

Remote Schooling Depresses Grades For The Most Vulnerable

Maria Bartlett¹, Benjamin Lira², Tim Kautz¹, and Angela Duckworth²

¹Mathematica

²University of Pennsylvania

Several quasi-experimental studies have documented the adverse impact of remote schooling on standardized test scores—but none have examined report card grades. We capitalized on data from a large, demographically diverse district whose families chose remote or in-person schooling for the 2020-21 academic year. Controlling for prior grades and demographic covariates, students who attended school remotely saw their grades decline steadily relative to classmates who attended school in-person, recovering the following year when all students attended school in-person. Notably, declines in GPA during remote schooling were steepest for students who were Black, Hispanic, male, underachieving, or from low-income families.

Keywords: Remote Schooling, Student Achievement, Moderation Analyses

How harmful is remote schooling to student performance—and whom does it harm the most? Now that the vast majority of American students have returned to in-person schooling, it may seem like remote schooling is no longer policy-relevant. However, at present, one out of three large U.S. school districts continues to offer students the remote learning options they developed in response to the pandemic (Bamberger, 2022). Moreover, now that districts have set a precedent of remote schooling, the practice could be reinstated in the event of future public health emergencies or even as a convenience (e.g., during inclement weather).

Quasi-experimental studies have linked remote schooling during the COVID-19 pandemic to lower standardized test scores in reading and, to an even greater extent, in mathematics (Goldhaber et al., 2022; Halloran et al., 2021; “NAEP Mathematics: Mathematics Highlights 2022”, 2022). Analyses suggest that the nation’s most vulnerable students were not only more likely to spend the most time in remote schooling but also to suffer the greatest learning loss as a result—whether vulnerability is indexed by ethnicity and race or by family income (Goldhaber et al., 2022; Halloran et al., 2021).

While evidence to date paints a consistently negative picture of remote schooling and achievement test outcomes, several limitations suggest the need for additional inquiry. First, studies have so far only compared remote and in-person schooling at the school-level. This leaves open the possibil-

ity that third-variable confounds inclining a district or state to choose one modality or the other account for the observed relationships. Second, data on annual standardized tests does not permit a fine-grained analysis of the temporal dynamics of remote schooling. If remote schooling causally impairs learning, we would expect to see progressive learning loss from marking period to marking period. Third, standardized tests are not the only valid indicator of student achievement. By comparison, report card grades better reflect student effort and engagement and are more prognostic of long-term outcomes, including college graduation Galla et al., 2019. Finally, extant research is silent on the question of what sort of families choose remote schooling when given the option.

In this investigation, we address these limitations using data from a large and diverse school district that asked students and families to choose between remote and in-person schooling. See Supplementary Materials for details. We used quarterly student transcript data ($N = 9,912$) for three full academic years: In 2019-20, all students attended school in-person for the first three marking periods; during the fourth marking period, all students attended school remotely. In 2020-21, students were given a choice of learning modality for the academic year. In 2021-22, all students returned to in-person schooling. (To avoid missing data, we report the results of analysis on students who were in grades 8, 9, 10 during the 2019-20 school year. In Supplementary Materials, we show that findings are robust when including sixth and seventh grade students, for whom certain demographic variables were missing in data received from the district. To account for multiple comparisons, we use a two-tailed p -value $< .01$ as a threshold for statistical significance.)

Were more vulnerable students more likely to choose to learn remotely during 2020-21? No. In our sample, 44.8% ($n = 4,439$) students attended school remotely, and

 Benjamin Lira

Correspondence concerning this article should be addressed to Benjamin Lira, Psychology Department, University of Pennsylvania, 425 S. University Avenue, Philadelphia, PA, 19104. E-mail: blira@upenn.edu

55.2% ($n = 5,473$) of students attended school in-person. As shown in Table S1, students who opted for remote schooling were more likely to be female, Asian, an English Language Learner, from a home where the primary language was neither English or Spanish, or in ninth or tenth (as opposed to eighth) grade. Notably, students who opted for remote schooling in 2020-21 had earned higher report card grades than their classmates the prior year, and as shown in **Figure 1**, this difference was not only still evident when controlling for all demographic covariates, it steadily widened each marking period in 2019-20.

On one hand, non-equivalence of remote versus in-person students is a threat to the validity of comparisons between these two groups. In particular, we can only speculate as to the unobserved characteristics that account for the steady upward trajectory of students who opted for remote schooling. On the other hand, insofar as one might expect this trend to continue in 2020-21, any observed negative effects during that year are likely to be conservative.

As shown in **Figure 1**, students in remote schooling saw monotonic decreases in their GPA during each marking period of the 2020-21 school year, relative to their in-person peers. When reunited with other students for in-person schooling in 2021-22, these students recovered their advantage. Detailed analyses and robustness checks are included in Supplementary Materials.

As shown in **Figure 2**, the drop in report card grades during remote-schooling in 2020-21 was steeper for more vulnerable students. Specifically, declines were steepest for students who were Black, Hispanic, male, or from low-income families, or whose GPAs were below-median the prior year. The following year, these vulnerable groups benefited more from the return to universal in-person schooling. In contrast, the magnitude of losses and gains was similar for math and English language arts classes, as shown in Tables V.3 and V.4 in Supplementary Materials.

Three limitations of this investigation are worth highlighting. First and foremost, without random-assignment to condition, strong causal inferences are not warranted. Second, and relatedly, our data do not offer an explanation for the lack of baseline equivalence between remote versus in-person stu-

dents. We can only speculate as to why certain families opted one schooling modality over the other and why higher-achieving students were more likely to opt for remote schooling, even when controlling for all measured demographic covariates. Finally, because our data are from a single school district, there are limits to the external validity of our results. It is difficult to know for certain whether our findings would replicate in other school districts subject to different pressures and affordances.

Notwithstanding these limitations, our results strongly suggest that remote schooling undermines school performance as measured by report card grades—despite the families of these students opting into remote learning voluntarily. The association between remote schooling and declining grades did not vary by academic subject but was markedly greater for the most vulnerable students.

References

- Bamberger, C. (2022). 1/3 of nation's largest school districts to keep remote learning option from COVID. *New York Post*. Retrieved February 2, 2023, from <https://nypost.com/2022/08/29/1-3-of-nations-largest-school-districts-to-keep-remote-learning-option-from-covid/>
- Galla, B. M., Shulman, E. P., Plummer, B. D., Gardner, M., Hutt, S. J., Goyer, J. P., D'Mello, S. K., Finn, A. S., & Duckworth, A. L. (2019). Why high school grades are better predictors of on-time college graduation than are admissions test scores: The roles of self-regulation and cognitive ability [Publisher: American Educational Research Association]. *American Educational Research Journal*, 56(6), 2077–2115. <https://doi.org/10.3102/0002831219843292>
- Goldhaber, D., Kane, T. J., McEachin, A., Morton, E., Patterson, T., & Staiger, D. O. (2022). The Consequences of Remote and Hybrid Instruction During the Pandemic.
- Halloran, C., Jack, R., Okun, J., & Oster, E. (2021). *Pandemic Schooling Mode and Student Test Scores: Evidence from US States* (tech. rep. w29497). National Bureau of Economic Research. Cambridge, MA. <https://doi.org/10.3386/w29497>
- NAEP Mathematics: Mathematics Highlights 2022. (2022). Retrieved January 27, 2023, from <https://www.nationsreportcard.gov/highlights/mathematics/2022/>

Figure 1

Adjusted Differences Between Remote and In-Person Students Controlling for Demographics

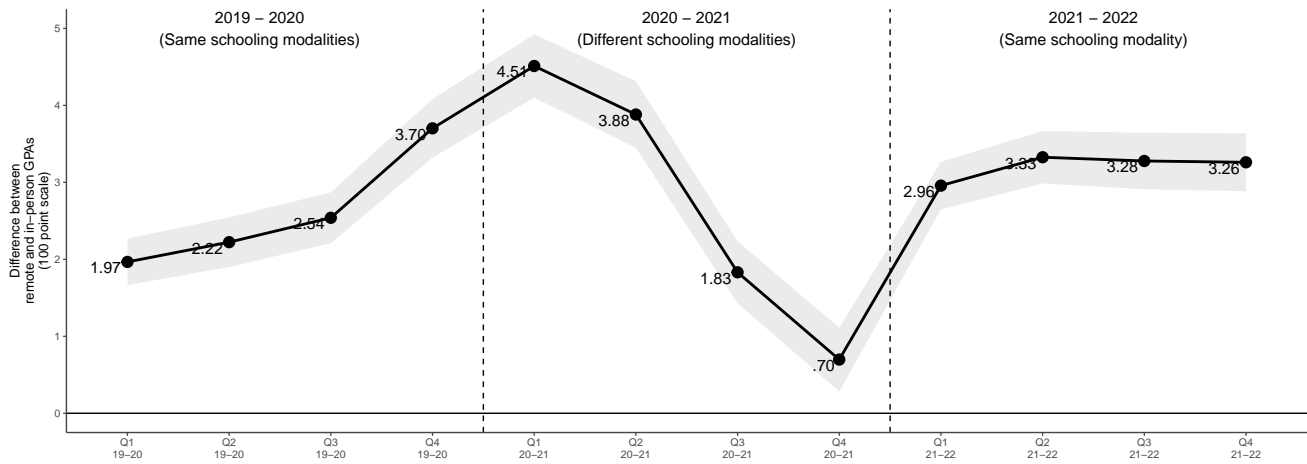
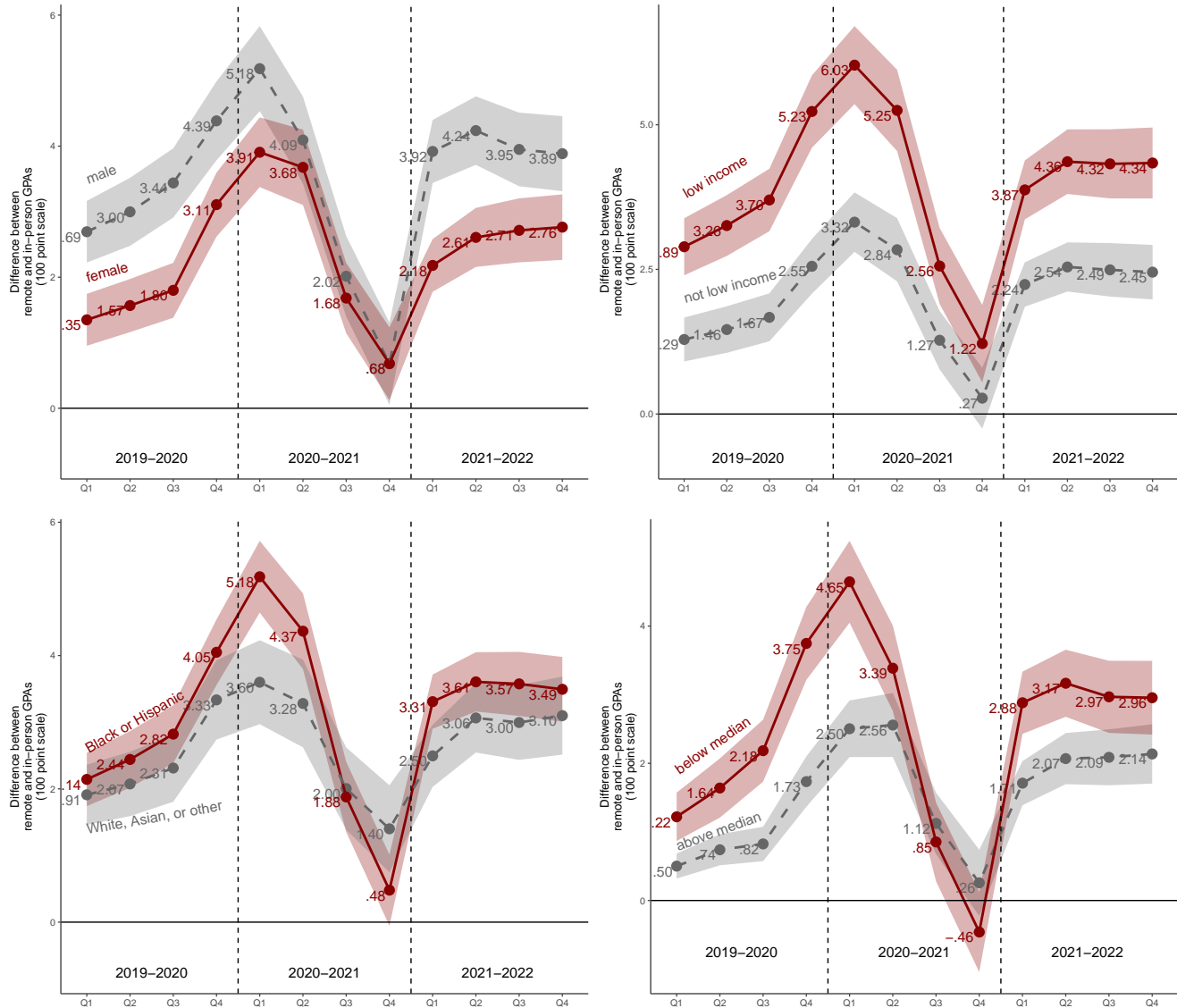


Figure 2

Adjusted Differences Between Remote and In-Person Students Controlling for Demographics for Vulnerable and Non-Vulnerable Groups.



Supporting Online Material for Remote Schooling Depresses Grades for The Most Vulnerable

Authors: Maria E. Bartlett*, Benjamin Lira*, Tim Kautz, Angela L. Duckworth

Corresponding author: Benjamin Lira, blira@sas.upenn.edu

This file includes:

Method	2
Participants and Procedure.....	2
Analytic Strategy	2
Results	3
Section I. Main table	4
Table I	4
Section II. Moderation analyses.....	5
Table II.1	5
Table II.2	6
Table II.3	7
Table II.4	8
Table II.5	9
Table II.6	10
Table II.7	11
Table II.8	12
Section III: Baseline Equivalence and Marginal Effects.....	13
Table III.1	13
Table III.2	15
Section IV: Pairwise comparisons for subgroups with three or more levels	16
Table IV.1	16
Table IV.2.....	17
Table IV.3.....	19
Section V: Sensitivity Checks	20
Table V.1	20
Table V.2.....	21
Table V.3.....	22
Table V.4.....	23

Method

Participants and Procedure

All data for this investigation were collected from Orange County District Public Schools by the Character Lab Research Network (CLRN). We obtained students' course grades from school records and calculated GPAs in a 0-100 scale.

Our main sample comprised 9,912 students in 8th, 9th, and 10th grade in the 2019-20 school year.

As a robustness check, we repeated analyses with a larger sample ($N = 20,951$) that also included sixth and seventh grade students, for whom the only demographic variables available in data received from the district were grade, gender, race/ethnicity, and baseline GPA.

Analytic Strategy

At each time point over the 3 academic years of this investigation, we estimated an ordinary least squares (OLS) model to estimate the difference in GPAs of students attending remotely vs. in-person in 2020-21 when accounting for baseline GPA, demographics, and fixed effects for each school:

$$Y_{ist} = \alpha + \beta \times InPerson_{is} + \gamma \times X_{is} + \nu_s + \epsilon_{ist}$$

Where Y_{ist} is the GPA of student i in school s during time period t , β is the estimated advantage of attending school in-person, $InPerson_{is}$ is an indicator for whether a student attended school in person during the 2020-2021 academic school year, X_{is} is a vector of control covariates, including GPA for the 2019-20 school year, grade, gender, race/ethnicity, eligibility for free or reduced-price lunch, English language learner status, special education student status, home language, and baseline GPA, ν_s is a school fixed effect, and ϵ_{ist} is an error term. Reported standard errors were corrected for heteroskedasticity with the Huber-White sandwich estimator.

To estimate moderation effects, we fit a series of models with interaction terms with the *InPerson* indicator. For grade level, gender, race/ethnicity, eligibility for free or reduced-price meals, English language learner status, special education student status, and home language, we included a moderation term between *InPerson* and each level of the moderator. For baseline GPA, we dichotomized the variable as students at or above the median and students below the median and interacted this dichotomous variable with the *InPerson* indicator.

Results

We present five sections of tables to substantiate our results.

Section I includes regression results from our main specification.

Section II presents moderations analyses, showing the effect of remote schooling on report card grades by grade, gender, race/ethnicity, eligibility for free or reduced-priced meals (FRPM), English language learner status, special education status, home language, and baseline GPA.

Section III shows the pre-existing differences in the demographic characteristics of students who attended school in person vs. remote in the 2020-21 school year. Table III.1 shows difference in baseline characteristics between students that chose remote vs. chose in-person learning. Table III.2 shows the marginal effects of each demographic characteristic estimated from a probit model which controls for the effects of all other demographics.

Section IV shows pairwise comparisons between moderation effects for grade, race/ethnicity, and home language.

Section V shows sensitivity analyses, which analyze the effect of remote schooling in a larger sample of data ($N = 20,951$) with a more limited set of demographic controls (Table V.1), and using core GPA, math GPA, and English language arts GPA as opposed to overall GPA (Tables V.2, V.3, and V.4, respectively).

Section I. Main specification

Table I

Overall GPA by quarter and learning location, adjusted for baseline demographics and GPA

Quarter	Policy on remote learning	Means by learning location		Adjusted difference between students that chose remote and students that chose in-person		p-value
		Chose remote	Chose in-person	Original units (standard error)	SD units (standard error)	
Time 5 (Q1 2020-21)	Remote learning optional	84.15	82.40	1.75*** (0.15)	0.16*** (0.01)	<.001
Time 6 (Q2 2020-21)		83.06	81.98	1.07*** (0.17)	0.09*** (0.01)	<.001
Time 7 (Q3 2020-21)		83.08	83.76	-0.69*** (0.16)	-0.07*** (0.02)	<.001
Time 8 (Q4 2020-21)		82.60	84.39	-1.78*** (0.17)	-0.17*** (0.02)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	87.13	85.78	1.35*** (0.13)	0.16*** (0.02)	<.001
Time 10 (Q2 2021-22)		85.66	84.15	1.51*** (0.14)	0.17*** (0.02)	<.001
Time 11 (Q3 2021-22)		84.63	83.32	1.31*** (0.16)	0.14*** (0.02)	<.001
Time 12 (Q4 2021-22)		84.95	83.61	1.33*** (0.16)	0.14*** (0.02)	<.001
Sample size		4,439	5,473			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The difference in standard deviation units was calculated using Hedge's *g* with a small sample adjustment.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Section II. Moderation analyses

Table II.1

Overall GPA by quarter, grade, and learning location, adjusted for baseline demographics and GPA

		Means by grade level at Time 1 (Q1 2019-20) and learning location						Adjusted difference between students that chose remote and students that chose in-person (standard error)			p-value
Quarter	Policy on remote learning	Chose remote			Chose in-person						
		8	9	10	8	9	10	8	9	10	
Time 5 (Q1 2020-21)	Remote learning optional	84.78	83.36	84.18	82.95	81.77	82.33	1.84*** (0.25)	1.59*** (0.24)	1.84*** (0.28)	0.705
Time 6 (Q2 2020-21)		83.74	82.39	82.68	82.98	81.18	81.37	0.77** (0.27)	1.22*** (0.27)	1.30*** (0.31)	0.334
Time 7 (Q3 2020-21)		83.41	82.79	82.78	84.39	83.36	83.23	-0.98*** (0.26)	-0.57* (0.25)	-0.45 (0.30)	0.349
Time 8 (Q4 2020-21)		82.75	82.19	82.79	84.85	84.04	84.06	-2.09*** (0.29)	-1.85*** (0.27)	-1.27*** (0.31)	0.133
Time 9 (Q1 2021-22)	In-person learning resumes	86.89	86.76	88.16	85.35	85.43	87.06	1.54*** (0.20)	1.33*** (0.20)	1.10*** (0.25)	0.382
Time 10 (Q2 2021-22)		85.37	85.56	86.45	83.65	83.85	85.47	1.72*** (0.23)	1.71*** (0.22)	0.98*** (0.27)	0.055
Time 11 (Q3 2021-22)		84.41	84.45	85.41	82.83	83.01	84.64	1.58*** (0.25)	1.45*** (0.24)	0.77** (0.29)	0.081
Time 12 (Q4 2021-22)		84.55	84.93	85.82	83.01	83.15	85.34	1.53*** (0.27)	1.78*** (0.26)	0.48 (0.29)	0.002
Sample size		1,489	1,636	1,314	2,301	1,871	1,301				

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across grade. Grade is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.2*Overall GPA by quarter, gender, and learning location, adjusted for baseline demographics and GPA*

		Means by gender at Time 1 (Q1 2019-20) and learning location				Adjusted difference between students that chose remote and students that chose in-person (standard error)		p-value
Quarter	Policy on remote learning	Chose remote		Chose in-person				
		Female	Male	Female	Male	Female	Male	
Time 5 (Q1 2020-21)	Remote learning optional	86.19	82.11	84.38	80.44	1.81*** (0.19)	1.68*** (0.23)	0.643
Time 6 (Q2 2020-21)		85.09	80.92	83.61	80.37	1.48*** (0.21)	0.55* (0.25)	0.003
Time 7 (Q3 2020-21)		84.89	81.17	85.20	82.34	-0.31 (0.20)	-1.18*** (0.24)	0.004
Time 8 (Q4 2020-21)		84.45	80.63	85.72	83.07	-1.27*** (0.22)	-2.44*** (0.26)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	88.33	86.06	87.38	84.21	0.95*** (0.16)	1.85*** (0.19)	<.001
Time 10 (Q2 2021-22)		86.97	84.46	85.77	82.56	1.21*** (0.18)	1.90*** (0.21)	0.010
Time 11 (Q3 2021-22)		86.21	83.10	84.99	81.68	1.22*** (0.20)	1.43*** (0.23)	0.479
Time 12 (Q4 2021-22)		86.44	83.51	85.20	82.04	1.23*** (0.21)	1.46*** (0.24)	0.459
Sample size		2,681	1,758	2,721	2,752			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across gender. Gender is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.3*Overall GPA by quarter, race, and learning location, adjusted for baseline demographics and GPA*

		Means by race at Time 1 (Q1 2019-20) and learning location										Adjusted difference between students that chose remote and students that chose in-person (standard error)					p-value
Quarter	Policy on remote learning	Chose remote					Chose in-person										
		White	Black	Hispanic	Asian	Other	White	Black	Hispanic	Asian	Other	White	Black	Hispanic	Asian	Other	
Time 5 (Q1 2020-21)	Remote learning optional	87.20	80.55	82.75	89.51	86.27	86.48	78.37	80.57	87.92	84.01	0.73** (0.25)	2.17*** (0.32)	2.19*** (0.25)	1.60** (0.58)	2.26** (0.81)	<.001
Time 6 (Q2 2020-21)		86.23	79.28	81.52	89.22	84.26	86.14	78.23	80.11	86.06	82.90	0.09 (0.27)	1.05** (0.36)	1.41*** (0.27)	3.16*** (0.64)	1.36 (0.94)	<.001
Time 7 (Q3 2020-21)		86.19	79.84	81.42	89.26	84.69	86.94	81.58	81.87	87.78	84.32	-0.75** (0.28)	-1.74*** (0.34)	-0.45 (0.26)	1.48** (0.56)	0.37 (0.90)	<.001
Time 8 (Q4 2020-21)		85.59	79.31	81.07	89.33	84.55	87.02	82.25	82.93	88.62	84.65	-1.42*** (0.31)	-2.93*** (0.35)	-1.86*** (0.27)	0.71 (0.58)	-0.09 (0.96)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	89.56	84.14	86.20	91.42	88.36	88.63	82.71	84.59	90.55	86.45	0.92*** (0.22)	1.44*** (0.28)	1.61*** (0.20)	0.87* (0.41)	1.92* (0.75)	0.107
Time 10 (Q2 2021-22)		88.31	82.90	84.39	90.42	86.95	87.06	81.08	82.85	89.05	85.56	1.25*** (0.24)	1.82*** (0.30)	1.54*** (0.23)	1.38** (0.48)	1.38 (0.75)	0.673
Time 11 (Q3 2021-22)		87.62	81.55	83.19	89.69	86.25	86.58	80.14	81.77	88.32	84.77	1.04*** (0.26)	1.40*** (0.33)	1.42*** (0.24)	1.38* (0.54)	1.47 (0.83)	0.839
Time 12 (Q4 2021-22)		87.77	82.12	83.54	90.05	86.10	86.60	80.61	82.20	88.59	84.93	1.17*** (0.28)	1.50*** (0.34)	1.34*** (0.26)	1.46* (0.59)	1.17 (0.87)	0.950
Sample size		1,018	1,006	1,834	451	130	1,801	1,196	2,131	210	135						

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across race. Race is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.4

Overall GPA by quarter, free and reduced-price meal status (FRPM), and learning location, adjusted for baseline demographics and GPA

		Means by FRPM status at Time 1 (Q1 2019-20) and learning location				Adjusted difference between students that chose remote and students that chose in-person (standard error)		p-value
Quarter	Policy on remote learning	Chose remote		Chose in-person				
		FRPM	Non-FRPM	FRPM	Non-FRPM	FRPM	Non-FRPM	
Time 5 (Q1 2020-21)	Remote learning optional	80.66	86.50	78.58	84.98	2.08*** (0.25)	1.52*** (0.18)	0.062
Time 6 (Q2 2020-21)		79.47	85.48	78.27	84.49	1.20*** (0.27)	0.99*** (0.20)	0.518
Time 7 (Q3 2020-21)		79.70	85.36	80.70	85.83	-1.00*** (0.26)	-0.47* (0.19)	0.095
Time 8 (Q4 2020-21)		79.20	84.90	81.53	86.31	-2.33*** (0.28)	-1.41*** (0.21)	0.006
Time 9 (Q1 2021-22)	In-person learning resumes	84.66	88.79	83.08	87.61	1.58*** (0.21)	1.18*** (0.15)	0.115
Time 10 (Q2 2021-22)		82.96	87.49	81.21	86.14	1.75*** (0.23)	1.35*** (0.17)	0.146
Time 11 (Q3 2021-22)		81.75	86.58	80.19	85.44	1.56*** (0.25)	1.14*** (0.19)	0.160
Time 12 (Q4 2021-22)		82.19	86.80	80.49	85.72	1.71*** (0.27)	1.08*** (0.19)	0.051
Sample size		1,842	2,597	2,205	3,268			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across FRPM status. FRPM status is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.5

Overall GPA by quarter, English language learner status (ELL), and learning location, adjusted for baseline demographics and GPA

		Means by ELL status at Time 1 (Q1 2019-20) and learning location				Adjusted difference between students that chose remote and students that chose in-person (standard error)		p-value
Quarter	Policy on remote learning	Chose remote		Chose in-person				
		ELL	Non-ELL	ELL	Non-ELL	ELL	Non-ELL	
Time 5 (Q1 2020-21)	Remote learning optional	81.48	84.45	79.56	82.71	1.93*** (0.50)	1.73*** (0.16)	0.713
Time 6 (Q2 2020-21)		81.03	83.28	80.08	82.19	0.95 (0.55)	1.09*** (0.17)	0.814
Time 7 (Q3 2020-21)		81.33	83.27	81.73	83.99	-0.40 (0.55)	-0.72*** (0.17)	0.575
Time 8 (Q4 2020-21)		81.72	82.71	82.77	84.56	-1.05 (0.58)	-1.85*** (0.18)	0.185
Time 9 (Q1 2021-22)	In-person learning resumes	84.57	87.41	83.32	86.05	1.25** (0.45)	1.36*** (0.13)	0.819
Time 10 (Q2 2021-22)		83.38	85.91	81.98	84.39	1.40** (0.49)	1.52*** (0.15)	0.812
Time 11 (Q3 2021-22)		82.12	84.91	80.62	83.62	1.50** (0.53)	1.29*** (0.16)	0.709
Time 12 (Q4 2021-22)		83.12	85.15	81.48	83.85	1.64** (0.56)	1.31*** (0.17)	0.568
Sample size		327	4,112	541	4,932			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across ELL status. ELL status is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.6*Overall GPA by quarter, special education status (SPED), and learning location, adjusted for baseline demographics and GPA*

		Means by SPED status at Time 1 (Q1 2019-20) and learning location				Adjusted difference between students that chose remote and students that chose in-person (standard error)		p-value
Quarter	Policy on remote learning	Chose remote		Chose in-person				
		SPED	Non-SPED	SPED	Non-SPED	SPED	Non-SPED	
Time 5 (Q1 2020-21)	Remote learning optional	86.15	83.31	84.64	81.47	1.52*** (0.26)	1.84*** (0.18)	0.290
Time 6 (Q2 2020-21)		85.12	82.18	84.46	80.95	0.66* (0.28)	1.23*** (0.20)	0.084
Time 7 (Q3 2020-21)		85.26	82.17	85.86	82.89	-0.60* (0.28)	-0.72*** (0.19)	0.691
Time 8 (Q4 2020-21)		84.76	81.71	86.45	83.52	-1.69*** (0.30)	-1.82*** (0.20)	0.727
Time 9 (Q1 2021-22)	In-person learning resumes	88.86	86.41	87.44	85.09	1.42*** (0.22)	1.32*** (0.15)	0.706
Time 10 (Q2 2021-22)		87.60	84.86	86.10	83.34	1.50*** (0.24)	1.52*** (0.17)	0.952
Time 11 (Q3 2021-22)		86.73	83.76	85.45	82.44	1.28*** (0.27)	1.32*** (0.18)	0.900
Time 12 (Q4 2021-22)		86.90	84.13	85.72	82.74	1.19*** (0.28)	1.39*** (0.19)	0.536
Sample size		1,184	3,255	1,610	3,863			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across SPED status. SPED status is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.7*Overall GPA by quarter, home language, and learning location, adjusted for baseline demographics and GPA*

		Means by home language at Time 1 (Q1 2019-20) and learning location						Adjusted difference between students that chose remote and students that chose in-person (standard error)			p-value
Quarter	Policy on remote learning	Chose remote			Chose in-person			English	Spanish	Other	
		English	Spanish	Other	English	Spanish	Other				
Time 5 (Q1 2020-21)	Remote learning optional	84.94	82.01	84.31	83.34	80.06	82.26	1.60*** (0.19)	1.95*** (0.31)	2.05*** (0.40)	0.423
Time 6 (Q2 2020-21)		83.82	80.93	83.30	82.88	79.72	81.89	0.94*** (0.20)	1.21*** (0.34)	1.41** (0.45)	0.546
Time 7 (Q3 2020-21)		83.78	80.84	83.90	84.57	81.62	83.97	-0.79*** (0.20)	-0.77* (0.32)	-0.08 (0.42)	0.286
Time 8 (Q4 2020-21)		83.11	80.70	83.84	84.92	82.82	84.82	-1.81*** (0.22)	-2.13*** (0.34)	-0.98* (0.43)	0.099
Time 9 (Q1 2021-22)	In-person learning resumes	87.76	85.54	87.06	86.43	84.14	85.77	1.33*** (0.16)	1.41*** (0.26)	1.29*** (0.33)	0.955
Time 10 (Q2 2021-22)		86.32	83.74	86.14	84.82	82.46	84.15	1.50*** (0.17)	1.29*** (0.28)	1.99*** (0.37)	0.304
Time 11 (Q3 2021-22)		85.40	82.58	84.82	84.07	81.39	83.35	1.33*** (0.19)	1.19*** (0.31)	1.47*** (0.41)	0.842
Time 12 (Q4 2021-22)		85.62	82.98	85.42	84.28	81.90	83.62	1.34*** (0.20)	1.08*** (0.32)	1.80*** (0.43)	0.392
Sample size		2,591	1,154	694	3,500	1,368	605				

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on an *F*-test with a null hypothesis that the effects of attending in person are equal for students across home language. Home language is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table II.8

Overall GPA by quarter, whether baseline overall GPA was at or above the median, and learning location, adjusted for baseline demographics and GPA

		Means by whether Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA was above or below the median and learning location				Adjusted difference between students that chose remote and students that chose in-person (standard error)		p-value
Quarter	Policy on remote learning	Chose remote		Chose in-person				
		Overall GPA at or above median	Overall GPA below median	Overall GPA at or above median	Overall GPA below median	Overall GPA at or above median	Overall GPA below median	
Time 5 (Q1 2020-21)	Remote learning optional	92.04	78.17	90.71	75.95	1.32*** (0.16)	2.22*** (0.26)	0.003
Time 6 (Q2 2020-21)		91.44	76.44	89.95	75.80	1.50*** (0.18)	0.64* (0.28)	0.008
Time 7 (Q3 2020-21)		90.88	76.73	90.53	78.52	0.35* (0.18)	-1.79*** (0.27)	<.001
Time 8 (Q4 2020-21)		90.33	76.27	90.91	79.32	-0.58** (0.20)	-3.05*** (0.28)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	92.20	83.33	91.29	81.51	0.91*** (0.14)	1.82*** (0.21)	<.001
Time 10 (Q2 2021-22)		91.30	81.40	90.13	79.51	1.17*** (0.16)	1.88*** (0.23)	0.010
Time 11 (Q3 2021-22)		90.83	79.89	89.68	78.39	1.15*** (0.18)	1.50*** (0.25)	0.240
Time 12 (Q4 2021-22)		90.90	80.41	89.77	78.83	1.12*** (0.19)	1.57*** (0.26)	0.154
Sample size		2,589	1,850	2,391	3,082			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA, and whether average of Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA was above or below the median. The p-value displayed in the table is based on an F-test with a null hypothesis that the effects of attending in person are equal for students regardless of whether overall GPA was above or below the median. Overall GPA was calculated as an average of Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA student records.

* two-tailed p < .05. ** two-tailed p < .01. *** two-tailed p < .001.

Section III: Baseline Equivalence and Marginal Effects

Table III.1

Difference in baseline characteristics between students that chose remote vs. chose in-person learning

Characteristic (percentage of students unless otherwise noted) at Time 1 (Q1 2019-20)	Means (standard errors) by learning location		Difference between students that chose remote and students that chose in-person (standard error)	p-value
	Chose remote	Chose in-person		
Female	60.40% (0.73)	49.72% (0.68)	10.68% (1.00)	<.001
Race/ethnicity				<.001
Hispanic	41.32% (0.74)	38.94% (0.66)	2.38% (0.99)	0.016
Black, non-Hispanic	22.66% (0.63)	21.85% (0.56)	0.81% (0.84)	0.335
Asian, non-Hispanic	10.16% (0.45)	3.84% (0.26)	6.32% (0.52)	<.001
White, non-Hispanic	22.93% (0.63)	32.91% (0.64)	-9.97% (0.90)	<.001
Other race, non-Hispanic	2.93% (0.25)	2.47% (0.21)	0.46% (0.33)	0.160
Free or reduced-price meal program	41.50% (0.74)	40.29% (0.66)	1.21% (0.99)	0.224
English language learner	7.37% (0.39)	9.88% (0.40)	-2.52% (0.56)	<.001
Special education	26.67% (0.66)	29.42% (0.62)	-2.74% (0.91)	0.002
Home language				<.001
English	58.37% (0.74)	63.95% (0.65)	-5.58% (0.98)	<.001
Spanish	26.00% (0.66)	25.00% (0.59)	1.00% (0.88)	0.256
Other language	15.63% (0.55)	11.05% (0.42)	4.58% (0.69)	<.001
Grade level				<.001
8	33.54% (0.71)	42.04% (0.67)	-8.50% (0.97)	<.001
9	36.86% (0.72)	34.19% (0.64)	2.67% (0.97)	0.006
10	29.60% (0.69)	23.77% (0.58)	5.83% (0.89)	<.001
Overall GPA at Time 1 (Q1 2019-20)	87.02 (0.12)	84.84 (0.12)	2.17 (0.17)	<.001
Overall GPA at Time 2 (Q2 2019-20)	86.08 (0.12)	83.64 (0.12)	2.44 (0.17)	<.001
Overall GPA at Time 3 (Q3 2019-20)	86.09 (0.12)	83.25 (0.13)	2.84 (0.18)	<.001
Overall GPA at Time 4 (Q4 2019-20)	89.47 (0.14)	85.34 (0.15)	4.13 (0.20)	<.001

Sample size	4,439	5,473		
-------------	-------	-------	--	--

Notes: For continuous and dichotomous variables, the p -values were calculated using two-tailed t-tests. For categorical variables, the p -values were calculated using chi-square tests.

Table III.2

Marginal effects of baseline characteristics on the percent chance of choosing remote learning during 2020-21

Characteristic at Time 1 (Q1 2019-20)	Unadjusted		Adjusted	
	Marginal effect	p-value	Marginal effect	p-value
Female (versus male)	10.65%***	<.001	6.40%***	<.001
Race/ethnicity	-	<.001	-	<.001
White, non-Hispanic (reference)	-	-	-	-
Hispanic	10.14%***	<.001	12.83%***	<.001
Black, non-Hispanic	9.57%***	<.001	12.31%***	<.001
Asian, non-Hispanic	32.12%***	<.001	26.10%***	<.001
Other race, non-Hispanic	12.94%***	<.001	12.20%***	<.001
Free or reduced-price meal program	1.24%	0.224	2.76%**	0.009
English language learner	-7.79%***	<.001	-11.81%***	<.001
Special education	-3.35%**	0.002	-3.44%**	0.002
Home language	-	<.001	-	<.001
English (reference)	-	-	-	-
Spanish	3.22%**	0.006	2.53%	0.108
Other language	10.89%***	<.001	6.28%***	<.001
Grade level	-	<.001	-	<.001
8 (reference)	-	-	-	-
9	7.36%***	<.001	7.00%***	<.001
10	10.96%***	<.001	11.51%***	<.001
Overall GPA at Time 1 (Q1 2019-20)	0.77%***	<.001	-0.11%	0.348
Overall GPA at Time 2 (Q2 2019-20)	0.80%***	<.001	-0.11%	0.388
Overall GPA at Time 3 (Q3 2019-20)	0.90%***	<.001	0.38%***	<.001
Overall GPA at Time 4 (Q4 2019-20)	0.95%***	<.001	0.85%***	<.001
Sample size	9,912		9,912	

Notes: The results are based on a probit model. The marginal effects were multiplied by 100, so they represent the effect of each covariate on the percent chance of choosing remote schooling. The *p*-values that appear next to individual variables come from chi-square tests of the null hypothesis that the effect is zero. The *p*-values that appear next to categorical variables come from chi-squared tests of the null hypothesis that the effects are equal across categories.

* two-tailed *p* < .05. ** two-tailed *p* < .01. *** two-tailed *p* < .001.

Section IV: Pairwise comparisons for subgroups with three or more levels

Table IV.1

Pairwise comparisons between grade levels, adjusted for baseline demographics and GPA

	Policy on remote learning	Grade level	<i>p</i> -value		
	Remote learning optional		8	9	10
Time 5 (Q1 2020-21)		8	—	—	—
		9	0.055	—	—
		10	0.270	<.001***	—
			8	9	10
Time 6 (Q2 2020-21)		8	—	—	—
		9	0.130	—	—
		10	0.339	0.008**	—
			8	9	10
Time 7 (Q3 2020-21)		8	—	—	—
		9	0.459	—	—
		10	0.658	0.113	—
			8	9	10
Time 8 (Q4 2020-21)		8	—	—	—
		9	0.174	—	—
		10	0.365	0.020*	—
	In-person learning resumes		8	9	10
Time 9 (Q1 2021-22)		8	—	—	—
		9	0.993	—	—
		10	0.115	<.001***	—
			8	9	10
Time 10 (Q2 2021-22)		8	—	—	—
		9	0.722	—	—
		10	0.079	<.001***	—
			8	9	10
Time 11 (Q3 2021-22)		8	—	—	—
		9	0.773	—	—
		10	0.133	<.001***	—
			8	9	10
Time 12 (Q4 2021-22)		8	—	—	—
		9	0.459	—	—
		10	0.032*	<.001***	—
Sample size		9,912			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on a *t*-test with a null hypothesis that the effects of attending in person are equal for students of both grades in the comparison. Grade is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table IV.2

Pairwise comparisons between race categories, adjusted for baseline demographics and GPA

	Policy on remote learning	Race	<i>p</i> -value				
			White	Black	Hispanic	Asian	Other
Time 5 (Q1 2020-21)	Remote learning optional	White	—	—	—	—	—
		Black	<.001***	—	—	—	—
		Hispanic	0.004**	0.164	—	—	—
		Asian	0.464	0.130	0.471	—	—
		Other	0.356	0.350	0.790	0.788	—
Time 6 (Q2 2020-21)		White	—	—	—	—	—
		Black	0.001**	—	—	—	—
		Hispanic	<.001***	0.906	—	—	—
		Asian	0.003**	0.292	0.307	—	—
		Other	0.103	0.947	0.994	0.480	—
Time 7 (Q3 2020-21)		White	—	—	—	—	—
		Black	0.643	—	—	—	—
		Hispanic	0.008**	0.010*	—	—	—
		Asian	0.065	0.052	0.701	—	—
		Other	0.077	0.059	0.622	0.900	—
Time 8 (Q4 2020-21)		White	—	—	—	—	—
		Black	0.031*	—	—	—	—
		Hispanic	0.163	0.002**	—	—	—
		Asian	0.386	0.044*	0.927	—	—
		Other	0.164	0.019*	0.474	0.598	—
Time 9 (Q1 2021-22)	In-person learning resumes	White	—	—	—	—	—
		Black	0.026*	—	—	—	—
		Hispanic	0.116	0.443	—	—	—
		Asian	0.170	0.008**	0.027*	—	—
		Other	0.118	0.592	0.363	0.031*	—
Time 10 (Q2 2021-22)		White	—	—	—	—	—
		Black	0.046*	—	—	—	—
		Hispanic	0.160	0.502	—	—	—
		Asian	0.352	0.038*	0.094	—	—
		Other	0.695	0.576	0.825	0.362	—
Time 11 (Q3 2021-22)		White	—	—	—	—	—
		Black	0.120	—	—	—	—
		Hispanic	0.017*	0.583	—	—	—
		Asian	0.813	0.252	0.122	—	—
		Other	0.508	0.889	0.658	0.489	—
Time 12 (Q4 2021-22)		White	—	—	—	—	—
		Black	0.067	—	—	—	—
		Hispanic	0.023*	0.830	—	—	—
		Asian	0.732	0.163	0.116	—	—
		Other	0.422	0.839	0.741	0.383	—

Sample size		9,912					
-------------	--	-------	--	--	--	--	--

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The p -value displayed in the table is based on a t -test with a null hypothesis that the effects of attending in person are equal for students of both races in the comparison. Race is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table IV.3
Pairwise comparisons between home languages, adjusted for baseline demographics and GPA

	Policy on remote learning	Home language	<i>p</i> -value		
	Remote learning optional		English	Spanish	Other language
Time 5 (Q1 2020-21)		English	—	—	
		Spanish	0.030*	—	
		Other language	0.624	0.038*	—
			English	Spanish	Other language
Time 6 (Q2 2020-21)		English	—	—	
		Spanish	0.182	—	
		Other language	0.855	0.242	—
	In-person learning resumes		English	Spanish	Other language
Time 7 (Q3 2020-21)		English	—	—	
		Spanish	0.360	—	
		Other language	0.927	0.527	—
			English	Spanish	Other language
Time 8 (Q4 2020-21)		English	—	—	
		Spanish	0.584	—	
		Other language	0.570	0.967	—
	In-person learning resumes		English	Spanish	Other language
Time 9 (Q1 2021-22)		English	—	—	
		Spanish	0.214	—	
		Other language	0.360	0.084	—
			English	Spanish	Other language
Time 10 (Q2 2021-22)		English	—	—	
		Spanish	0.464	—	
		Other language	0.895	0.504	—
	In-person learning resumes		English	Spanish	Other language
Time 11 (Q3 2021-22)		English	—	—	
		Spanish	0.943	—	
		Other language	0.428	0.474	—
			English	Spanish	Other language
Time 12 (Q4 2021-22)		English	—	—	
		Spanish	0.971	—	
		Other language	0.810	0.819	—
Sample size		9,912			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The *p*-value displayed in the table is based on a *t*-test with a null hypothesis that the effects of attending in person are equal for students of both home languages in the comparison. Home language is as of Time 1 (Q1 2019-20) student record.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Section V: Sensitivity Checks

Table V.1

Sensitivity check using overall GPA by quarter and learning location, adjusted for baseline grade, gender, race, and GPA

Quarter	Policy on remote learning	Means by learning location		Adjusted difference between students that chose remote and students that chose in-person		p-value
		Chose remote	Chose in-person	Original units (standard error)	SD units (standard error)	
Time 5 (Q1 2020-21)	Remote learning optional	83.35	81.85	1.50*** (0.11)	0.13*** (0.01)	<.001
Time 6 (Q2 2020-21)		82.15	81.46	0.69*** (0.12)	0.06*** (0.01)	<.001
Time 7 (Q3 2020-21)		82.22	83.54	-1.32*** (0.11)	-0.13*** (0.01)	<.001
Time 8 (Q4 2020-21)		82.11	84.65	-2.54*** (0.12)	-0.24*** (0.01)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	86.93	85.53	1.40*** (0.09)	0.17*** (0.01)	<.001
Time 10 (Q2 2021-22)		85.40	83.92	1.49*** (0.10)	0.16*** (0.01)	<.001
Time 11 (Q3 2021-22)		84.34	83.10	1.23*** (0.11)	0.13*** (0.01)	<.001
Time 12 (Q4 2021-22)		84.82	83.46	1.36*** (0.11)	0.14*** (0.01)	<.001
Sample size		7,923	13,028			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA. The difference in standard deviation units was calculated using Hedge's *g* with a small sample adjustment.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table V.2

Sensitivity check using core GPA instead of overall GPA, by quarter and learning location, adjusted for baseline demographics and GPA

Quarter	Policy on remote learning	Means by learning location		Adjusted difference between students that chose remote and students that chose in-person		p-value
		Chose remote	Chose in-person	Original units (standard error)	SD units (standard error)	
Time 5 (Q1 2020-21)	Remote learning optional	82.50	80.63	1.86*** (0.17)	0.16*** (0.01)	<.001
Time 6 (Q2 2020-21)		81.57	80.08	1.49*** (0.18)	0.13*** (0.02)	<.001
Time 7 (Q3 2020-21)		81.44	81.56	-0.12 (0.18)	-0.01 (0.02)	0.505
Time 8 (Q4 2020-21)		81.06	82.35	-1.29*** (0.20)	-0.11*** (0.02)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	84.99	83.27	1.72*** (0.15)	0.19*** (0.02)	<.001
Time 10 (Q2 2021-22)		83.66	81.86	1.81*** (0.17)	0.18*** (0.02)	<.001
Time 11 (Q3 2021-22)		82.63	81.01	1.62*** (0.18)	0.16*** (0.02)	<.001
Time 12 (Q4 2021-22)		83.12	81.40	1.73*** (0.19)	0.16*** (0.02)	<.001
Sample size		4,361	5,420			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) core GPA. The difference in standard deviation units was calculated using Hedge's g with a small sample adjustment.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table V.3

Sensitivity check using math GPA instead of overall GPA, by quarter and learning location, adjusted for baseline demographics and GPA

Quarter	Policy on remote learning	Means by learning location		Adjusted difference between students that chose remote and students that chose in-person		<i>p</i> -value
		Chose remote	Chose in-person	Original units (standard error)	SD units (standard error)	
Time 5 (Q1 2020-21)	Remote learning optional	80.49	78.59	1.91*** (0.26)	0.13*** (0.02)	<.001
Time 6 (Q2 2020-21)		80.41	78.94	1.46*** (0.27)	0.10*** (0.02)	<.001
Time 7 (Q3 2020-21)		79.31	79.63	-0.32 (0.27)	-0.02 (0.02)	0.239
Time 8 (Q4 2020-21)		78.91	80.78	-1.87*** (0.30)	-0.12*** (0.02)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	81.88	80.61	1.27*** (0.26)	0.10*** (0.02)	<.001
Time 10 (Q2 2021-22)		81.36	80.05	1.31*** (0.26)	0.10*** (0.02)	<.001
Time 11 (Q3 2021-22)		79.55	78.47	1.08*** (0.29)	0.08*** (0.02)	<.001
Time 12 (Q4 2021-22)		80.37	79.00	1.38*** (0.30)	0.09*** (0.02)	<.001
Sample size		3,680	4,653			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) math GPA. The difference in standard deviation units was calculated using Hedge's *g* with a small sample adjustment.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.

Table V.4

Sensitivity check using ELA GPA instead of overall GPA, by quarter and learning location, adjusted for baseline demographics and GPA

Quarter	Policy on remote learning	Means by learning location		Adjusted difference between students that chose remote and students that chose in-person		<i>p</i> -value
		Chose remote	Chose in-person	Original units (standard error)	SD units (standard error)	
Time 5 (Q1 2020-21)	Remote learning optional	84.17	82.40	1.78*** (0.22)	0.14*** (0.02)	<.001
Time 6 (Q2 2020-21)		82.60	81.33	1.27*** (0.24)	0.09*** (0.02)	<.001
Time 7 (Q3 2020-21)		82.77	83.48	-0.71** (0.24)	-0.06** (0.02)	0.003
Time 8 (Q4 2020-21)		81.91	83.63	-1.72*** (0.26)	-0.13*** (0.02)	<.001
Time 9 (Q1 2021-22)	In-person learning resumes	86.90	84.89	2.01*** (0.21)	0.19*** (0.02)	<.001
Time 10 (Q2 2021-22)		85.46	83.20	2.26*** (0.23)	0.19*** (0.02)	<.001
Time 11 (Q3 2021-22)		84.67	82.61	2.06*** (0.23)	0.17*** (0.02)	<.001
Time 12 (Q4 2021-22)		84.27	82.25	2.02*** (0.25)	0.16*** (0.02)	<.001
Sample size		3,824	4,868			

Notes: The models control for Time 1 (Q1 2019-20) grade, gender, race, free and reduced-price meal status, English language learner status, special education status, home language, school, Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) overall GPA, and Time 1 (Q1 2019-20) through Time 4 (Q4 2019-20) ELA GPA. The difference in standard deviation units was calculated using Hedge's *g* with a small sample adjustment.

* two-tailed $p < .05$. ** two-tailed $p < .01$. *** two-tailed $p < .001$.