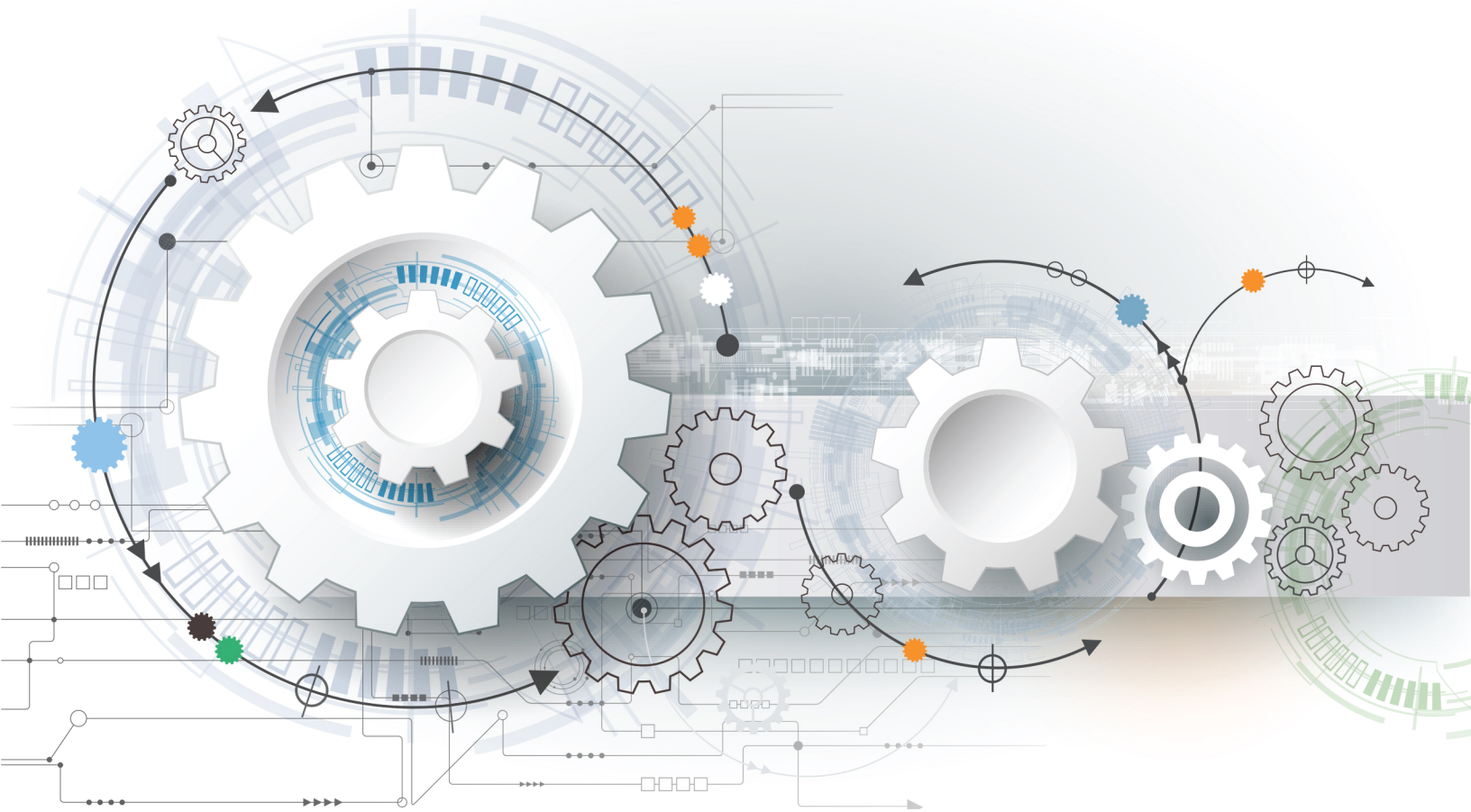


Working Paper

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Have ACT Scores Declined During the COVID-19 Pandemic? An Examination of Fall State and District Testing Data

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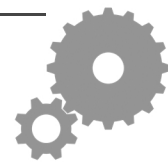
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Have ACT Scores Declined During the COVID-19 Pandemic? An Examination of Fall State and District Testing Data

Jeff Allen

Executive Summary

For schools that were able to administer the ACT® test during the COVID-19 pandemic in fall 2020, lower scores were observed compared to those before the pandemic. Scores decreased by 0.88 points (0.12 standard deviations) in English, 0.49 points (0.09 standard deviations) in math, 0.44 points (0.06 standard deviations) in reading, and 0.26 points (0.04 standard deviations) in science. Score decreases of this magnitude are comparable to percentile rank decreases of about 5 points in English, 3 points in math, 2 points in reading, and 2 points in science. Because of study limitations and natural year-to-year fluctuation in ACT scores, the study does not provide a precise estimate of how much of the score decreases are due to the pandemic. While score decreases for African American, Hispanic, and White students were mostly consistent, the average scores for Asian students were stable across years. Relative to students attending private or parochial schools, the score declines in English and math were more severe for students attending public schools. The results of the study are compared to those from earlier studies, including a parallel analysis of PreACT® test scores.

Introduction

Concerns about the pandemic's negative effects should center primarily around the health and wellness of students, educators, and their families or caregivers. While secondary to those concerns, there is also broad interest in the pandemic's effects on student learning and progression toward college and career readiness. Recent studies based on standardized test scores suggest that the disruptions to K–12 education (e.g., school closures, instructional

delivery model, etc.) brought on by the COVID-19 pandemic have caused students to fall behind academically (Kuhfeld et al., 2020; Renaissance, 2020, 2021; Curriculum Associates, 2020; Allen, 2021). Table 1 summarizes the results of the early studies, which are all based on assessment results from fall 2020 or winter 2021. While the studies vary in sample representation, statistical methodology, and assessments used, the results generally suggest that the negative impacts of the pandemic are more pronounced for math relative to reading and more pronounced for younger students relative to those in later grade levels. An analysis of PreACT score trends (Allen, 2021) suggests that the pandemic's negative impact extends to summative assessments of college readiness and may be more severe for English relative to other subject areas.

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

Study	Difference Metric Assessment	Subject	Pre- Post Pandemic Difference, by Grade Level									
			1	2	3	4	5	6	7	8	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	% ≤ 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	Percentile PreACT	English									-7	
		Math									-5	
		Reading									-2	
		Science									+3	
Current Study	Percentile ACT	English										-5
		Math										-3
		Reading										-2
		Science										-2

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.

In this report, ACT score trends from fall State and District testing programs are examined for possible impacts of the pandemic on high school students' academic achievement. Using schools that tested a comparable number of students before and during the

pandemic, we examined changes in average scores over time. In addition to examining the overall trend, we considered differences across student and school subgroups, including by gender, race/ethnicity, and school characteristics (school control, poverty level, and locale).

Most of the early studies on the pandemic's effect on academic achievement have focused on math and reading, have only included students up to 8th grade, and have been based on diagnostic or interim assessments. The analysis of PreACT score trends (Allen, 2021) examined later grade levels (primarily 10th but also included 9th and 11th grades) and additional subject areas (English and science, in addition to math and reading), using a summative test aligned to college and career readiness standards. The approach used for the current study mirrors that used for the PreACT analysis but is based on schools that administered the ACT test in fall 2020 as part of a state or district testing program.

The ACT Test

The ACT includes four multiple-choice tests—English, math, reading, and science—as well as an optional writing test. Some states and districts administer the ACT to all students through the ACT State and District testing program. ACT scores are traditionally used for college entrance (e.g., admissions, scholarships, placement) and are also used for state and federal accountability and program evaluation. The ACT is usually administered to students in 11th grade but is also used in 10th and 12th grades. When the test is administered in the fall through the ACT State and District testing program, it is usually administered to students in 12th grade. More detailed information about the test is provided in the *ACT Technical Manual* (ACT, 2020a).

Methods

Sample

We considered high schools in the United States that administered the ACT test during the falls of 2019 and 2020 to 11th or 12th graders. High school by grade level combinations

were eligible for the analysis if (a) at least 20 students were tested in fall 2020, (b) the number of students tested in fall 2019 was within 25% of the number tested in fall 2020, (c) at least 75% of all enrolled students were tested across the two years, and (d) the tests were administered at most one month apart in their respective year. This yielded a sample of 311 high schools from 20 states that tested 49,767 students in 2019 and 50,817 students in 2020 (Table 2). During fall 2019 (before schools were affected by the pandemic), the schools administered the ACT test in early October. During fall 2020, the ACT test was administered between September 22 and October 20. The number of days between September 1 and the ACT test was similar across years (30 for 2019, 27 for 2020). Of the 311 high schools included in the study, only nine were also included in the earlier analysis of PreACT test scores (Allen, 2021), so the study samples are mostly independent.

Table 2. Demographics and Summary Statistics

Variable	Year	
	2019	2020
Number of schools	311	311
Number of students	49,767	50,817
Gender (%)		
Female	43.5	44.0
Male	42.6	44.1
Missing	13.9	11.9
Race/Ethnicity (%)		
African American	13.0	13.0
Asian	1.8	2.0
Hispanic	11.0	10.7
Other	4.1	4.0
White	53.3	54.5
Missing	16.9	15.9
Grade Level (%)		
11th	6.7	6.6
12th	93.3	93.4
School type (%)		
Public	94.2	94.2
< 25% FRL	17.2	17.2
25–50% FRL	27.8	27.8
50–75% FRL	37.6	37.9
> 75% FRL	7.6	7.2
% FRL Unknown	4.0	4.1
Nonpublic	5.8	5.8
School locale (%)		
Rural	23.2	23.0

Variable	Year	
	2019	2020
Town	19.1	20.0
Suburb	23.3	23.2
City	26.9	26.6
Missing	7.5	7.2
Days since Sep 1 (mean)	30.0	27.0
ACT scores (mean)		
English	19.3	18.4
Math	18.8	18.4
Reading	19.8	19.5
Science	19.4	19.1
Composite	19.5	19.0
High school GPA		
Percent missing	67.4	58.1
Mean	3.27	3.40

Note. FRL = free or reduced lunch

Given the inclusion criteria described above, the 2019 and 2020 cohorts were similar on demographic characteristics and grade level tested. Across the two cohorts, most of the sample (93%) took the ACT in 12th grade with the remainder testing in 11th grade. The sample included students from public (94%) and nonpublic (6%) schools and students from different racial/ethnic groups, including African American (13%), Asian (2%), Hispanic (11%), Other (4%), and White (54%). About 16% of the sample was missing race/ethnicity data.

Statistical Model

To estimate the difference in average ACT scores from fall 2019 (pre-pandemic) to fall 2020, we used hierarchical linear regression models. More details on the statistical models are provided in the appendix. Scores from the optional ACT writing test are not used in this study.

Results

Table 3 provides the adjusted difference in average scores from fall 2019 to fall 2020. Estimates are provided for the total group and subgroups. As compared to the pre-pandemic fall 2019 cohort, average ACT scores were lower in all four subjects for the fall 2020 cohort. The difference was largest in English (−0.88), followed by math (−0.49), reading (−0.44), and science (−0.26).

Table 3. Adjusted Difference in Average Scores from Fall 2019 to Fall 2020

Group	English		Math		Reading		Science		Composite	
	EST	SE	EST	SE	EST	SE	EST	SE	EST	SE
Total	-0.88	0.05	-0.49	0.04	-0.44	0.05	-0.26	0.04	-0.52	0.04
Gender										
Female	-0.89	0.06	-0.48	0.05	-0.50	0.06	-0.19	0.05	-0.52	0.05
Male	-0.88	0.06	-0.49	0.05	-0.38	0.06	-0.32	0.05	-0.52	0.05
Race/ethnicity										
African American	-0.99	0.11	-0.50	0.08	-0.63	0.11	-0.30	0.09	-0.61	0.09
Asian	0.35	0.25	-0.02	0.18	0.23	0.26	0.29	0.21	0.22	0.20
Hispanic	-0.86	0.11	-0.46	0.09	-0.53	0.12	-0.30	0.09	-0.54	0.09
Other	-1.12	0.17	-0.70	0.13	-0.65	0.18	-0.59	0.14	-0.77	0.14
White	-0.89	0.06	-0.49	0.05	-0.38	0.06	-0.23	0.05	-0.50	0.05
Grade level										
11th	-0.84	0.18	-0.24	0.14	-0.48	0.18	-0.16	0.15	-0.43	0.15
12th	-0.91	0.05	-0.53	0.04	-0.43	0.05	-0.28	0.04	-0.54	0.04
School type										
Public	-0.93	0.05	-0.53	0.04	-0.41	0.05	-0.28	0.04	-0.54	0.04
< 25% FRL	-1.03	0.14	-0.43	0.12	-0.40	0.14	-0.20	0.12	-0.52	0.12
25–50% FRL	-0.95	0.10	-0.54	0.08	-0.37	0.10	-0.29	0.08	-0.54	0.08
50–75% FRL	-0.86	0.08	-0.51	0.07	-0.37	0.08	-0.26	0.07	-0.50	0.07
75–100% FRL	-0.82	0.17	-0.50	0.14	-0.38	0.17	-0.23	0.14	-0.48	0.14
Nonpublic	-0.45	0.17	-0.11	0.13	-0.75	0.17	-0.07	0.14	-0.35	0.14
School locale										
Rural	-0.84	0.10	-0.46	0.08	-0.45	0.10	-0.26	0.08	-0.51	0.08
Town	-0.86	0.11	-0.49	0.09	-0.40	0.11	-0.23	0.09	-0.50	0.09
Suburb	-0.96	0.11	-0.49	0.10	-0.39	0.11	-0.31	0.09	-0.54	0.09
City	-0.87	0.10	-0.47	0.09	-0.38	0.10	-0.21	0.08	-0.49	0.08

Note. EST = estimate of adjusted difference in average score; SE = standard error of estimate; FRL = free or reduced lunch

Adjusted differences in average scores are also provided for student subgroups and for groups defined by school characteristics (school control, poverty level, and locale). Values that appear in bold in Table 3 indicate that the difference was statistically significant across different categories of the grouping variable. For example, for science, scores decreased by 0.19 score points for female students and by 0.32 score points for male students, and this gender difference (of 0.13 points) was statistically significant. Science was the only subject with a

significant gender difference. The decrease in math scores was more severe for students in 12th grade (−0.53) than for students in 11th grade (−0.24).

Across all subjects, Asian students did not experience significant score decreases and even had slight increases in English, reading, and science. Conversely, the other racial/ethnic groups had significant score decreases in all subject areas. The Asian/White differences were statistically significant for all four subject areas. In reading, the score decrease for African American students (0.63 points) was more severe than that of White students (0.38 points). Otherwise, the score changes for African American, Hispanic, White, and the other racial/ethnic groups were generally consistent.

In English and math, students enrolled at public schools had larger score decreases than students enrolled at nonpublic schools. In English, scores dropped by 0.93 points for students at public schools and by 0.45 points for students at nonpublic schools. In math, scores for public school students dropped by 0.53 points, compared to 0.11 points for nonpublic school students. Score changes were consistent across different school poverty levels (examined for public schools only) and school locales (rural, town, suburb, or city).

Discussion

The study revealed changes in ACT scores that may be at least partly attributed to the COVID-19 pandemic. The adjusted score differences in Table 3 are expressed on the ACT score scale. The differences can also be expressed in standard deviation units to facilitate comparisons across studies using different assessments and scales. Using the standard deviations from the latest ACT high school graduating class (ACT, 2020b), we found that the scores decreased by 0.88 points (0.12 standard deviations) in English, 0.49 points (0.09 standard deviations) in math, 0.44 points (0.06 standard deviations) in reading, and 0.26 points (0.04 standard deviations) in science. The standard deviation differences can also be expressed as changes in percentile ranks:¹ The adjusted score differences are comparable to percentile

rank decreases of about 5 points in English, 3 in math, 2 in reading, and 2 in science. The results can then be compared to those from the earlier studies of the pandemic's impact on test scores, as in Table 1.

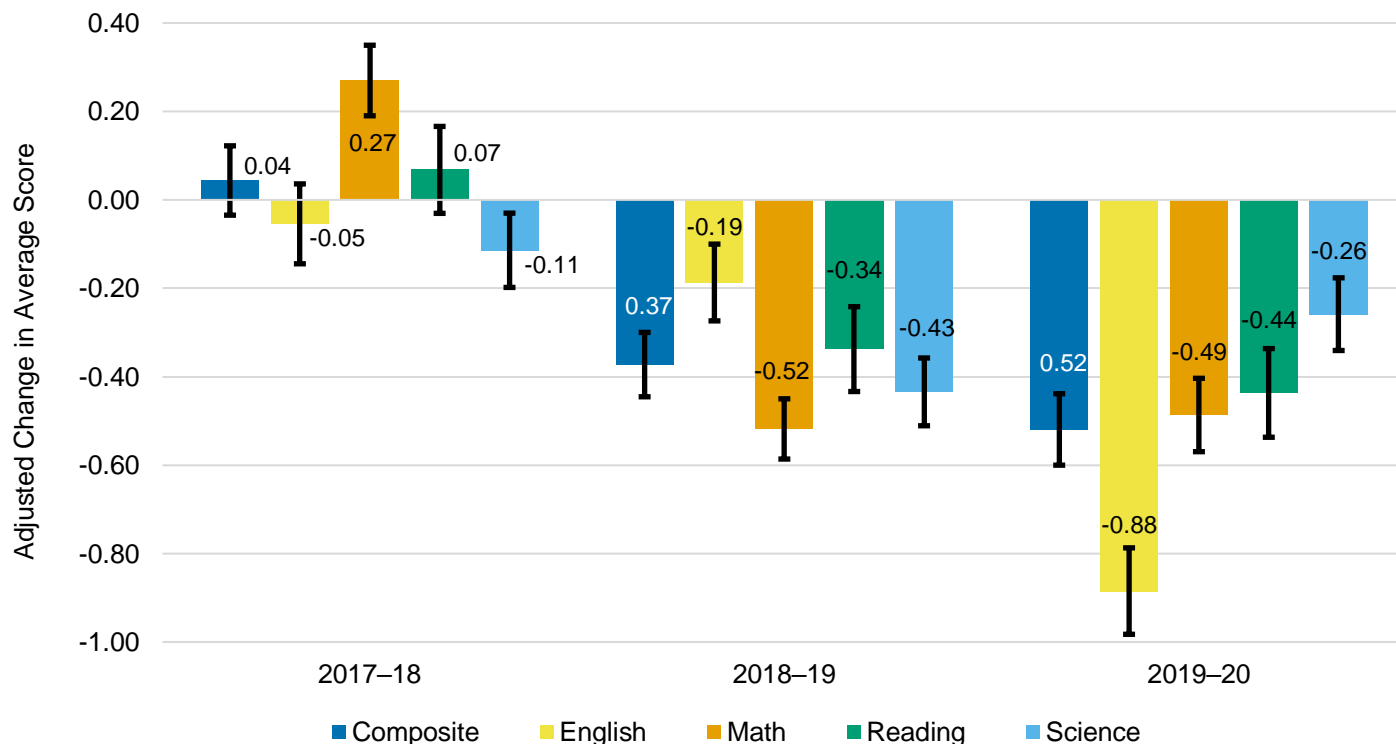
The results for English, math, and reading agree with those from the earlier analysis of PreACT test scores (Allen, 2021), which found decreases comparable to percentile rank decreases of 7 (English), 5 (math), and 2 (reading). The results for science were not consistent across studies: A 0.04 standard deviation decrease was observed in this study, whereas a 0.06 standard deviation increase was observed in the PreACT study.

All the research to date suggests that the impact of the pandemic is more severe for math than for reading (Table 1). Further, the analyses of PreACT and ACT test scores suggest that the impact is more severe for English than for reading. The PreACT and ACT English tests require students to make decisions about how to edit a text and to demonstrate understanding of the conventions of standard written English, production of writing, and knowledge of language. The reading tests require students to read closely, reason about texts using evidence, and integrate information from multiple sources (ACT, 2020a). One theory for why English scores are affected more by the pandemic is that the skills assessed by the English test are emphasized more as part of regular school instruction (e.g., assignments requiring writing and revision of text) and are more instructionally sensitive, relative to the skills assessed by the reading test. Supporting this theory, a prior analysis of ACT gain scores found that ACT English scores increased by 0.310 score points, on average, for each month of schooling, compared to 0.182 points for ACT Reading scores (Allen, Mattern, & Camara, 2020).

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 differences across cohorts in academic readiness. To better understand year-to-year variation in average ACT scores, we applied the same methods and statistical model to prior years of fall ACT State and District testing (2017 vs. 2018, 2018 vs. 2019). Figure 1 summarizes the results. The 2019–2020 comparison is the focus

of this study, comparing the fall of the most recent pre-pandemic year (2019) to the fall of 2020. The other comparisons show that there is some natural year-to-year variation in average ACT scores from fall State and District testing programs, even when there are no major disrupting events like the pandemic, schools are kept constant, and scores are adjusted for gender and race/ethnicity. For the 2018 vs. 2019 comparison, the differences were as large as 0.52 score points (for math). If the score decreases are expressed in standard deviation units, the pre-pandemic year-to-year score changes range from -0.09 to 0.05 , with a standard deviation of 0.04 .

Figure 1. Adjusted Annual Changes in Average ACT Scores



Therefore, while the average score decreases are likely due—at least in part—to the pandemic, there is also an unexplained component to year-to-year changes in ACT scores such that the actual effect of the pandemic could be more or less severe than suggested by the observed score changes. Based on the prior year comparisons, it seems plausible that the adjusted differences in Table 3 could be shifted by as much as 0.04 standard deviation units

from natural year-to-year variation. If this were the case, the pandemic's true effect on English scores, for example, could be -0.12 ± 0.04 (expressed in standard deviation units), or anywhere from -0.16 (-1.15 English score points) to -0.08 (-0.58 English score points). Earlier, we pointed out that the results for science were not consistent between the current study and the prior analysis of PreACT test scores. The results of the current study suggest that the score increase observed for science in the PreACT study may have been due to natural year-to-year variation that was enough to offset the negative effects of the pandemic.

Subgroup 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 African American and Hispanic students to show larger score decreases than White students. We found evidence that reading scores decreased more for African American students relative to White students but found no other evidence of widening achievement gaps. One notable finding was that the scores of Asian students were consistent across years, whereas the scores for students from all other racial/ethnic groups decreased. In science, score decreases were somewhat more pronounced for males relative to females, but no other gender differences were observed.

While score decreases were observed in all subject areas for public schools, nonpublic schools only saw significant score decreases in English and reading. This result was not consistent with the earlier analysis of PreACT test scores (Allen, 2021), which found that nonpublic school students had larger PreACT score decreases in math and reading.

Study Limitations

Because the methods used for this study mirror those used for the earlier analysis of PreACT test scores (Allen, 2021), the same study limitations apply. While this study provides some evidence of the pandemic's effects on academic achievement, the limitations should be considered. The study relied on schools that administered the ACT to a comparable number of students in fall 2019 and fall 2020 and tested at least 75% of their enrolled students.

Presumably, those schools were able to maintain their in-person ACT testing program during the pandemic. Such schools may rely less on remote and hybrid forms of instruction, relative to schools that were not able to administer the ACT to the same level during the pandemic. If that is the case, the results of the study do not generalize to all schools that normally administer the ACT test, and the study results may provide a conservative estimate of the pandemic's negative impact on academic achievement.

Also, the study assumes that there is no major selection bias for students testing during the pandemic. By virtue of the inclusion criteria (only including schools who tested the vast majority of their enrolled students before and during the pandemic), this assumption may be reasonably well supported. However, it is still possible for the students who tested during the pandemic to be different from those who did not test on unmeasured variables, such as high school grades. The statistical model controlled for differences across years in race/ethnicity and gender but no other student characteristics. High school GPA data collected as part of the ACT administration process was not available for most of the study sample: It was not available for 67% of students tested in 2019 and 58% of students tested in 2020 (Table 2). Among the students who reported high school grade data, the mean high school GPA was 3.27 for students in the 2019 sample and 3.40 for students in the 2020 sample. If we restrict the sample to those schools where at least 50% of students reported their grades, we find that average high school GPA is slightly higher for students in the 2020 cohort, suggesting that students who earn higher grades were slightly more likely to test during the pandemic.² This suggests that the study may err on the side of underestimating the negative effect of the pandemic on ACT scores.

While the study included 311 high schools from 20 states, most of the sample came from one state that has a fall ACT testing program for 12th graders. Therefore, the schools are not representative of schools across the country.

A final limitation is that data were not available to examine how scores are impacted by mode of learning (e.g., remote, in-person, hybrid) and level of student engagement. As these data become available, additional studies should be done to examine those differences.

Conclusions

Valid and reliable data from national assessment programs, including the ACT, are valuable for understanding the effect of the pandemic on academic achievement. This study found evidence of the pandemic's negative impact on the academic achievement of high school seniors, mostly corroborating the main findings from earlier studies that considered earlier grade levels. This study contributes to the evidence base by examining results on a college-entrance exam primarily taken by students in 12th grade. Like the earlier analysis of PreACT data, the current study also illustrated the technical challenges and limitations of using assessment trend data to measure the pandemic's impact. This study was based on fall ACT State and District testing programs. Many more states and districts participate in spring ACT State and District testing programs, so upcoming analyses of that data should be more generalizable to districts and states across the country. Further, because more schools have moved to offering full-time in-person instruction in spring 2021 (relative to fall 2020), the spring ACT State and District testing data may have relatively more participating schools and students.

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

To account for clustering of students within high schools and grade levels, we modeled ACT scores with hierarchical linear regression models. Student gender and race/ethnicity were used as covariates to reduce confounding in the comparison of scores across years.³ Additional variables such as parent education level and high school GPA were considered but not used because too many students were missing data on these variables.

The model also included an indicator for year (e.g., $I_{2020} = 1$ for students in the 2020 sample, $I_{2020} = 0$ otherwise). If the coefficient for year is negative, it provides evidence of a negative effect of the pandemic on ACT scores. Model intercepts and year effects were allowed to vary across high schools/grade levels. The model was fit for each subject area of the test (English, math, reading, and science) and for the Composite score.

The hierarchical regression model can be written as

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

where Y_{ij} is the ACT score for the i th student from the j th school/grade combination, b_{0j} is the intercept for the j th school/grade, I_{2020ij} indicates whether the i th student from the j th school/grade tested in fall 2020 (during the pandemic), b_{1j} is the increase (or decrease) in average ACT 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 , and e_{ij} is the model's error term. Intercepts (b_{0j}) and year effects (b_{1j}) are assumed to vary across high school/grades, and the model also estimates the mean intercept (β_0) and mean year effect (β_1) across school/grades.

The model described above estimates the overall COVID-19 impact. Subgroup estimates can be obtained by estimating interactions between subgroup 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.

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

This approach was also used to obtain estimates by race/ethnicity, grade level, school type (public vs. nonpublic and, within public, poverty level), and school locale.

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

² Among high schools where at least 50% of students reported their course grades, we estimate that the mean high school GPA for all students (e.g., assuming no missing data) would be 3.27 for students tested in fall 2019 and 3.30 for students tested in fall 2020.

³ Gender and race/ethnicity were missing for some students (Table 2), so values were imputed prior to fitting the hierarchical regression models.