

## Supplemental Information

Study Characteristic	Statewide Analysis ( <i>N</i> = 115 Districts)	District-Wide Analysis ( <i>n</i> = 3 Districts)
Organization administering test	State	District
Data availability	Publically available	Provided to ABC Science Collaborative
Districts included	All 115 public school districts in NC	3 public school districts included in ABC Science collaborative
Grades included	Grades 3–8	Kindergarten–grade 8
Subjects analyzed	Mathematics	Mathematics
	Reading	Reading
Timing of test administered	End-of-grade	Beginning of grade
		Middle of grade
Years analyzed	2018–2019	2018–2019
	2020–2021	2019–2020
		2020–2021
Type of analysis conducted	Multivariate analysis	Univariate analysis

District-Level Characteristic	Districts, <i>N</i>	Proportion of Total ( <i>N</i> = 115)	Mathematics		Reading	
			Schools, <i>N</i>	Students Proficient, %	Schools, <i>N</i>	Students Proficient, %
Proportion of time in person						
<1/3 of the year	16	13.9	270	28.21	277	35.90
1/3 to 2/3 of the year	22	19.1	555	37.22	558	41.99
>2/3 of the year	77	67.0	1013	42.34	1020	43.67
Rural or urban classification						
Rural	60	52.2%	515	34.59	523	38.62
Urban	55	47.8%	1323	40.16	1332	43.26
ADI rank score						
		Median (Q1, Q3)				
Higher ADI	99	71.36 (65.53–78.54)	1301	36.61	1316	39.37
Lower ADI	16	45.18 (39.28–45.91)	537	43.47	539	48.26

Values reported as *N*, Median (Q1, Q3). *N*, number of districts; *Q*, quarter.

**SUPPLEMENTAL TABLE 7** Multivariable Sensitivity Analysis of District-level End-of-Grade (2020–2021) Student Proficiency by a 10% Increase in District Time In-Person (Hybrid Categorized as Not Fully in-Person)

	Change in % Students Proficient in Mathematics <sup>a</sup>	Change in % Students Proficient in Reading <sup>a</sup>
Primary analysis		
All students, grades 3–8	1.20 (1.10–1.29)	0.41 (0.35–0.48)
Secondary analysis		
All students, grades 3–5 (elementary levels)	1.40 (1.11–1.70)	0.46 (0.24–0.69)
All students, grades 6–8 (middle school levels)	0.84 (0.56–1.12)	0.29 (0.10–0.49)
Sensitivity analysis (in-person time, excluding hybrid instruction)		
All students	3.89 (3.40–4.37)	1.15 (0.81–1.49)
Secondary sensitivity analysis		
All students, grades 3–5 (elementary levels)	2.60 (2.26–2.94)	0.82 (0.55–1.10)
All students, grades 6–8 (middle school levels)	1.65 (0.56–2.74)	–0.16 (–0.93–0.60)

Model estimates reported as  $\beta$ -coefficient (95% CI); *P* value.  
<sup>a</sup>Multivariate linear regression of change in proportion of all students proficient modeled as a function of 0.1 increase in time the district spent in person, weighted by 2020–2021 district enrollment, adjusted for 2018–2019 proficiency, and controlled for district rural/urban status and area deprivation index rank score.

**SUPPLEMENTAL TABLE 8** Unweighted Multivariable Analysis of District-Level End-of-Grade (2020–2021) Student Proficiency by a 10% Increase in District Time In-Person<sup>a</sup>

Student Demographic	Change in % Students Proficient in Mathematics	Change in % Students Proficient in Reading
All students	1.12 (1.05–1.18)	0.41 (0.36–0.46)
Economic status		
Economically disadvantaged	1.31 (1.24–1.37)	0.57 (0.52–0.63)
Not economically disadvantaged	1.20 (1.12–1.28)	0.412 (0.35–0.48)
Race or ethnicity		
American Indian	0.95 (0.66–1.23)	1.27 (0.94–1.61)
Asian	0.19 (–0.04 to 0.43)	0.12 (–0.10 to 0.34)
Black	0.88 (0.80–0.96)	0.44 (0.36–0.51)
Hispanic	1.43 (1.35–1.52)	0.45 (0.37–0.53)
White	1.01 (0.93–1.08)	0.27 (0.20–0.34)
Two or more races	0.85 (0.72–0.99)	0.58 (0.45–0.71)
Disability status		
Student with a disability	0.28 (0.22–0.35)	0.02 (–0.05 to 0.08)
Not a student with a disability	1.28 (1.20–1.35)	0.50 (0.45–0.56)
English learner	0.80 (0.69–0.91)	0.09 (0.002–0.17)
Migrant	0.71 (–0.16 to 1.59)	0.55 (–0.27 to 1.38)

<sup>a</sup>Model estimates reported as  $\beta$ -coefficient (95% CI). Multivariate linear regression of change in the percentage point of students proficient modeled for a 10% increase in time the district allowed in-person instruction, adjusting for 2018–2019 proficiency, and controlling for district rural or urban status and area deprivation index rank score.

<b>SUPPLEMENTAL TABLE 9</b> Unweighted Multivariable Sensitivity Analysis of District-level End-of-Grade (2020–2021) Student Proficiency by a 10% Increase in District Time In-Person (Hybrid Categorized as Not Fully in-Person) <sup>a</sup>		
	<b>Change in % Students Proficient in Mathematics<sup>b</sup></b>	<b>Change in % Students Proficient in Reading<sup>b</sup></b>
Primary analysis		
All students, grades 3–8	1.13 (1.06–1.20)	0.41 (0.36–0.46)
Secondary analysis		
All students, grades 3–5 (elementary levels)	1.44 (1.22–1.65)	0.54 (0.36–0.73)
All students, grades 6–8 (middle school levels)	0.68 (0.46–0.90)	0.26 (0.09–0.43)
Sensitivity analysis (in-person time, excluding hybrid instruction)		
All students	2.19 (1.86–2.53)	0.86 (0.61–1.10)
Secondary sensitivity analysis		
All students, grades 3–5 (elementary levels)	1.84 (1.62–2.07)	0.70 (0.50–0.90)
All students, grades 6–8 (middle school levels)	0.62 (0.07–1.17)	–0.07 (–0.48 to 0.35)

<sup>a</sup>Model estimates reported as  $\beta$ -coefficient (95% CI); *P* value.  
<sup>b</sup>Multivariate linear regression of change in proportion of all students proficient modeled as a function of 0.1 increase in time the district spent in person, adjusting for 2018–2019 proficiency, and controlling for district rural/urban status and area deprivation index rank score.

**SUPPLEMENTAL TABLE 10** Proportion of Students (Grades K-8) Achieving Grade-Level Beginning- and Middle- of Grade Proficiency, By District and Grade

	Mathematics						Reading					
	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency, (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)
District 1												
Kindergarten	N/A	N = 684		N/A	N = 687		N = 16	N/A		N = 15	N/A	
% Proficient		55.7	N/A		60.8	N/A	0			N/A		
Grade 1	N = 2	N = 744		N = 4	N = 695		N = 712	N = 138		N = 734	N = 329	
% Proficient	50.0	57.3	7.3 (-6.2 to 7.6)	25.0	61.2	36.2 (-64.4 to 78.7)	51.5	64.5	13.0 (4.2–21.7)	62.1	54.1	-8.0 (-14.4 to -1.6)
Grade 2	N = 708	N = 186		N = 750	N = 125		N = 717	N = 729		N = 472	N = 734	
% Proficient	68.2	15.1	-53.2 (-59.3 to -47.0)	74.9	9.6	-65.3 (-71.4 to 59.3)	71.1	36.5	-34.6 (-39.5 to -29.8)	66.1	39.9	-26.2 (-31.7 to -20.6)
Grade 3	N = 1382	N = 44		N = 1441	N = 26		N = 388	N = 751		N = 467	N = 783	
% Proficient	69.2	15.9	-53.3 (-64.3 to -42.2)	71.6	7.7	-63.92 (-74.4 to -53.4)	54.1	35.3	-18.8 (-24.9 to -12.8)	54.2	40.1	-14.0 (-19.6 to -8.3)
Grade 4	N = 1388	N/A		N = 1398	N/A		N = 708	N = 727		N = 700	N = 747	
% Proficient	71.3	N/A	N/A	72.7	N/A	N/A	46.9	36.2	-10.7 (-15.8 to -5.6)	47.9	36.9	-10.9 (-16.0 to -5.8)
Grade 5	N = 1414	N/A		N = 1413	N/A		N = 687	N = 731		N = 702	N = 776	
% Proficient	73.3	N/A	N/A	75.7	N/A	N/A	48.1	30.3	-17.8 (-22.8 to -12.8)	50.1	31.6	-18.6 (-23.5 to -13.6)
Grade 6	N = 1486	N/A		N = 1489	N/A		N = 731	N = 769		N = 724	N = 712	
% Proficient	77.9	N/A	N/A	76.3	N/A	N/A	43.4	26.5	-16.8 (-21.6 to -12.1)	43.0	29.5	-13.5 (-18.4 to -8.5)
Grade 7	N = 1624	N/A		N = 1628	N/A		N = 809	N = 799		N = 795	N = 790	
% Proficient	72.2	N/A	N/A	69.2	N/A	N/A	36.1	25.9	-10.2 (-14.7 to -5.7)	37.1	25.1	-12.0 (-16.6 to -7.5)
Grade 8	N = 1787	N/A		N = 1762	N/A		N = 875	N = 841		N = 866	N = 807	
% Proficient	62.9	N/A	N/A	64.1	N/A	N/A	31.2	20.1	11.1 (-15.2 to -7.0)	31.9	18.2	-13.7 (-17.7 to -9.6)
District 2												
Kindergarten	N = 334	N = 1183		N = 333	N = 1260		N = 188	N = 1154		N = 187	N = 1261	
% Proficient	23.4	26.6	3.3 (-1.9 to 8.5)	51.4	52.7	1.4 (-4.7 to 7.4)	41.0	36.8	-4.13 (-11.7 to 3.4)	70.6	67.3	-3.3 (-10.3 to -3.8)
Grade 1	N = 580	N = 1279		N = 578	N = 1335		N = 301	N = 1280		N = 295	N = 1336	
% Proficient	14.1	16.5	2.4 (-1.1 to 5.8)	40.0	30.7	-9.3 (-14.0 to -4.6)	29.2	21.2	-8.1 (-13.7 to -2.5)	55.9	38.5	-17.5 (-23.7 to -11.2)
Grade 2	N = 647	N = 1224		N = 641	N = 1274		N = 344	N = 1218		N = 341	N = 1266	
% Proficient	20.7	16.7	-4.0 (-7.7 to -0.2)	38.7	29.7	-8.9 (-13.5 to -4.4)	47.7	28.7	-18.9 (-24.8 to -13.1)	68.6	46.7	-21.9 (-27.6 to -16.3)
Grade 3	N = 1805	N = 1342		N = 1782	N = 1372		N = 353	N = 1334		N = 335	N = 1371	

**SUPPLEMENTAL TABLE 10** Continued

	Mathematics						Reading					
	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency, (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)
% Proficient	16.7	15.2	-1.5 (-4.1, 1.1)	35.5	33.7	-1.9 (-5.2 to 1.5)	61.8	45.4	-16.4 (-22.1 to -10.7)	76.1	59.1	-17.0 (-22.3 to -11.8)
Grade 4	N = 2739	N = 1341		N = 2725	N = 1398		N = 2745	N = 1351		N = 2732	N = 1389	
% Proficient	31.7	21.2	-10.5 (-13.3 to -7.7)	49.4	39.8	-9.6 (-12.7 to -6.4)	33.7	31.8	-1.9 (-5.0 to 1.1)	45.1	44.1	-1.0 (-4.2, 2.2)
Grade 5	N = 2895	N = 1364		N = 2879	N = 1403		N = 2908	N = 1363		N = 2872	N = 1402	
% Proficient	40.9	30.6	-10.2 (-13.3 to -7.2)	57.7	46.6	-11.0 (-14.2 to -7.9)	34.6	33.6	-1.0 (-4.0 to 2.1)	44.0	42.2	-1.8 (-4.9 to 1.4)
Grade 6	N = 2749	N = 1268		N = 2550	N = 1306		N = 2738	N = 1339		N = 2515	N = 1381	
% Proficient	39.6	36.7	-2.9 (-6.2 to 0.3)	52.1	42.0	-10.1 (-13.4 to -6.8)	34.8	43.1	8.3 (5.1–11.5)	42.9	44.1	1.2 (-2.1 to 4.4)
Grade 7	N = 2874	N = 1303		N = 2693	N = 1319		N = 2792	N = 1324		N = 2620	N = 1369	
% Proficient	39.7	40.1	0.4 (-2.8 to 3.6)	47.4	43.7	-3.7 (-7.0 to -0.4)	40.5	47.0	6.5 (3.2–9.7)	48.2	47.3	-0.9 (-4.1 to 2.4)
Grade 8	N = 2510	N = 1206		N = 2332	N = 1239		N = 2645	N = 1188		N = 2323	N = 1258	
% Proficient	33.9	35.8	1.9 (-1.4 to 5.2)	41.5	40.3	-1.2 (-4.6 to 2.1)	42.5	41.4	-1.1 (-4.5 to 2.3)	48.6	45.6	-2.9 (-6.4 to 0.5)
District 3												
Kindergarten	N = 725	N = 326		N = 772	N = 322		N = 725	N = 325		N = 724	N = 309	
% Proficient	11.6	15.3	3.8 (-0.8 to 8.3)	46.4	47.8	1.4 (-5.1 to 8.0)	18.1	21.2	3.2 (-2.1 to 8.4)	63.7	35.6	-28.1 (-34.5 to -21.7)
Grade 1	N = 734	N = 361		N = 723	N = 358		N = 717	N = 359		N = 717	N = 341	
% Proficient	7.5	12.7	5.3 (1.3 to 9.2)	32.2	17.3	-14.9 (-20.1 to -9.7)	12.3	20.3	8.1 (3.3–12.9)	39.9	45.2	5.3 (-1.1 to 11.7)
Grade 2	N = 721	N = 352		N = 718	N = 347		N = 717	N = 348		N = 715	N = 339	
% Proficient	10.1	11.1	1.0 (-3.0 to 4.9)	27.7	23.9	-3.8 (-9.4 to 1.8)	19.8	26.4	6.6 (1.2–12.1)	41.3	41.3	0.0 (-6.3 to 6.4)
Grade 3	N = 733	N = 359		N = 731	N = 351		N = 733	N = 351		N = 733	N = 333	
% Proficient	8.7	10.9	2.1 (-1.7 to 5.9)	39.5	28.8	-10.8 (-16.7 to -4.8)	38.2	38.7	0.6 (-5.6 to 6.7)	61.3	43.5	-17.7 (-24.1 to -11.3)
Grade 4	N = 775	N = 355		N = 774	N = 350		N = 778	N = 350		N = 778	N = 332	
% Proficient	28.6	16.1	-12.6 (-17.6 to -7.6)	50.1	36.3	-13.8 (-20.0 to -7.7)	27.8	27.1	-0.6 (-6.2 to 5.0)	37.4	43.1	5.7 (-0.7 to 12.0)
Grade 5	N = 805	N = 367		N = 805	N = 360		N = 803	N = 360		N = 802	N = 346	
% Proficient	38.3	23.4	-14.8 (-20.3 to -9.3)	53.8	36.7	-17.1 (-23.2 to -11.1)	26.9	32.2	5.3 (-0.4 to 11.0)	40.5	46.2	5.7 (-0.5 to 12.0)
Grade 6	N = 793	N = 402		N = 790	N = 398		N = 792	N = 399		N = 791	N = 377	

SUPPLEMENTAL TABLE 10 Continued

	Mathematics						Reading					
	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)	BOY Proficiency Prepandemic <sup>a</sup>	BOY Proficiency in 2020–2021	Difference in BOY Student Proficiency (95% CI)	MOY Proficiency Prepandemic <sup>b</sup>	MOY Proficiency in 2020–2021	Difference in MOY Student Proficiency (95% CI)
% Proficient	29.1	30.1	-9.0 (-14.6 to -3.4)	50.9	38.4	-12.4 (-18.4 to -6.5)	32.6	29.8	-2.8 (-8.3 to 2.8)	40.7	42.4	1.7 (-4.3 to 7.8)
Grade 7	<i>N</i> = 798	<i>N</i> = 369		<i>N</i> = 794	<i>N</i> = 350		<i>N</i> = 800	<i>N</i> = 372		<i>N</i> = 797	<i>N</i> = 367	
% Proficient	34.7	31.4	-3.3 (-9.1 to 2.5)	44.5	40.9	-3.6 (-9.8 to 2.6)	38.0	38.4	0.4 (-5.5 to 6.4)	39.6	45.8	6.1 (0–12.3)
Grade 8	<i>N</i> = 787	<i>N</i> = 394		<i>N</i> = 784	<i>N</i> = 358		<i>N</i> = 787	<i>N</i> = 389		<i>N</i> = 786	<i>N</i> = 379	
% Proficient	31.5	27.7	-3.9 (-9.3 to 1.6)	42.7	32.1	-10.6 (-16.6 to -4.7)	37.0	39.3	2.4 (-3.6 to 8.3)	41.6	36.9	-4.7 (-10.6 to 1.3)

<sup>a</sup>BOY "Pre-pandemic" included the average of 2018–2019 and 2019–2020 beginning of the year student proficiency.

<sup>b</sup>MOY "Prepandemic" included the average of 2018–2019 and 2019–2020 middle of the year student proficiency.