments that helps improve their work.
		Sq46acom: I provide accommodations to students who need them.
		Sq48chwk: I believe all students can do challenging school work
Non-instructional staff survey	SRSC	**Sq19sfos:** How safe do you feel outside around the school?
		Sq21sfcs: How safe do you feel in classroom or work area?

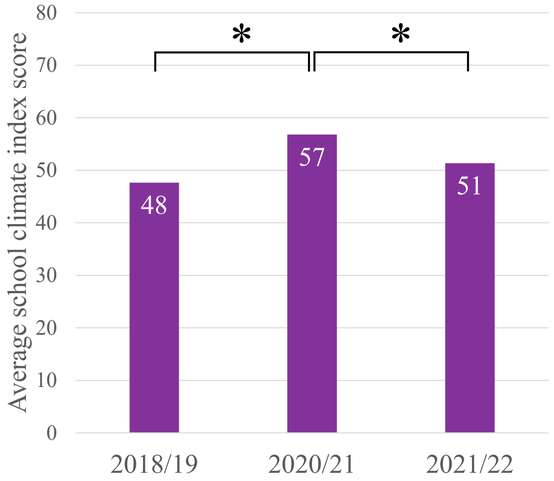
SSAE = student support and academic engagement; SRSC = safe and respectful school climate

Appendix B: Additional analyses for Research Question 2

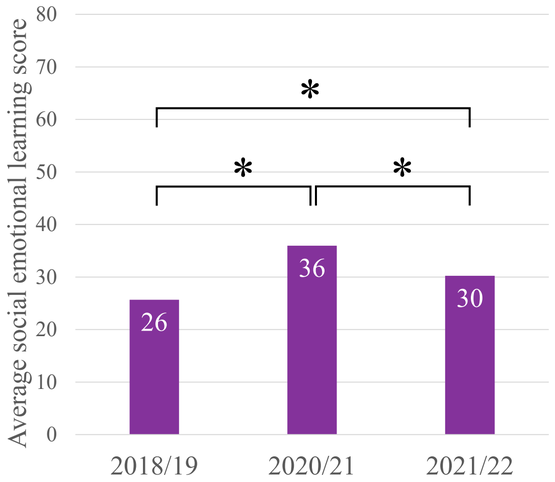
Perceptions of school climate in 2018/19, 2020/21, and 2021/22 for adults

Matching the findings for teachers, **adults**' perceptions of school climate increased from 2018/19 to 2020/21 and decreased from 2020/21 to 2021/22 for overall school climate, social emotional learning, and safe and respectful school climate, but did not change for student support and academic engagement.

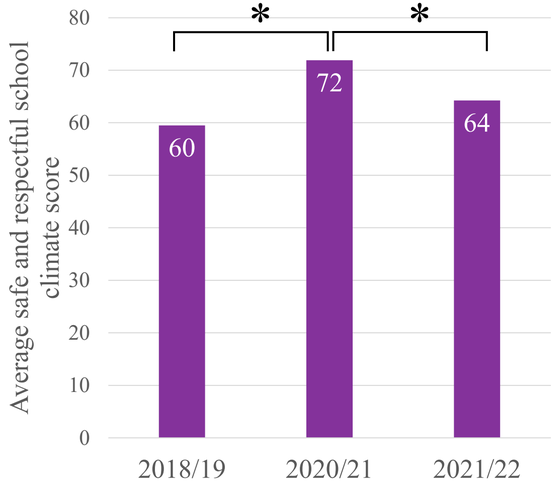
Change in **adults'** perceptions of overall school climate



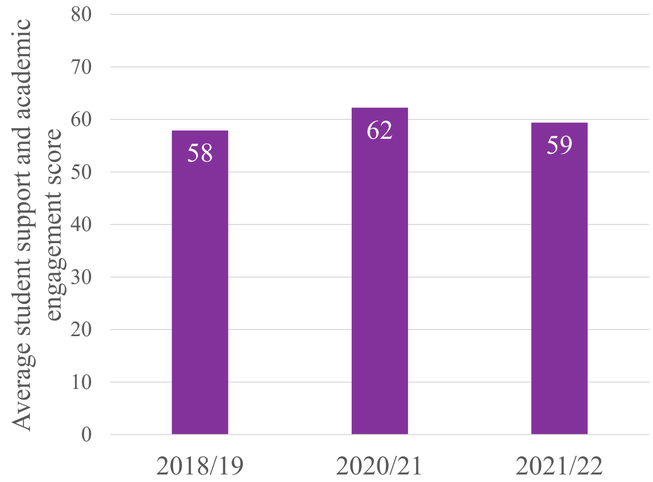
Change in **adults'** perceptions of social emotional learning



Change in **adults'** perceptions of safe and respectful school climate



Change in **adults'** perceptions of student support and academic engagement

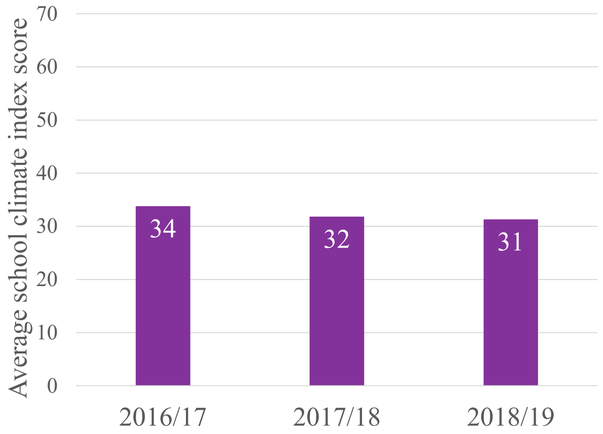


* indicates *p*-values < .05, N = 28 schools

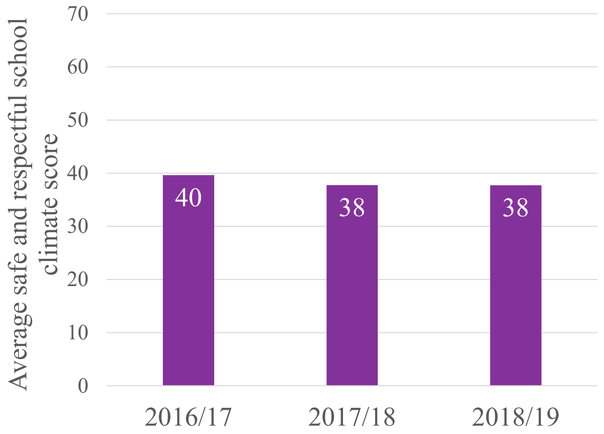
Perceptions of school climate in the pre-COVID years (2016/17, 2017/18, and 2018/19) for students and teachers

No evidence of difference in **students'** perceptions of school climate (overall or individual domains) 2016/17 to 2018/19 (comparing each pair), except for social emotional learning, which was more favorable in 2016/17 compared to 2018/19.

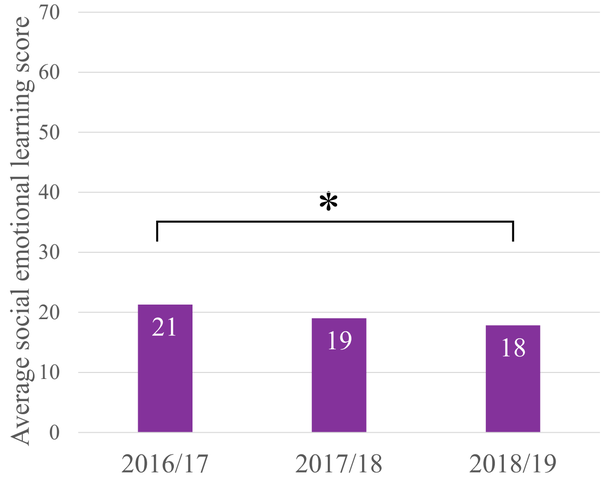
Change **students'** perceptions of overall school climate



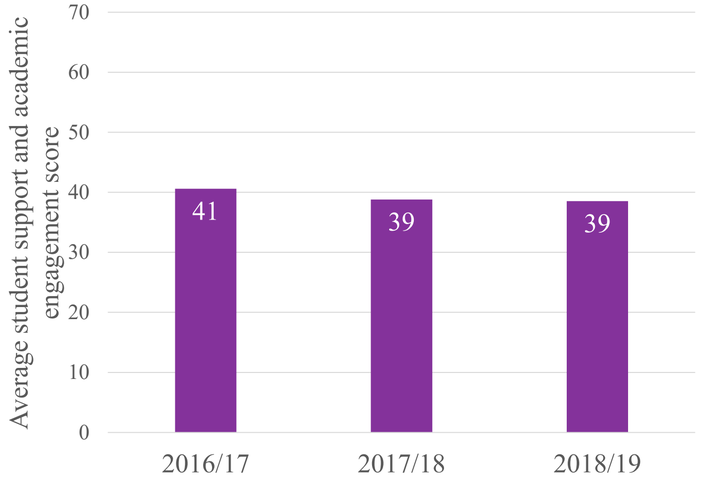
Change in **students'** perceptions of safe and respectful school climate



Change in **students'** perceptions of social emotional learning



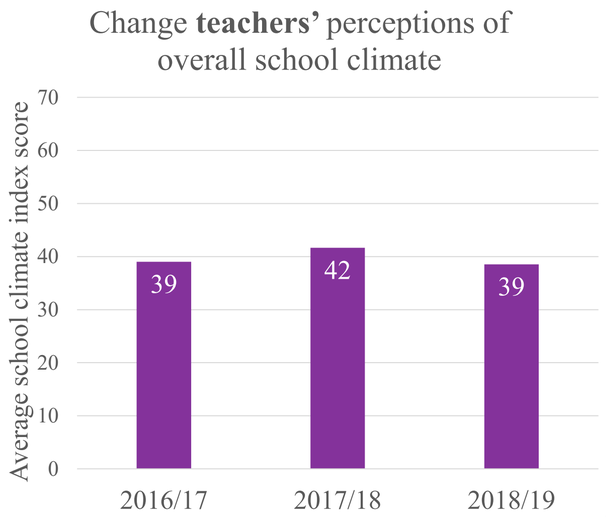
Change in **students'** perceptions of student support and academic engagement

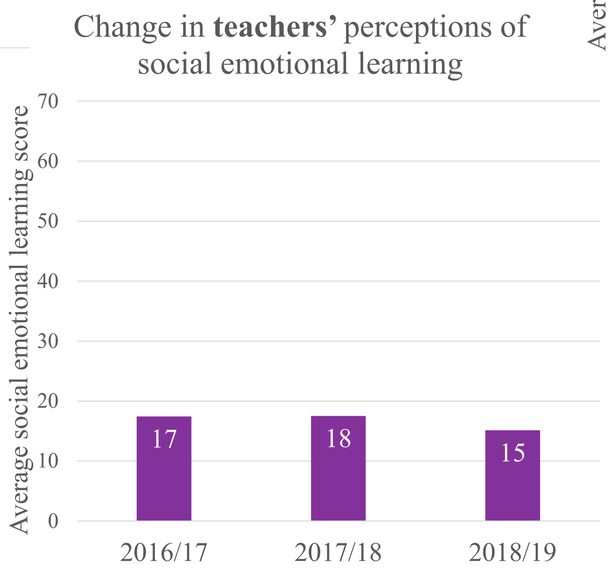


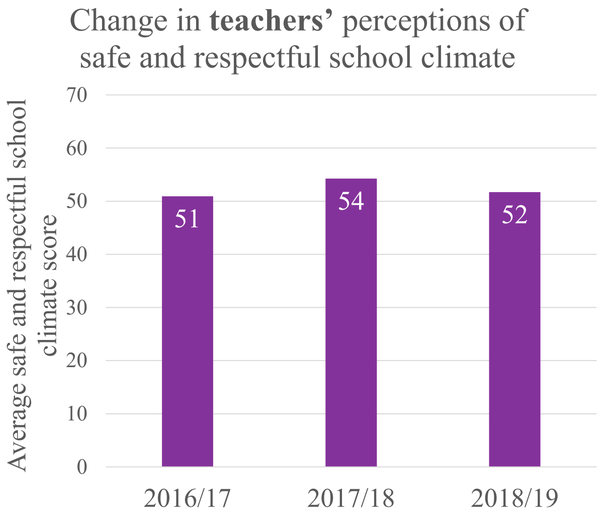
IES Institute of Education Sciences

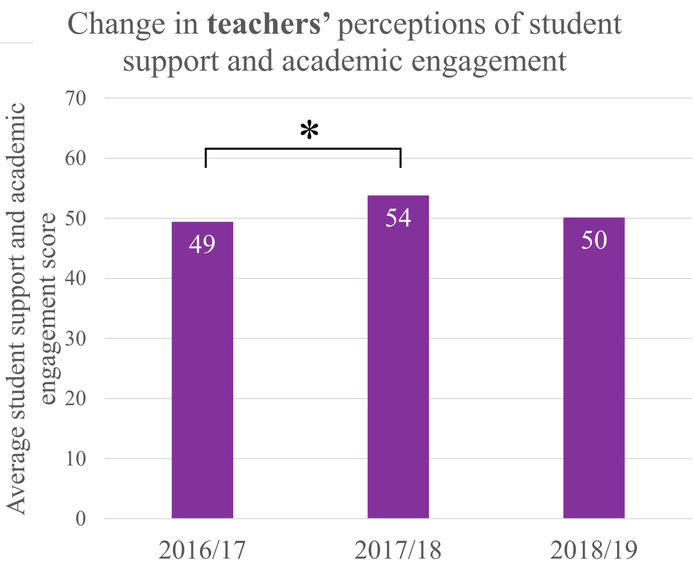
* indicates *p*-values < .05, N = 28 schools

No evidence of difference in **teachers'** perceptions of school climate (overall or individual domains) 2016/17 to 2018/19 (comparing each pair), except for student support and academic engagement, which was more favorable in 2017/18 compared to 2016/17.





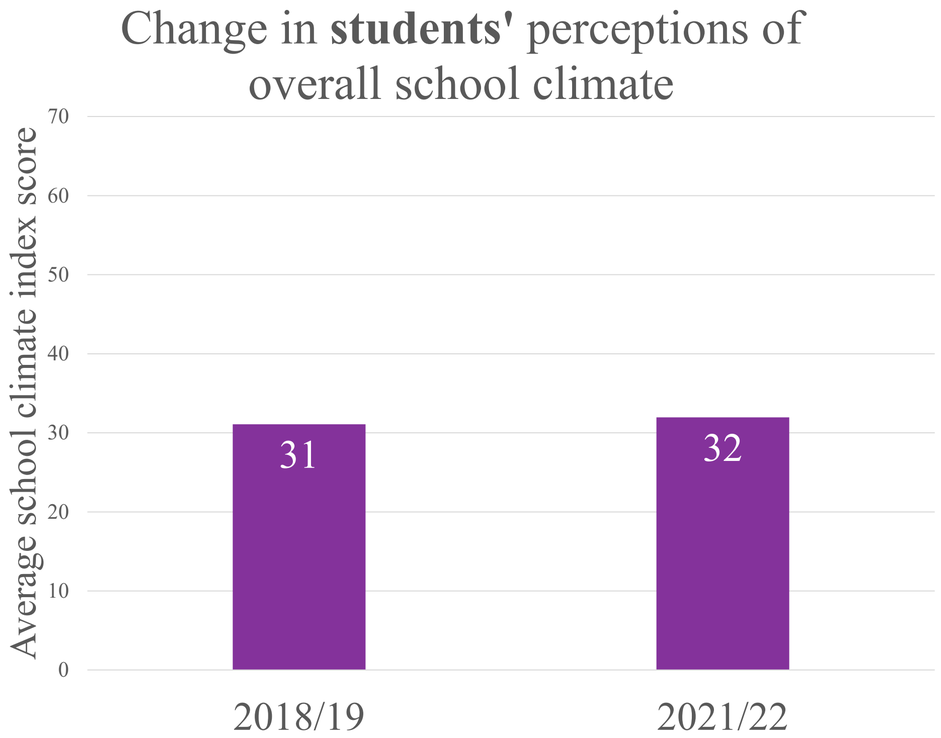




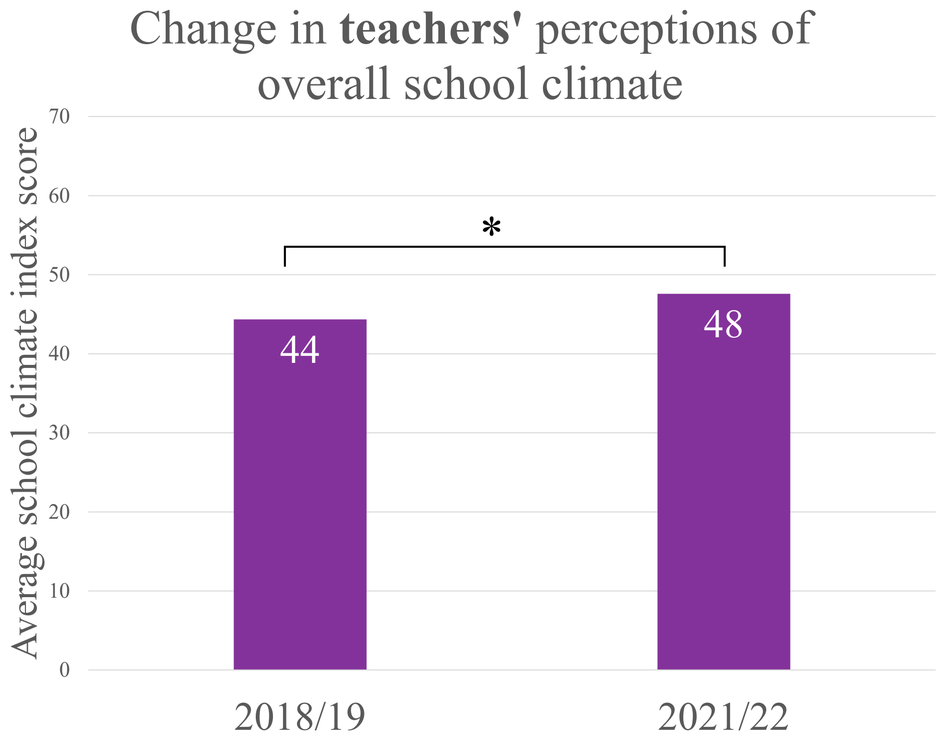
* indicates *p*-values < .05, N = 28 schools

Perceptions of school climate in 2018/19 and 2021/22 for a larger sample of schools

In a larger sample of schools with data in 2018/19 and 2021/22, no evidence of a difference in **students' perceptions of overall school climate** between 2018/19 and 2021/22, but **teachers' perceptions were more favorable** in 2021/22 than in 2018/19

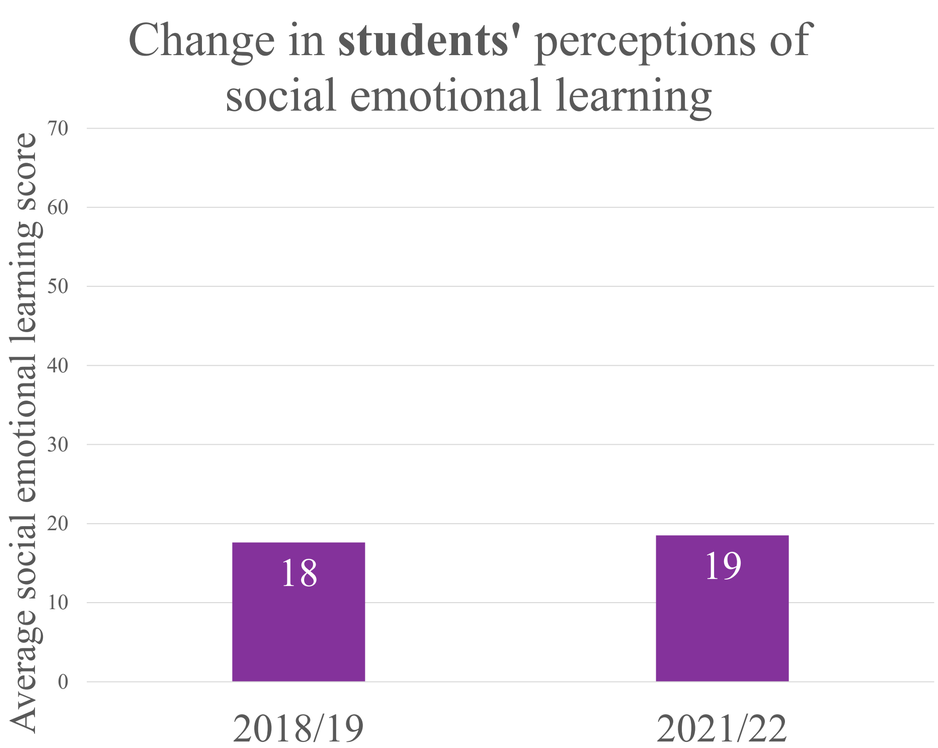


* indicates *p*-values < .05, N = 30 schools

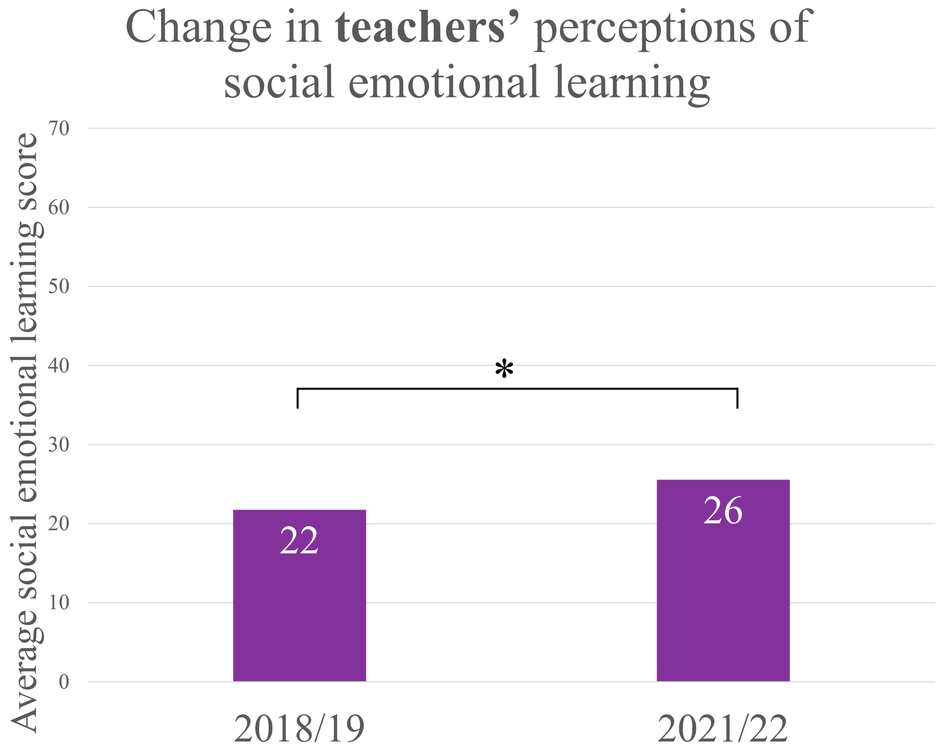


* indicates *p*-values < .05, N = 52 schools

In a larger sample of schools with data in 2018/19 and 2021/22, no evidence of a difference in **students' perceptions of students' social emotional learning** between 2018/19 and 2021/22, but teachers' perceptions were more favorable in 2021/22 than in 2018/19



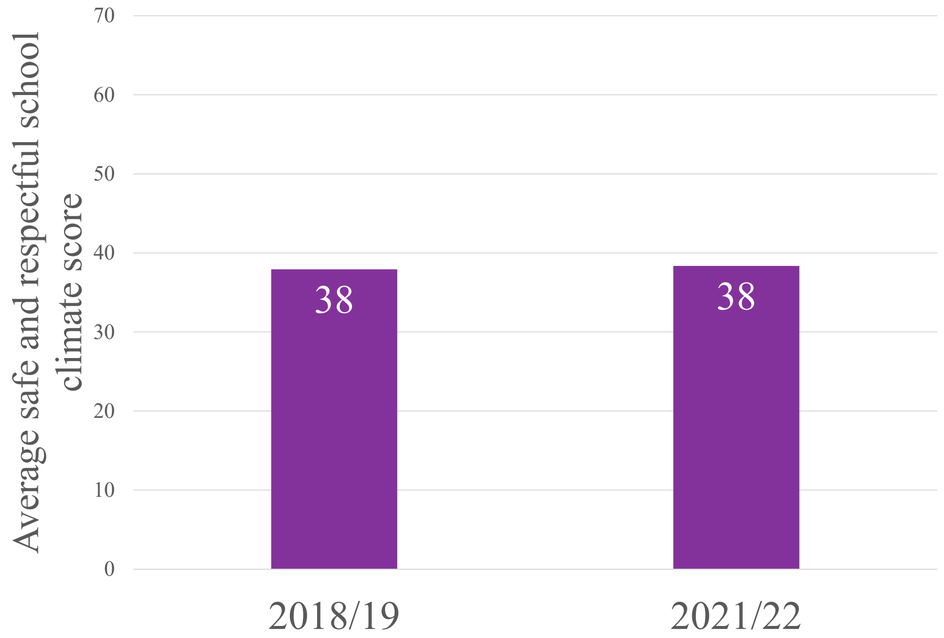
* indicates *p*-values < .05, N = 30 schools



* indicates *p*-values < .05, N = 52 schools

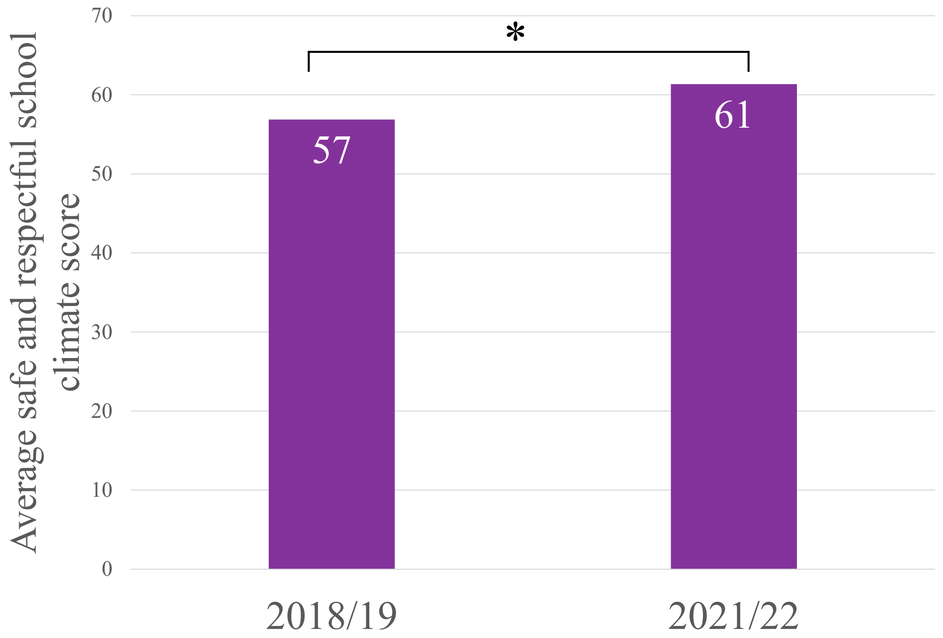
In a larger sample of schools with data in 2018/19 and 2021/22, no evidence of a difference in **students' perceptions of safe and respectful school climate** between 2018/19 and 2021/22, but teachers' perceptions were more favorable in 2021/22 than in 2018/19

Change in **students'** perceptions of safe and respectful school climate



* indicates *p*-values < .05, N = 30 schools

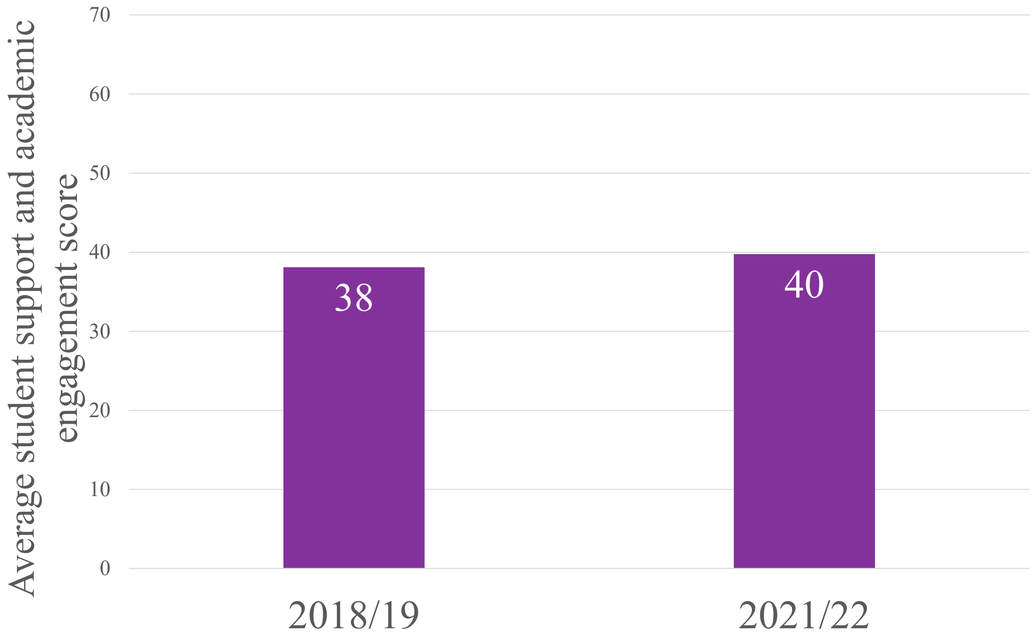
Change in **teachers'** perceptions of safe and respectful school climate



* indicates *p*-values < .05, N = 52 schools

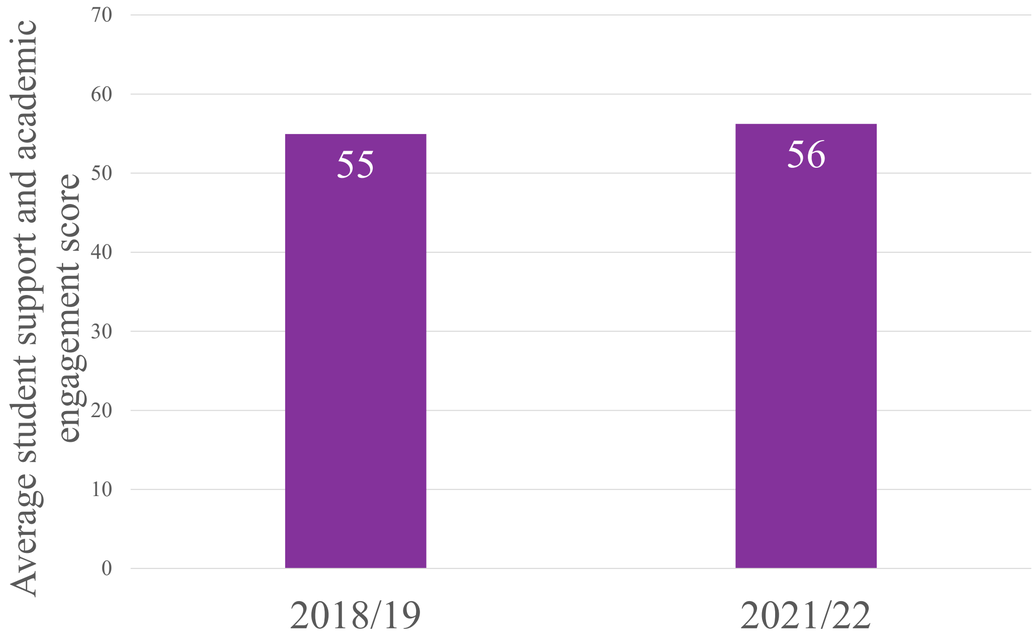
In a larger sample of schools with data in 2018/19 and 2021/22, no evidence of a difference in **students' or teachers' perceptions of student support and academic engagement** between 2018/19 and 2021/22

Change in **students'** perceptions of student support and academic engagement



* indicates *p*-values < .05, N = 30 schools

Change in **teachers'** perceptions of student support and academic engagement



* indicates *p*-values < .05, N = 52 schools

Appendix C: Additional analyses for Research Question 3

Measuring learning modalities

- Mathematica had conducted a survey that, in part, collected data on LEAs' use of different learning modalities in 2020/21
- Mathematica survey covers fewer schools than the R2L tracker, but we wanted to assess consistency between both sources for districts in Pennsylvania with data from both sources.
- Percentage of districts using fully remote instruction is similar across both sources (differences of less than 10 percentage points), but large differences (up to 38 percentage points) between the two sources for the percentage of districts using in-person instruction. Likely due to differences in how both sources define "hybrid".
- Both sources report declines in remote learning and increases in in-person instruction from the start to the end of the school year

Average district-level reported modality use across the 2020/21 school year by data source

		First 30 days			30 days after winter break			Last 30 days		
Dataset	Number of districts	Percent of districts in-person	Percent of districts hybrid	Percent of districts remote	Percent of districts in-person	Percent of districts hybrid	Percent of districts remote	Percent of districts in-person	Percent of districts hybrid	Percent of districts remote
R2L	134	13	57	30	12	72	16	27	72	2
Mathematica survey grades 3–5	133*	41	23	36	41	32	23	65	31	2
Mathematica survey grades 6-8	133*	31	31	38	28	42	26	56	40	2
Mathematica survey grades 9-12	134	25	36	39	22	48	26	50	45	2

*One school district only reported serving high schools in the Mathematica survey.

Regression models used to estimate the relationship between school climate and learning modality

Model 1 (remote learning): $y_d = \phi + R_d\theta_1 + C_d\,\gamma + \epsilon_d$

Model 2 (in-person learning): $y_d = \phi + P_d\theta_2 + C_d\,\gamma + \epsilon_d$

Model 3 (remote and hybrid learning): $y_d = \phi + R_d\theta_1 + H_d\theta_3 + C_d\,\gamma + \epsilon_d$

R_d: Percentage of 2020/21 school year in remote learning in district d

H_d: Percentage of 2020/21 school year in hybrid learning in district d

P_d: Percentage of 2020/21 school year in in-person learning in district d

C_d: Average school climate score in the 2018/19 school year for schools in the sample in district d

y_d: Average school climate score in the 2021/22 school year for schools in the sample in district d

Neither students' nor teachers' perceptions of overall school climate in 2021/22 were associated with learning modalities used in 2020/21

For students

(1) % Remote: Coef. = -0.08, $SE = 0.14$, $p = .56$

(2) % In-person: Coef. = 0.05, $SE = 0.10$, $p = .62$

(3) % Remote + Hybrid: Coef.$_R$ = -0.10, $SE_R = 0.16$, $p_R = .54$

% Remote + Hybrid: Coef.$_H$ = 0.00, $SE_H = 0.11$, $p_H = .74$

For teachers

(1) % Remote: Coef. = 0.03, $SE = 0.11$, $p = .83$

(2) % In-person: Coef. = 0.00, $SE = 0.05$, $p = .93$

(3) % Remote + Hybrid: Coef.$_R$ = 0.02, $SE_R = 0.11$, $p_R = .83$

% Remote + Hybrid: Coef.$_H$ = 0.00, $SE_H = 0.05$, $p_H = .99$

Neither students' nor teachers' perceptions of students' social emotional learning in 2021/22 were associated with learning modalities used in 2020/21

For students

(1) % Remote: Coef. = -0.03, $SE = 0.15$, $p = .85$

(2) % In-person: Coef. = -0.01, $SE = 0.09$, $p = .94$

(3) % Remote + Hybrid: $\text{Coef.}_R = -0.03$, $SE_R = 0.16$, $p_R = .87$

% Remote + Hybrid: $\text{Coef.}_H = 0.00$, $SE_H = 0.10$, $p_H = 1$

For teachers

(1) % Remote: Coef. = 0.02, $SE = 0.07$, $p = .74$

(2) % In-person: Coef. = 0.04, $SE = 0.05$, $p = .44$

(3) % Remote + Hybrid: $\text{Coef.}_R = 0.00$, $SE_R = 0.08$, $p_R = .99$

% Remote + Hybrid: $\text{Coef.}_H = -0.05$, $SE_H = 0.05$, $p_H = .36$

Neither students' nor teachers' perceptions of safe and respectful school climate in 2021/22 were associated with learning modalities used in 2020/21

For students

(1) % Remote: Coef. = -0.10, *SE* = 0/19, *p* = .62

(2) % In-person: Coef. = 0.12, *SE* = 0.19, *p* = .54

(3) % Remote + Hybrid: Coef._R = -0.15, SE_R = 0.24, p_R = .54

% Remote + Hybrid: Coef._H = -0.11, SE_H = 0.20, p_H = .58

For teachers

(1) % Remote: Coef. = 0.00, *SE* = 0.15, *p* = 1

(2) % In-person: Coef. = -0.04, *SE* = 0.04, *p* = .39

(3) % Remote + Hybrid: Coef._R = 0.02, SE_R = 0.14, p_R = .89

% Remote + Hybrid: Coef._H = 0.04, SE_H = 0.05, p_H = .47

Neither students' nor teachers' perceptions of student support and academic engagement in 2021/22 were associated with learning modalities used in 2020/21

For students

(1) % Remote: Coef. = -0.06, SE = 0.07, p = .43

(2) % In-person: Coef. = 0.02, SE = 0.03, p = .44

(3) % Remote + Hybrid: Coef.$_R$ = -0.06, SE_R = 0.06, p_R = .37

% Remote + Hybrid: Coef.$_H$ = -0.01, SE_H = 0.04, p_H = .90

For teachers

(1) % Remote: Coef. = 0.01, SE = 0.11, p = .92

(2) % In-person: Coef. = 0.00, SE = 0.05, p = .93

(3) % Remote + Hybrid: Coef.$_R$ = 0.01, SE_R = 0.11, p_R = .92

% Remote + Hybrid: Coef.$_H$ = 0.00, SE_H = 0.05, p_H = .96

Understanding the relationship between learning modality and the school climate index: None of the relationships are statistically significant, but the confidence intervals show that the relationships are unlikely to be very large.

- For example, a 10 percentage point increase in the percentage of the year spent in in-person learning is unlikely (based on the confidence interval) to increase or decrease scores by more than 2.7 scale score points.

A 10 percentage point increase in the percentage of the year spent in the listed learning modality was associated with…:

	Student school climate index		**Teacher school climate index**	
	Estimated change in scale score points	Confidence interval on estimated change in scale score points	Estimated change in scale score points	Confidence interval on estimated change in scale score points
Remote learning	-0.8 points	[-3.9 to 2.2]	0.3 points	[-2.1 to 2.6]
In-person learning	0.5 points	[-1.7 to 2.7]	0.0 points	[-1.0 to 1.0]