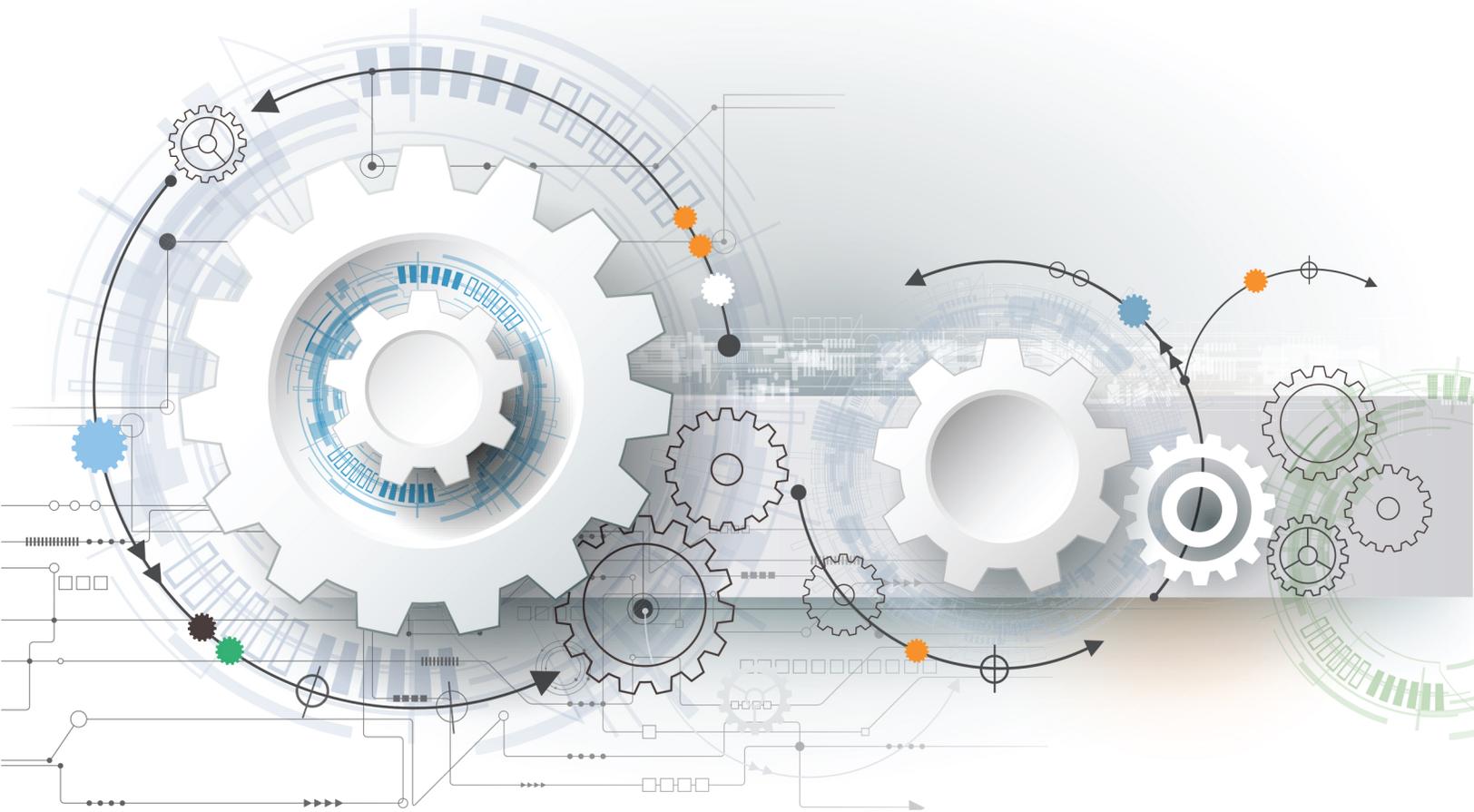


Working Paper

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Have ACT Aspire Interim Scores Declined During the COVID-19 Pandemic?

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ABOUT THE AUTHOR

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Have ACT Aspire Interim Test Scores Declined During the COVID-19 Pandemic?

Executive Summary

For schools that administered ACT[®] Aspire[®] Interim Assessments during the COVID-19 pandemic, lower scores were observed compared to those before the pandemic in all grade levels (5–10) and all subject areas (English, math, reading, and science). The size of the score decreases varied across subjects and grade levels, with score decreases in math as large as 0.20 standard deviations, which is comparable to a percentile rank decrease of 8 points. Despite concerns of widening racial/ethnic achievement gaps due to the pandemic, score decreases in math for African American students were less severe than those observed for White students. Across subjects, score decreases for students with disabilities were generally less severe than those observed for the total group. In math, the score decreases were more severe for higher achieving students. Collectively, the findings suggest that the pandemic-related score decreases were most pronounced for subjects, grade levels, and student and school groups that experience higher growth under normal circumstances. The study contributes to the growing literature on the pandemic's impact on academic achievement.

Introduction

In this report, ACT Aspire Interim scores are examined for possible negative effects of the pandemic on students' academic achievement. Using schools that administered tests before and during the pandemic and controlling for students' prior test scores, we examined changes in average scores over time. In addition to examining the overall trend, we compared differences across student and school groups, including by gender, race/ethnicity, disability status, economic status, English learner status, prior achievement score, school control (public or nonpublic), and school poverty level.

The earliest studies on the pandemic's impact on academic achievement focused on math and reading, included students only up to grade 8, and were based on diagnostic or interim assessments (Curriculum Associates, 2020; Kuhfeld, Tarasawa, Johnson, Ruzek, &

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Lewis, 2020; Renaissance, 2020, 2021). Table 1 summarizes the results of the early studies, which are all based on assessment results from fall 2020 or early 2021. While the studies vary in sample representation, statistical methodology, and assessments used, the results generally suggest that the negative effects of the pandemic are more pronounced for math relative to reading and for younger students relative to those in later grade levels.

Table 1. Summary of Early Research on the Pandemic’s Impact on Student Achievement

Study	Difference Metric Assessment	Subject	2019–2020 to 2020–2021 Difference, by Grade Level											
			1	2	3	4	5	6	7	8	9	10	12	
Kuhfeld et al., 2020	Percentile MAP® Growth™	Math			-9	-10	-9	-6	-5	-6				
		Reading			0	-2	-1	0	+1	+1				
Renaissance, 2020	Percentile Star	Math		-4	-8	-10	-10	-8	-5	-3				
		Reading	+1	+9	+2	-2	-2	-2	-2	-2				
Renaissance, 2021	Percentile Star	Math		-4	-5	-9	-8	-6	-4	-1				
		Reading	+2	-2	+1	-3	-1	-3	-3	-3				
Curriculum Assoc., 2020	% within 2 grade levels i-Ready Diagnostic	Math	-6	-10	-9	-7	-5	-6	-5	-1				
		Reading	-1	-6	-5	-2	+1	+1	+1	+2				
Allen, 2021, 2021b	Percentile PreACT, ACT	English										-7	-5	
		Math										-5	-3	
		Reading											-2	-2
		Science											+3	-2
Current Study	Percentile ACT Aspire Interim	English					-5	-3	-5	-5	-2	-1		
		Math					-8	-8	-7	-4	-7	-6		
		Reading					-4	-3	-3	-3	-2	-2		
		Science					-6	-7	-3	-6	-5	-1		

Note. Cells shaded orange indicate decreases and cells shaded blue indicate increases of 5 or more points; cells shaded light orange indicate decreases and cells shaded light blue indicate increases of 2–4 points.

An analysis of PreACT® score trends (Allen, 2021a) examined later grade levels (primarily grade 10) and additional subject areas (English and science, along with math and reading). A parallel analysis of ACT® score trends (Allen, 2021b) focused primarily on grade 12 and the same four subject areas. The PreACT and ACT analyses suggest that the pandemic’s negative effect on academic achievement extends to summative assessments of college and career readiness and is most pronounced in English. Consistent with the earlier studies, the PreACT and ACT analyses suggest that the impact is more severe in math than in reading. The

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current study is based on a low-stakes interim assessment, focuses on grades 5–10, and examines the same four subject areas as the PreACT and ACT analyses.

ACT Aspire Interim Assessments

ACT Aspire Interim Assessments include multiple-choice tests in English, math, reading, and science for grades 3–10. (The same tests are available for grades 9 and 10.) The Interim tests are abbreviated versions of the ACT Aspire® Summative Assessments, covering the same knowledge and skills and using the same reporting categories as the Summative tests. There are four Interim test forms for each subject area and grade level. Within grade level and subject area, the content of the Interim tests is not sequenced, and the scores from different test forms are equated. Thus, any of the test forms can be administered at any point during the academic year, and scores can be compared over the course of the academic year to monitor progress. The tests are fixed format, computer based, multiple choice, and typically administered in 45 minutes or less. Beginning with the 2020–2021 school year, the tests can be taken remotely. The ACT Aspire Interim Assessments are primarily used to (a) generate data to inform instruction, (b) gauge how well students are progressing toward meeting academic standards, and (c) help students prepare for Summative assessments. More detailed information about the assessments is provided in the *ACT Aspire Periodic Technical Manual* (ACT, 2020).

Methods

Sample

We considered schools that administered ACT Aspire Interim Assessments during both 2019–2020 (pre-pandemic) and 2020–2021 (during the pandemic). Students were only included if they had a previous ACT Aspire Summative test score in the same subject area. For students tested in 2020–2021, the prior Summative test was from spring 2019; for students tested in 2019–2020, the prior Summative test was from spring 2018. Summative test scores from 2019

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(or 2018) were used because the Summative test score from the most recent previous spring (spring 2020) was not available because of pandemic-related test cancellations. Note that ACT Aspire Interim Assessments are offered for grades 3–10, but because we required a prior Summative test score, the analysis was limited to grades 5–10.

Eligibility for inclusion in the analysis was determined for each study unit defined by combination of school, grade level, and subject area. Units were eligible for the analysis if (a) at least five students were tested through February in both 2019–2020 and 2020–2021 and (b) the number of students tested in 2020–2021 was at least 50%, and no more than 200%, of the number tested in 2019–2020.

Overall, 433 schools from eight states and two U.S. territories qualified for the analysis, with 79% of the schools coming from one state. The number of schools and students that qualified for the analysis varied across the 24 analysis samples, defined by the four subject areas and six grade levels (Table 2). The number of schools ranged from 90 (English grades 9 and 10) to 217 (math grade 5). For the 2020–2021 cohort, the number of students ranged from 10,754 (English grade 10) to 19,556 (science grade 5). Fewer students were assessed in 2020–2021 (15,927 on average) compared to 2019–2020 (18,838 on average). During 2019–2020 (before schools were affected by the pandemic), the schools administered the tests between September 3, 2019 and March 13, 2020. During 2020–2021, the schools administered the tests between September 1, 2020 and March 8, 2021.

For each analysis sample, background characteristics of the two cohorts are compared in Table 2. The percentage of students in an underrepresented group (African American, Hispanic, Native American, Native Hawaiian/Other Pacific Islander, or two or more races) was similar across the two cohorts: On average, the percentage of underrepresented group students was 30.9% for the 2019–2020 cohort and 30.1% for the 2020–2021 cohort. Likewise, the percentage of students with disabilities was similar for the two cohorts, with an average of

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14.6% for the 2019–2020 cohort and 16.1% for the 2020–2021 cohort. On average, the percentage of students classified as economically disadvantaged was 53.5% for the 2019–2020 cohort and 57.2% for the 2020–2021 cohort.

Table 2. Demographics of Study Samples

Subject	Grade level	N schools	N students		%Under represented		%SWD		%ED	
			19–20	20–21	19–20	20–21	19–20	20–21	19–20	20–21
English	5	167	16,028	13,097	29.8	26.7	13.7	15.7	50.5	52.4
	6	154	16,596	13,092	28.3	26.4	12.9	16.6	48.0	52.1
	7	130	15,062	13,282	28.8	27.6	13.8	15.7	50.0	55.4
	8	130	15,469	13,827	31.5	29.1	13.7	15.0	51.9	53.5
	9	90	13,544	11,288	30.4	30.7	16.3	17.3	57.6	62.0
	10	90	13,782	10,754	31.1	29.5	14.0	15.7	56.2	60.1
Math	5	217	23,817	19,168	32.6	30.9	14.2	15.6	53.8	54.6
	6	186	21,398	17,421	29.0	28.2	14.0	16.5	50.5	53.8
	7	151	18,731	16,936	28.7	29.5	14.9	15.4	49.1	56.6
	8	151	18,635	17,704	31.6	31.8	14.7	15.2	51.6	55.9
	9	108	19,367	16,615	33.7	35.5	16.3	16.7	57.6	61.9
	10	104	17,586	13,530	33.6	31.9	15.0	16.1	57.3	60.3
Reading	5	215	23,150	19,030	31.9	30.6	13.7	15.2	53.2	54.8
	6	188	20,813	17,486	28.6	27.7	12.9	16.3	49.5	52.9
	7	153	18,637	16,822	28.9	28.7	13.8	15.7	50.6	55.9
	8	157	18,925	17,660	31.1	29.9	13.7	15.2	52.3	54.8
	9	113	19,745	17,145	33.4	35.0	15.9	16.7	57.8	61.7
	10	106	17,565	14,014	33.6	31.8	14.1	16.2	57.2	60.5
Science	5	211	24,593	19,556	32.7	30.0	15.2	16.5	55.7	57.3
	6	184	23,406	18,606	29.4	29.1	15.1	17.5	52.6	57.5
	7	151	20,703	18,485	29.9	29.6	15.4	16.1	52.9	58.8
	8	151	20,369	19,198	31.6	31.2	15.8	15.8	54.9	57.8
	9	105	17,454	14,693	31.4	32.2	17.0	17.1	57.4	62.6
	10	103	16,745	12,835	31.1	29.5	15.2	16.0	56.6	60.1

Note. SWD = students with disabilities, ED = economically disadvantaged.

Statistical Model

To estimate the difference in average ACT Aspire Interim scores from 2019–2020 (pre-pandemic) to 2020–2021, we used hierarchical linear regression models for each analysis sample. The models accommodate multiple test scores per student, account for the nesting of students within schools, and estimate the difference in scores across years while controlling for prior Summative test score, test date, race/ethnicity, and student group indicators (gender, disability, economic status, and English learner status). More details on the statistical models are provided in the appendix.

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Results

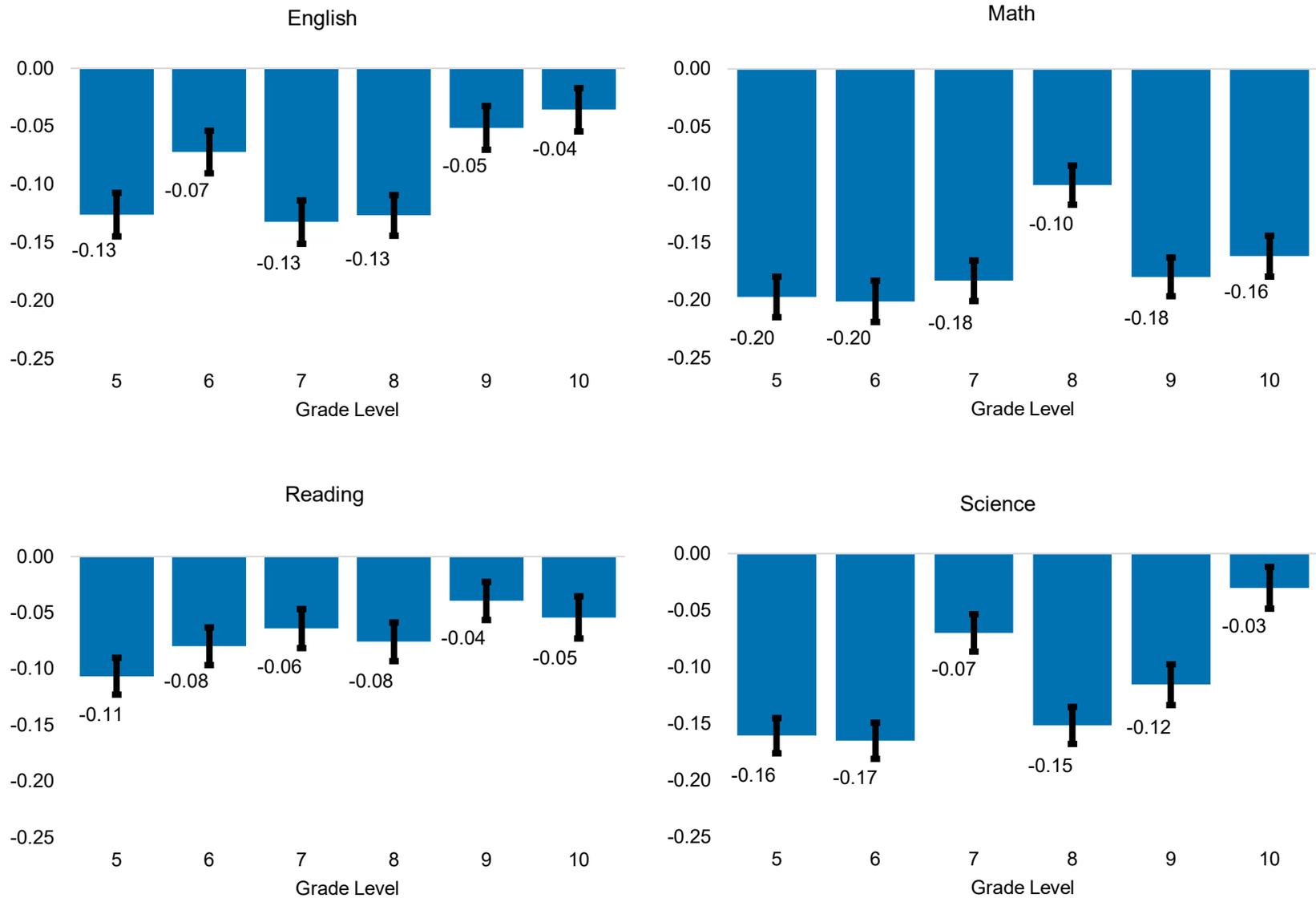
Figures 1 and 2 and Tables 3–5 provide the adjusted difference in average scores from 2019–2020 to 2020–2021. The estimates are provided in standard deviation units, making it easier to compare results across subjects and grade levels. Figure 1 provides the overall estimates in graphic form and shows the 95% confidence intervals for each estimate. Figure 2 plots the change in average scores by grade level and subject, showing how the severity of the score declines tends to decrease for higher grade levels. Table 3 provides the estimates for each racial/ethnic group. Table 4 provides the estimates for student groups: females, males, students with disabilities, students classified as economically disadvantaged, and English learners. Table 5 provides the estimates for school groups: public, nonpublic, and by school locale. For reference, each table also provides the overall estimates for each analysis sample (Total estimate) as well as the standard error of the overall estimate.

As compared to the pre-pandemic 2019–2020 cohort, average ACT Aspire Interim scores were lower in all subjects and all grade levels for the 2020–2021 cohort, suggesting a negative effect of the pandemic on academic achievement. The size of the differences varied across subjects and grade levels, but the score decreases tended to be most severe for math (-0.17 , averaged across six grade levels), followed by science (-0.12), English (-0.09), and reading (-0.07). The score decreases tended to be less severe for higher grade levels. Figure 2 plots the score decrease by grade level for the 24 analysis samples: The correlation of grade level and score decrease was 0.44.

The estimates marked with an asterisk in Table 3 indicate cases where the score change for the racial/ethnic group was significantly different than that observed for White students. For math, across all grade levels, the score decreases for African American students were less severe than the decreases observed for White students. For grades 5, 7, and 8, the same was true for Hispanic students. Other differences did not show the same consistency across grade levels.

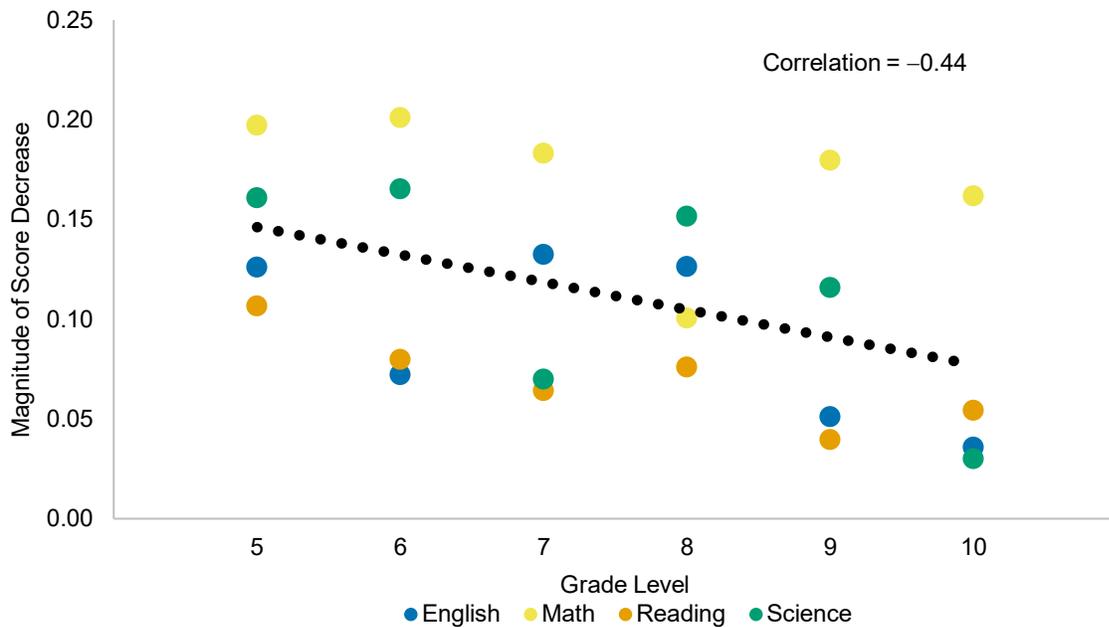
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Figure 1. Adjusted Difference in Average Scores from 2019–2020 to 2020–2021, by Subject and Grade Level



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Figure 2. Change in Average Scores from 2019–2020 to 2020–2021, by Grade Level and Subject



The score decreases were generally similar for female and male students; only three of the 24 differences suggested that the score decreases were more severe for female students (Table 4). The score decreases for students with disabilities tended to be less severe than those for the total group, particularly in math and English. For math, across all grade levels, the score decreases for the SWD (students with disabilities) group were less severe than those for students not in the SWD group. Students classified as economically disadvantaged and English learners also had less severe decreases in math relative to students not belonging to those groups, though the differences were not significant for all grade levels. Across the other subject areas, there were other differences for students classified as economically disadvantaged and English learners, but the differences were not in a consistent direction.

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Table 3. Adjusted Difference in Average Scores from 2019–2020 to 2020–2021, by Race/Ethnicity

Subject	Grade level	Total estimate (SE)	Estimates by race/ethnicity				
			African American	Asian	Hispanic	Other race	White
English	5	-0.13 (0.01)	-0.16	-0.14	-0.15	-0.14	-0.11
	6	-0.07 (0.01)	-0.10	-0.11	-0.04	*-0.00	-0.08
	7	-0.13 (0.01)	*-0.21	-0.03	-0.08	-0.10	-0.14
	8	-0.13 (0.01)	-0.11	*-0.01	-0.13	-0.13	-0.13
	9	-0.05 (0.01)	*-0.00	-0.03	* 0.04	-0.08	-0.08
	10	-0.04 (0.01)	* 0.01	0.03	-0.08	0.03	-0.04
Math	5	-0.20 (0.01)	*-0.16	-0.19	*-0.14	-0.16	-0.21
	6	-0.20 (0.01)	*-0.14	-0.24	-0.18	-0.19	-0.22
	7	-0.18 (0.01)	*-0.14	-0.19	*-0.12	-0.21	-0.19
	8	-0.10 (0.01)	*-0.04	-0.09	*-0.06	-0.16	-0.11
	9	-0.18 (0.01)	*-0.06	*-0.37	-0.20	-0.17	-0.20
	10	-0.16 (0.01)	*-0.02	-0.28	-0.20	-0.16	-0.18
Reading	5	-0.11 (0.01)	*-0.15	-0.12	-0.08	-0.13	-0.10
	6	-0.08 (0.01)	-0.09	-0.11	* 0.01	-0.12	-0.09
	7	-0.06 (0.01)	-0.11	0.03	* 0.00	* 0.00	-0.07
	8	-0.08 (0.01)	-0.08	* 0.03	-0.04	-0.05	-0.09
	9	-0.04 (0.01)	*-0.09	-0.03	-0.02	-0.08	-0.04
	10	-0.05 (0.01)	-0.05	0.03	-0.09	0.00	-0.05
Science	5	-0.16 (0.01)	-0.15	-0.06	*-0.19	-0.19	-0.15
	6	-0.17 (0.01)	-0.13	*-0.34	-0.17	-0.16	-0.17
	7	-0.07 (0.01)	*-0.13	0.00	-0.05	-0.12	-0.06
	8	-0.15 (0.01)	-0.13	-0.16	*-0.10	-0.16	-0.16
	9	-0.12 (0.01)	-0.13	-0.12	-0.13	-0.09	-0.11
	10	-0.03 (0.01)	-0.03	-0.01	0.00	-0.01	-0.04

* The estimate is significantly different from the estimate for White students.

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Table 4. Adjusted Difference in Average Scores from 2019–2020 to 2020–2021, by Student Group

Subject	Grade level	Total estimate (SE)	Student group				
			Female	Male	SWD	ED	EL
English	5	-0.13 (0.01)	-0.11	-0.14	*-0.05	-0.14	-0.17
	6	-0.07 (0.01)	-0.07	-0.08	-0.07	*-0.09	-0.05
	7	-0.13 (0.01)	*-0.17	*-0.11	*-0.09	*-0.16	-0.08
	8	-0.13 (0.01)	-0.14	-0.11	*-0.08	-0.14	-0.16
	9	-0.05 (0.01)	-0.05	-0.05	-0.04	*-0.02	* 0.11
	10	-0.04 (0.01)	-0.05	-0.03	* 0.03	-0.04	-0.04
Math	5	-0.20 (0.01)	-0.19	-0.19	*-0.14	-0.20	*-0.14
	6	-0.20 (0.01)	-0.20	-0.21	*-0.13	*-0.18	-0.15
	7	-0.18 (0.01)	-0.18	-0.18	* 0.02	-0.17	*-0.05
	8	-0.10 (0.01)	*-0.11	*-0.08	* 0.08	*-0.08	* 0.03
	9	-0.18 (0.01)	-0.18	-0.18	*-0.03	*-0.15	*-0.09
	10	-0.16 (0.01)	-0.16	-0.18	*-0.06	*-0.15	-0.12
Reading	5	-0.11 (0.01)	-0.09	-0.11	-0.08	*-0.13	-0.12
	6	-0.08 (0.01)	-0.09	-0.09	*-0.03	-0.08	* 0.02
	7	-0.06 (0.01)	-0.05	-0.08	-0.08	*-0.09	0.00
	8	-0.08 (0.01)	-0.08	-0.07	-0.10	*-0.09	-0.03
	9	-0.04 (0.01)	-0.05	-0.03	-0.06	-0.04	-0.09
	10	-0.05 (0.01)	-0.06	-0.05	-0.05	*-0.07	*-0.11
Science	5	-0.16 (0.01)	-0.14	-0.16	-0.15	*-0.19	*-0.26
	6	-0.17 (0.01)	*-0.19	*-0.15	*-0.13	-0.17	-0.18
	7	-0.07 (0.01)	-0.07	-0.07	*-0.12	*-0.09	-0.04
	8	-0.15 (0.01)	-0.15	-0.14	*-0.08	-0.15	*-0.07
	9	-0.12 (0.01)	-0.12	-0.12	*-0.07	-0.12	-0.09
	10	-0.03 (0.01)	-0.02	-0.05	* 0.06	-0.03	* 0.07

Note. SWD = students with disabilities; ED = economically disadvantaged; EL = English learners

* The estimate is significantly different from the estimate for students not in the student group.

Score changes are examined by school group in Table 5. For 13 of the analysis samples, the score change for public schools was significantly different from the score change for nonpublic schools; in 12 of 13 of those cases, the difference suggested that the score decrease was more severe for students attending public schools. There were also several significant differences in score changes across different school locales. In most cases, the pattern of results suggested that the severity of the pandemic was greater for schools in rural and town settings relative to those in suburbs and cities. For example, for grade 7 reading, scores decreased by 0.10 points for schools in rural locales and 0.12 points for schools in towns but increased by 0.02 points for schools in cities. For grades 9 and 10 math, the pattern of

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results suggest that the pandemic's impact was more severe for students in suburban and city schools.

Table 5. Adjusted Difference in Average Scores from 2019–2020 to 2020–2021, by School Group

Subject	Grade level	Total estimate (SE)	School control		School locale			
			Non public	Public	Rural	Town	Suburb	City
English	5	-0.13 (0.01)	*-0.08	-0.14	*-0.11	*-0.14	*-0.07	-0.20
	6	-0.07 (0.01)	-0.07	-0.08	*-0.07	*-0.09	*-0.08	0.06
	7	-0.13 (0.01)	*-0.05	-0.17	-0.13	*-0.20	-0.09	-0.09
	8	-0.13 (0.01)	*-0.08	-0.13	-0.12	-0.13	-0.15	-0.13
	9	-0.05 (0.01)	0.06	-0.05	*-0.05	*-0.07	*-0.06	0.03
	10	-0.04 (0.01)	NA	-0.04	-0.02	-0.07	* 0.10	-0.03
Math	5	-0.20 (0.01)	*-0.15	-0.20	*-0.24	-0.19	-0.16	-0.17
	6	-0.20 (0.01)	*-0.26	-0.19	*-0.22	*-0.23	-0.17	-0.14
	7	-0.18 (0.01)	*-0.09	-0.18	-0.17	-0.16	-0.09	-0.14
	8	-0.10 (0.01)	-0.07	-0.10	-0.09	-0.06	-0.10	-0.09
	9	-0.18 (0.01)	*0.17	-0.19	*-0.07	*-0.22	*-0.12	-0.28
	10	-0.16 (0.01)	NA	-0.17	*-0.11	*-0.18	*-0.19	-0.30
Reading	5	-0.11 (0.01)	*-0.02	-0.12	-0.09	*-0.15	-0.05	-0.09
	6	-0.08 (0.01)	-0.08	-0.09	-0.05	*-0.13	*-0.11	-0.03
	7	-0.06 (0.01)	*0.04	-0.09	*-0.10	*-0.12	-0.03	0.02
	8	-0.08 (0.01)	*0.02	-0.09	*-0.10	-0.06	-0.11	-0.05
	9	-0.04 (0.01)	-0.08	-0.04	*-0.06	*-0.09	-0.07	-0.01
	10	-0.05 (0.01)	NA	-0.06	-0.05	-0.07	0.03	-0.06
Science	5	-0.16 (0.01)	*-0.04	-0.17	*-0.19	-0.15	-0.16	-0.15
	6	-0.17 (0.01)	-0.16	-0.17	*-0.16	*-0.20	*-0.18	-0.07
	7	-0.07 (0.01)	*0.02	-0.09	-0.09	-0.09	-0.07	-0.04
	8	-0.15 (0.01)	*-0.10	-0.16	-0.15	*-0.17	*-0.20	-0.11
	9	-0.12 (0.01)	-0.14	-0.12	-0.13	-0.12	-0.12	-0.08
	10	-0.03 (0.01)	NA	-0.03	-0.04	-0.03	-0.02	-0.04

Note. FRL = free or reduced lunch; NA = estimate not available

* The estimate is significantly different from the estimate for the reference group. Reference groups are Control = Public and Locale = City, respectively.

Table 6 presents results of analyses examining whether the pandemic-related score changes varied by students' academic achievement (measured by prior Summative test score), time during the school year (number of days since September 1), and school poverty level (proportion eligible for free or reduced lunch, examined for public school students only). A negative interaction estimate suggests that the severity of the pandemic's impact increased with increasing values of the variable. For example, for grade 5 English, the interaction estimate was -0.053. This indicates that the pandemic-related score decrease was more severe (by 0.053

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standard deviation units) for each standard deviation increase in prior Summative test score. This suggests that the pandemic's impact was more severe for higher achieving students for grade 5 English. The estimates in Table 6 in bold font represent statistically significant results.

In math, the pandemic-related score decreases were more severe for higher achieving students across all grade levels, and this observation was more apparent for higher grade levels. For English, the same was true for four of the six grade levels. Prior achievement interactions for reading and science were not as consistent across grade levels.

For some analysis samples, the pandemic-related score decreases varied by time, but the results were not consistent across grade levels, and significant results were in both directions. A positive interaction coefficient would suggest that the severity of the pandemic is decreasing over time (e.g., students are catching up as more time passes), whereas a negative interaction coefficient would suggest that the severity of the pandemic is increasing over time (e.g., students are falling further behind as more time passes).

For math, there is some evidence that the effects of the pandemic are not as severe for schools with higher poverty levels: The interaction estimate was positive for all grade levels and was statistically significant for five of the six grade levels. For the other subject areas, the results were not consistent across grade levels, and there were fewer significant interactions.

Table 6. Interaction Tests of Differential Score Changes

Subject	Grade level	Prior achievement			Time (days since Sep. 1)			School %FRL		
		EST	SE	p-val	EST	SE	p-val	EST	SE	p-val
English	5	-0.053	0.008	0.000	-0.009	0.009	0.269	0.032	0.040	0.415
	6	-0.003	0.008	0.705	-0.027	0.008	0.001	-0.020	0.038	0.605
	7	-0.011	0.008	0.173	-0.051	0.008	0.000	-0.011	0.037	0.760
	8	-0.016	0.008	0.036	0.017	0.008	0.037	0.040	0.035	0.251
	9	-0.047	0.008	0.000	-0.008	0.008	0.334	0.181	0.039	0.000
	10	-0.033	0.008	0.000	-0.031	0.008	0.000	0.082	0.037	0.027
Math	5	-0.052	0.008	0.000	-0.032	0.008	0.000	0.069	0.035	0.050
	6	-0.070	0.008	0.000	-0.014	0.008	0.084	0.184	0.035	0.000
	7	-0.101	0.008	0.000	0.043	0.008	0.000	0.033	0.033	0.326
	8	-0.115	0.007	0.000	0.065	0.008	0.000	0.100	0.033	0.002
	9	-0.128	0.007	0.000	-0.019	0.008	0.012	0.270	0.036	0.000
	10	-0.102	0.008	0.000	-0.052	0.008	0.000	0.170	0.035	0.000
Reading	5	-0.008	0.007	0.278	-0.019	0.007	0.011	-0.085	0.033	0.011
	6	-0.038	0.007	0.000	-0.004	0.008	0.585	0.044	0.033	0.182
	7	-0.003	0.008	0.652	-0.005	0.008	0.540	-0.083	0.034	0.016
	8	-0.011	0.007	0.157	0.018	0.008	0.018	-0.009	0.034	0.798
	9	0.013	0.007	0.070	0.007	0.008	0.344	0.023	0.036	0.527
	10	0.004	0.008	0.584	-0.034	0.009	0.000	-0.071	0.037	0.056
Science	5	0.022	0.007	0.001	-0.020	0.007	0.005	-0.073	0.032	0.021
	6	-0.037	0.007	0.000	0.008	0.007	0.257	0.116	0.032	0.000
	7	0.010	0.007	0.151	-0.031	0.007	0.000	-0.062	0.034	0.066
	8	-0.053	0.007	0.000	0.034	0.007	0.000	-0.082	0.034	0.015
	9	-0.010	0.008	0.186	0.028	0.008	0.001	0.061	0.036	0.091
	10	-0.024	0.008	0.003	-0.019	0.008	0.022	0.047	0.035	0.182

Note. FRL = free or reduced lunch; EST = estimate of interaction coefficient; SE = standard error of estimate. The estimates in bold font represent statistically significant results.

Discussion

Comparing test scores from 2019–2020 (pre-pandemic) to those from 2020–2021, the study revealed decreases in ACT Aspire Interim test scores across all subjects and grade levels. The adjusted score differences, expressed in standard deviation units, ranged from -0.03 (science grade 10) to -0.20 (math grades 5 and 6). The differences can also be expressed as changes in percentile ranks:¹ For example, the decrease of 0.03 standard deviation units is comparable to a percentile rank decrease of about 1 point, and the decrease of 0.20 standard deviation units is comparable to a percentile rank decrease of about 8 points. By expressing the differences on the percentile rank scale, we can compare results of the current study with those from previous studies, as in Table 1.

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Consistent with the earliest studies of the pandemic's effect on academic achievement, the results suggest that the impact is most severe for math and for earlier grade levels. Using the percentile metric, we found that the size of the math score decreases observed in this study were consistent with those observed for earlier studies (Table 1), averaging around 7 percentile points for grades 5–8. But the size of the reading score decreases observed in this study were larger than those observed in the earlier studies for grades 5–8, averaging about 3 percentile points.

The grade 10 results for the current study are generally consistent with the PreACT and ACT studies that focused on grades 10 and 12, except that the decrease in English was less severe for the current study. Differences across studies may be due to differences across states and districts in the severity of the pandemic's impact, differences in effectiveness of remote and hybrid learning models, sampling error, differences in assessment design, and differences in the statistical methodology used to estimate the pandemic's impact on test scores.

While it is reasonable to attribute some of the score decreases to the pandemic, it is also possible for scores to change for other reasons, such as unexplained differences across cohorts in academic achievement. To better understand year-to-year variation in scores, we applied the same methods and statistical model to prior year comparisons (2017–2018 vs. 2018–2019, 2018–2019 vs. 2019–2020). By doing so, we obtained estimates of the adjusted difference in average scores under normal circumstances (before the pandemic). If all adjusted differences were 0, it would suggest that the statistical model explains all year-to-year variation in scores, and we could be confident that the score decreases observed in this study are strictly due to the pandemic.

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Figure 3. Pre-COVID Frequency Distribution of Adjusted Differences in Average ACT Aspire Interim Test Scores

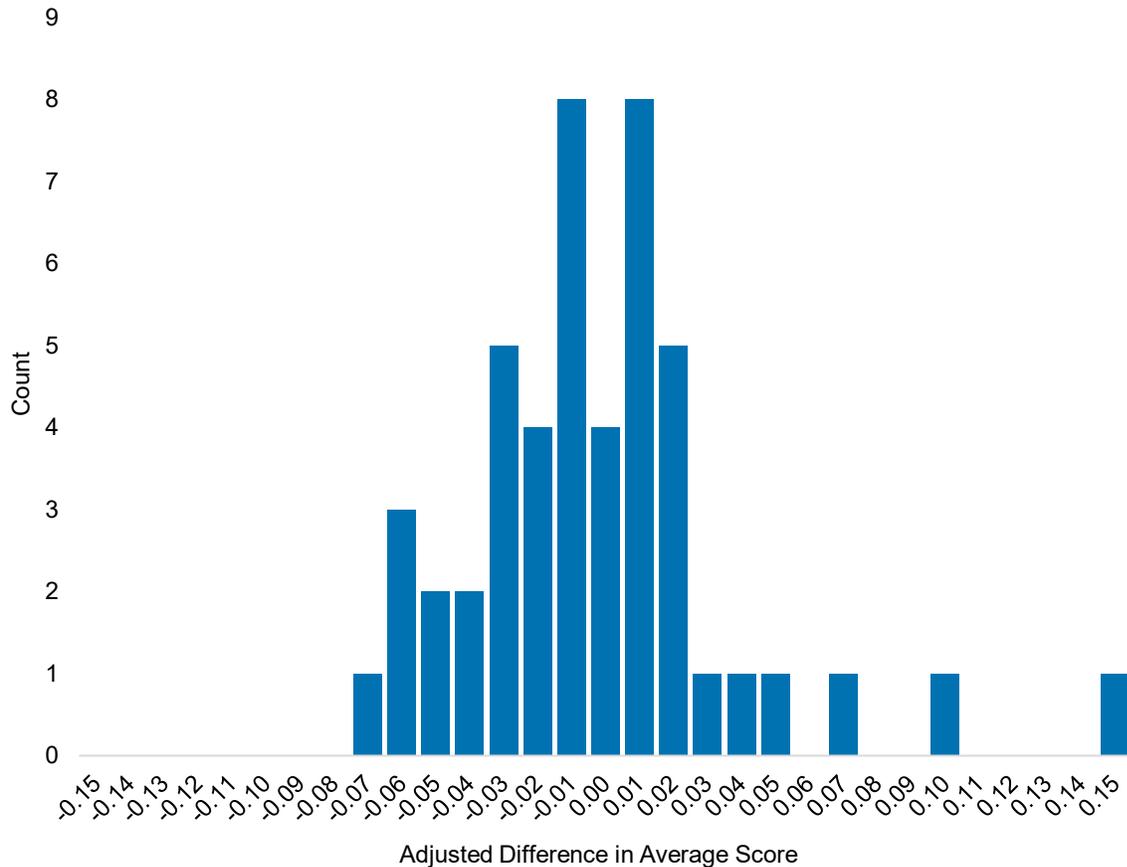


Figure 3 shows the distribution of the pre-COVID adjusted differences. Note that there are 48 adjusted differences because there are four subject areas, six grade levels, and two cohort comparisons. Figure 3 shows that the adjusted differences are centered around 0 (mean = 0.00), but there is variation in adjusted differences (standard deviation = 0.04). Most of the adjusted differences (85%) are within 0.05 units of 0, and the maximum difference is 0.15. Because of the variation in adjusted differences, we can conclude that there is natural year-to-year variation in scores that is not fully explained by the statistical model. Therefore, the annual score changes observed in the current study most likely have a systemic component (the pandemic) and a random component (unexplained variation). Accordingly, it may be reasonable to expect the pandemic's true effect to vary by as much as 0.04 units from the adjusted score differences. For example, for grade 6 math, the adjusted score difference was -0.20 , and the

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pandemic's true effect may have been -0.20 ± 0.04 , or a score decrease of -0.24 to -0.16 units.²

School and Student Group Differences

If the pandemic is having a disproportionate effect on traditionally disadvantaged groups, achievement gaps will widen. If this were the case, for example, we would expect students with disabilities to show larger pandemic-related score decreases than students not belonging to the SWD group. We did not find consistent evidence of widening achievement gaps in the current study. Rather, we found evidence that the pandemic's impact was **less** severe for students in groups that have been traditionally disadvantaged, particularly in math for African American students and students with disabilities—and to a lesser extent for English learners, Hispanic students, and students classified as economically disadvantaged.

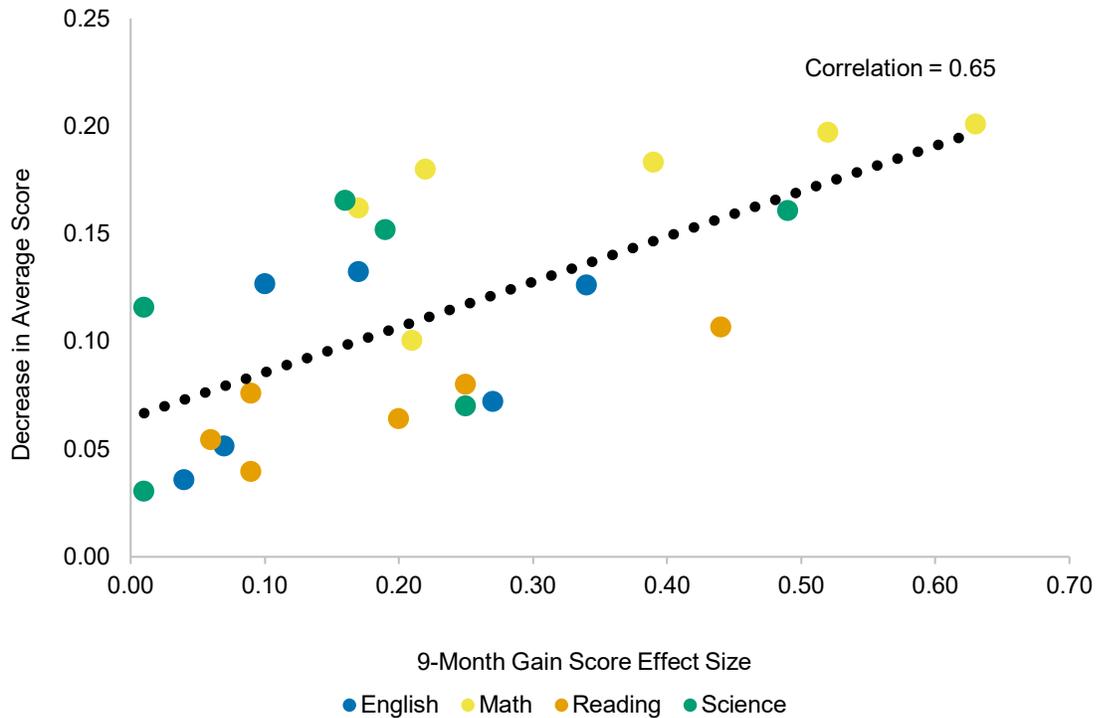
The smaller score decreases in math for African American and Hispanic students are consistent with results from the earlier analysis of PreACT test scores (Allen, 2021a). However, the same phenomena were not found in the earlier analysis of ACT test scores (Allen, 2021b). While gender differences were observed in the PreACT analysis (e.g., females had larger score decreases in reading), neither the current study nor the early analysis of ACT test scores found clear patterns of gender differences. Similar to the earlier PreACT analysis, the current study did not find a clear pattern of differences for Asian students (relative to White students), whereas the analysis of ACT test scores found that scores did not decrease for Asian students.

Additional analyses revealed that the pandemic-related score decreases were more severe for higher achieving students in math and English and for students from more affluent public schools (for math only). The findings generally suggest that pandemic-related score decreases are most pronounced for subjects, grade levels, and school and student groups that experience higher growth under normal circumstances. For example, for each of the 24 analysis samples, Figure 4 plots the pandemic-related score decreases by the assessment gain score effect size (obtained from Table 14.8 of the *ACT Aspire Periodic Technical Manual*, ACT, 2020).

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Pandemic-related score decreases tend to be larger for subjects and grade levels in which students normally demonstrate more growth during an academic year.

Figure 4. Decrease in Average Scores from 2019–2020 to 2020–2021, by Typical Academic Growth for Each Subject/Grade Level Combination



Study Limitations

The study was based on the ACT Aspire Interim Assessment, with most of the sample coming from one state, potentially limiting the generalizability of the findings to other states and assessment systems. The results are based on students who were able to test during the pandemic, but such students may not be representative of all students. For example, students or schools who were not able to test during the 2020–2021 academic year may have more barriers to both testing and learning. If this were the case, we would expect this study to underestimate the pandemic’s impact on academic achievement.

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Conclusions

The study contributes to the growing literature on the pandemic's impact on academic achievement. It offers a unique perspective by examining the pandemic's effect across multiple subjects, grade levels, and student and school groups. The early research suggests that the pandemic's effect on academic achievement—both overall and especially by student group—may vary substantially across states and assessment programs. Therefore, it is important to collect evidence across multiple studies to gain a thorough understanding of the impact.

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Appendix: Statistical Model for Estimating Year-to-Year Score Changes

To account for clustering of students within schools and grade levels, hierarchical linear regression models were used to model ACT Aspire Interim test scores. ACT Aspire Summative test score, gender, race/ethnicity, student group indicator variables (disability status, economic status, and English learner status), and number of days from September 1 to the Interim test were used as covariates to reduce confounding in the comparison of scores across years.³

The model also included an indicator for year (i.e., $I_{2020} = 1$ for students in the 2020–2021 sample during the pandemic; $I_{2020} = 0$ for students in the 2019–2020 sample prior to the pandemic). If the coefficient for year is negative, it provides evidence of a negative effect of the pandemic on ACT Aspire Interim test scores. Model intercepts and year effects were allowed to vary across schools. The model was fit for each subject area (English, math, reading, and science) and grade level (5–10) for a total of 24 analyses.

The hierarchical regression model can be written as

$$Y_{ij} = b_{0j} + I_{2020ij}b_{1j} + \sum_{p=1}^P X_{ijp}\theta_p + r_{ij} + e_{ij}$$

where Y_{ij} is the ACT Aspire Interim test score for the i th student from the j th school, b_{0j} is the intercept for the j th school, I_{2020ij} indicates whether the i th student from the j th school tested in 2020–2021, b_{1j} is the increase (or decrease) in average test score associated with testing during the pandemic, X_{ijp} is the p th covariate for the i th student from the j th school with associated coefficient θ_p , r_{ij} is the random student effect (e.g. student-specific intercept) to accommodate multiple test scores per student, and e_{ij} is the model's error term. Intercepts (b_{0j}) and year effects (b_{1j}) are assumed to vary across schools, and the model also estimates the mean intercept (β_0) and mean year effect (β_1) across schools. In each analysis sample, prior to fitting the model, the test scores were standardized to have mean 0 and standard deviation 1. Therefore, the resulting estimates of changes in mean scores over time (e.g., estimate for β_1)

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are on the standard deviation scale, making it easier to compare results across subjects and grade levels. The SAS Mixed Procedure (SAS, 2015) was used to fit the hierarchical linear regression models.

The model described above estimates the overall COVID-19 impact. Student group estimates can be obtained by estimating interactions between student group indicators and the year indicator. For example, in the model below, the γ coefficient tests whether the COVID-19 impact is different for female students compared to male students. (Note that the same covariates are used as in the main effects model described earlier: ACT Aspire Summative test score, gender, race/ethnicity, disability status, economic status, English learner status, and number of days from September 1 to the Interim test.)

$$Y_{ij} = b_{0j} + I_{2020ij}b_{1j} + \sum_{p=1}^P X_{ijp}\theta_p + \mathbf{female}_{ij}I_{2020ij}\gamma + r_{ij} + e_{ij}$$

This approach was also used to obtain estimates by categorical variables (race/ethnicity, gender, disability status, economic status, and English learner status). Moreover, interactions were tested for three continuous variables (prior Summative test score, number of days from September 1 to the Interim test, and school proportion eligible for free or reduced lunch).

¹ This assumes an underlying normal distribution for test scores and measures change in percentile rank relative to the median score.

² Note that the interval would be even wider if the sampling error were incorporated, as in the confidence intervals shown in Figure 1.

³ Race/ethnicity was missing for some students, so values were imputed prior to fitting the hierarchical regression models.