



MID-ATLANTIC

Regional Educational Laboratory
at Mathematica

Delaware • District of Columbia • Maryland • New Jersey • Pennsylvania

Changes in academic achievement in Pittsburgh Public Schools during remote instruction in the COVID-19 pandemic

Whitney Kozakowski
Principal investigator
REL-Mid- Atlantic

Brian Gill
Senior Fellow
REL Mid-Atlantic

Patrick Lavallee
Data Scientist
REL Mid-Atlantic

Alyson Burnett
Researcher
REL Mid-Atlantic

Jonathan Ladinsky
Senior Program Lead
REL Mid-Atlantic

For the Pittsburgh Board of Education
2021.09.14

Regional Educational Laboratories (RELs) address research and analysis needs of states and districts



**Work directly
with states
and districts**

**1 of 10 RELs funded by
the U.S. Department of
Education's Institute of
Education Sciences**

**Regional
needs drive
REL work**

How was student achievement affected by the COVID-19 pandemic and disruptions to instruction?

- National evidence of declines relative to typical performance.¹
- Reports suggest that students typically learned less in remote instruction than in-person.
- Reports from some districts suggest that proportion of students receiving failing grades has increased in 2020/21 relative to 2019/20.²

How did Pittsburgh students fare academically during remote instruction in the pandemic?

Preview of Findings

- On average, PPS students in most grades experienced test score growth.
- But the growth was less than typical pre-pandemic growth (nationally)
 - Growth lag largest for students in elementary grades.
 - Growth lag in Pittsburgh consistent with evidence of growth lags nationally
- PPS course failure rates increased substantially, especially in grades 6-12.
 - Course failure rates increased more among economically disadvantaged students.
 - Chronic absenteeism strongly predicted course failure—and chronically absent students missed a lot more days, on average, in fall 2020 vs fall 2019.
 - Course failure and absenteeism data suggests there is an identifiable group of students who were most negatively affected by the pandemic and remote instruction.

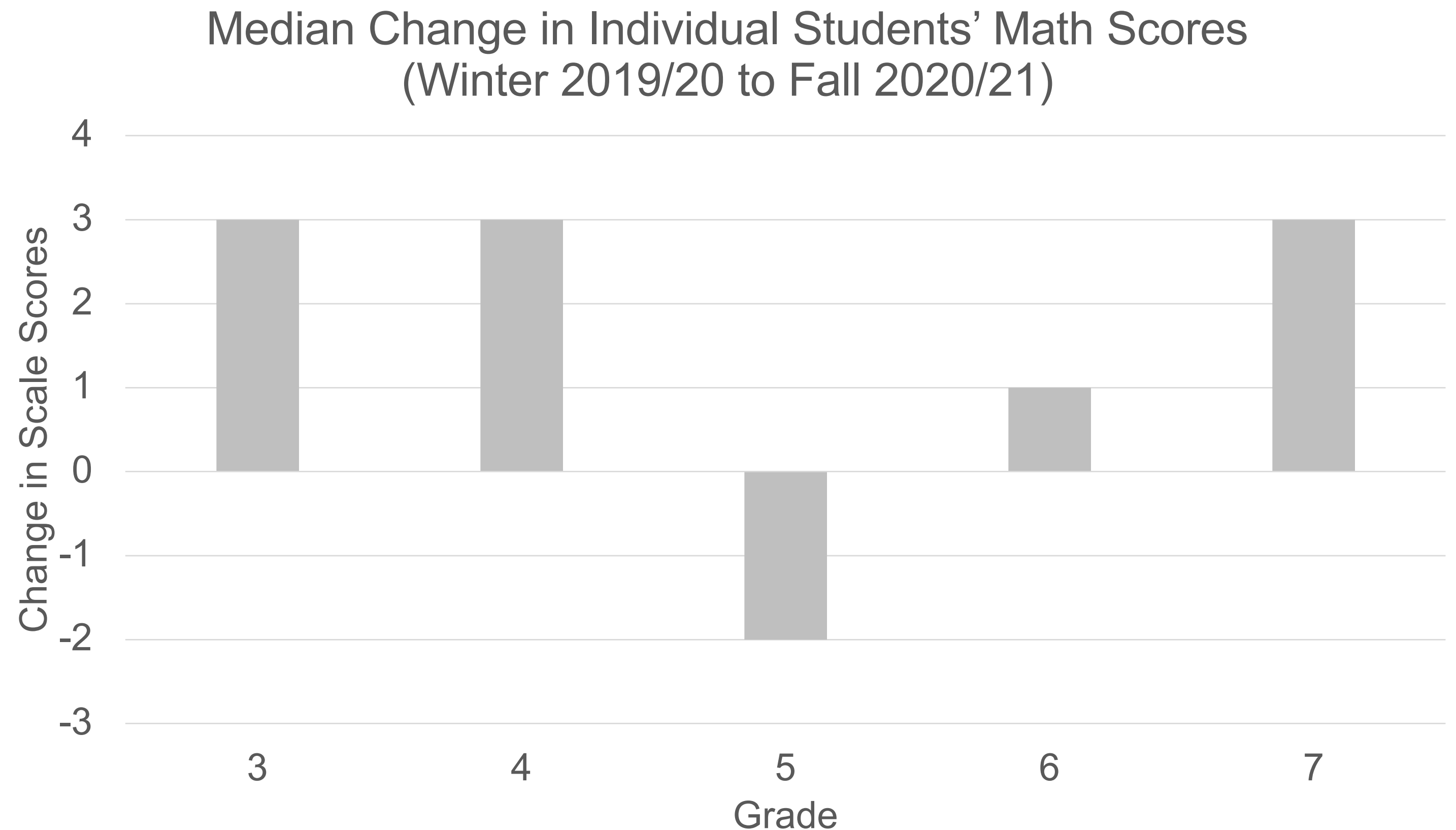
Did PPS students show learning growth while school buildings were closed during the pandemic?

PPS students' average test scores increased from winter 2019/20 to winter 2020/21.



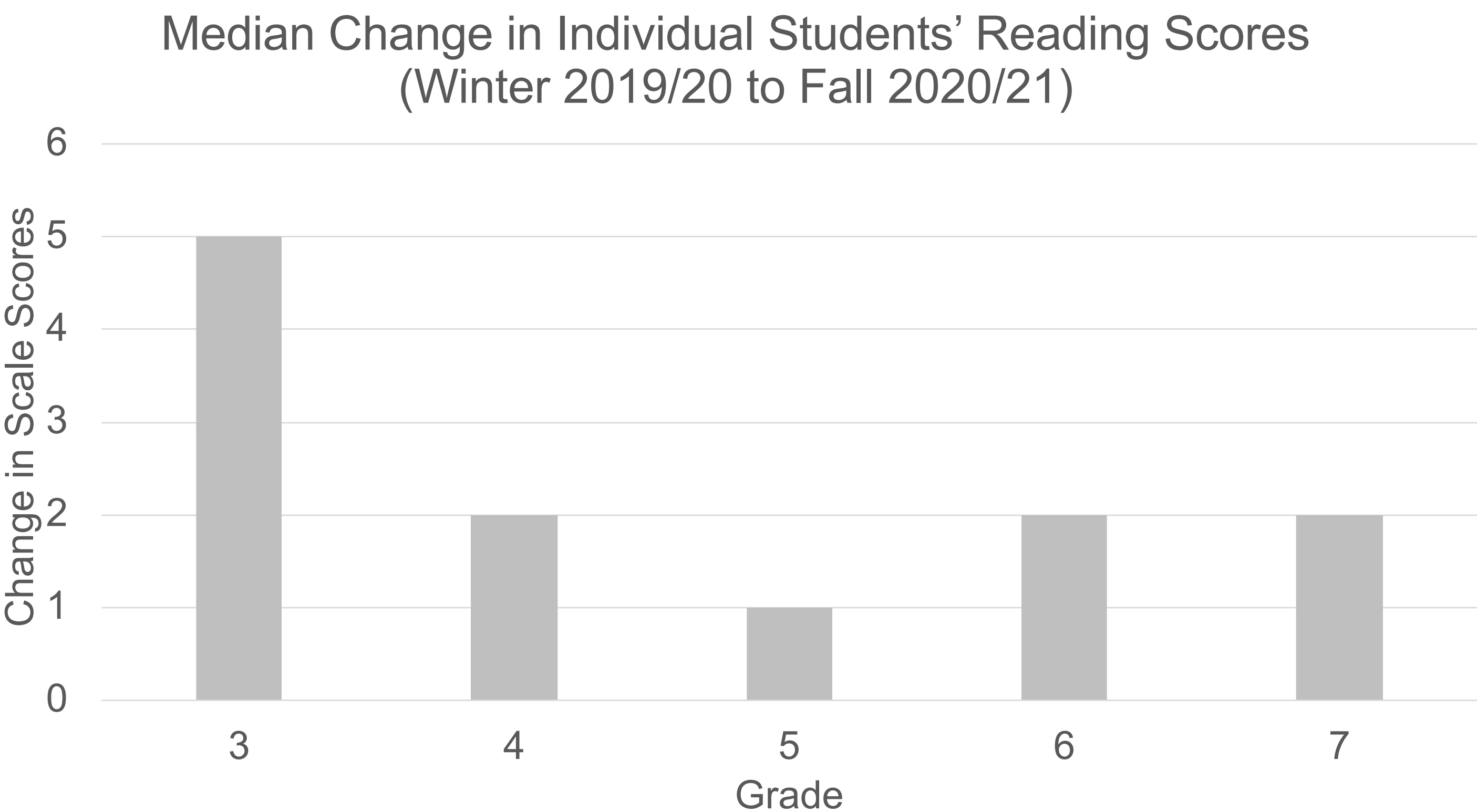
On average, PPS students showed math score growth

For students who took the math test in both Winter 2019/20 and Fall 2020/21, PPS students scored higher in fall 2020/21 than in winter 2019/20 in almost all grades, indicating learning occurred



On average, PPS students showed reading growth

For students who took the reading test in both Winter 2019/20 and Fall 2020/21, PPS students scored higher in fall 2020/21 than in winter 2019/20 in all grades, indicating learning occurred.



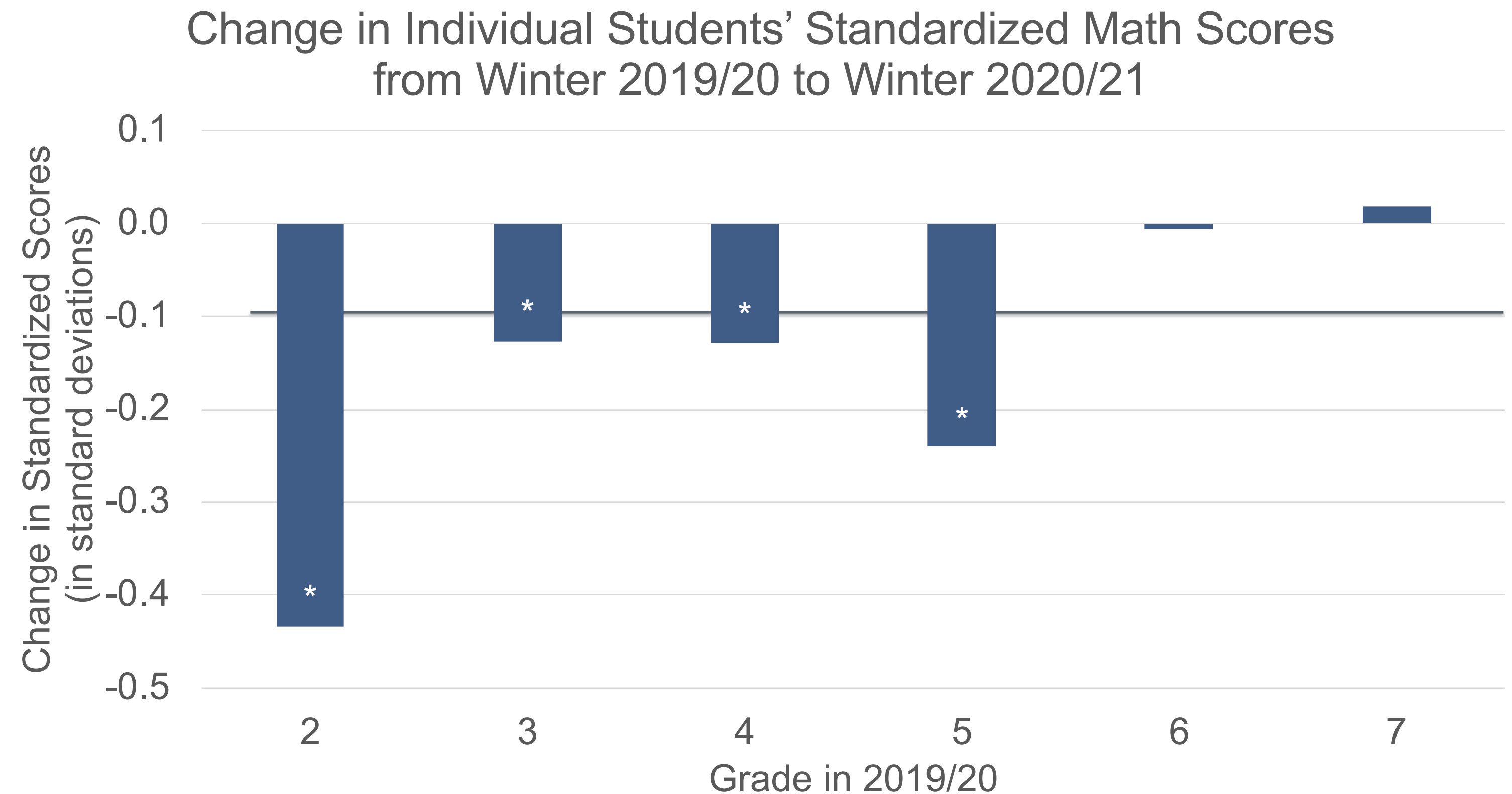
How did PPS students' scores change over time, relative to prior national norms?



Consistent with national findings, PPS students' test score growth in remote instruction was lower than average growth nationally in pre-pandemic years.

Examining individual students' change from 2019/20 to 2020/21, largest lags in math scores (relative to pre-pandemic national norms) in elementary grades.

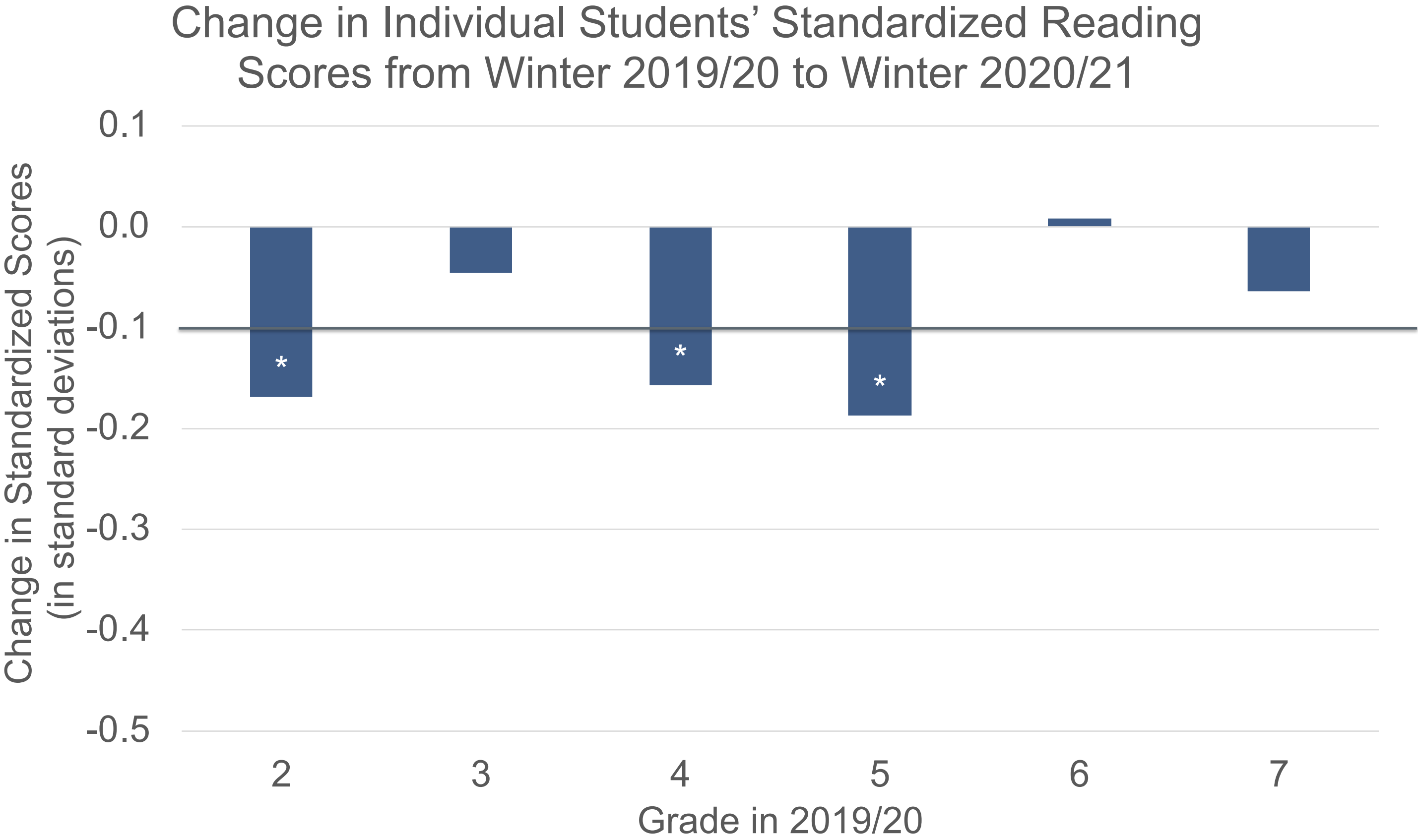
Students in grades 2-7 in 2019/20 had average declines from winter 2019/20 to winter 2020/21 of 0.15 standard deviations (SDs) in math.



Note: Stars indicate change was greater or equal to +/- 0.1 standard deviations.

Examining individual students' change from 2019/20 to 2020/21, lags in reading scores (relative to pre-pandemic national norms) are for grades 2, 4, and 5.

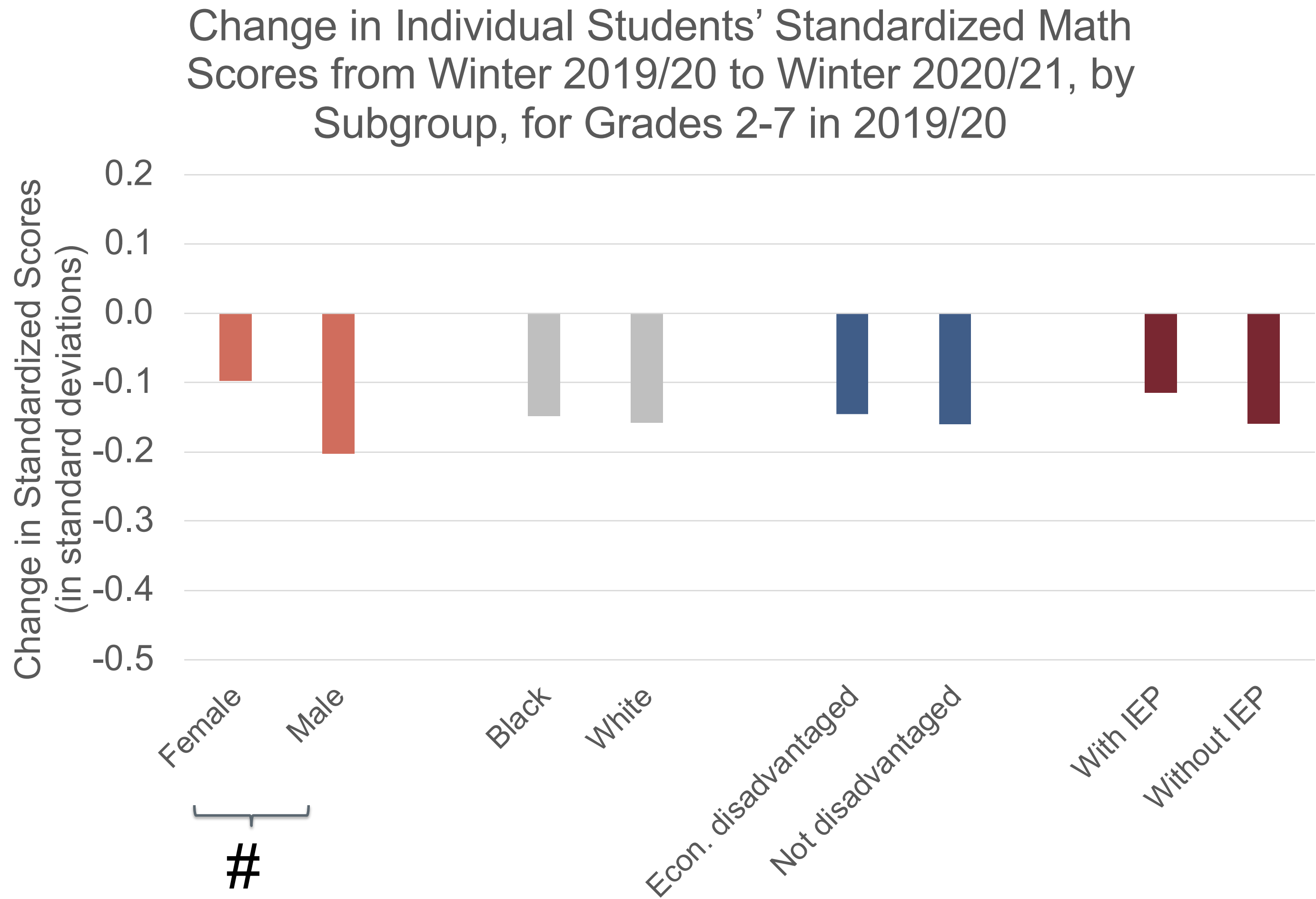
Students in grades 2-7 in 2019/20 had average declines from winter 2019/20 to winter 2020/21 of 0.10 standard deviations (SDs) in reading.



Note: Stars indicate change was greater or equal to +/- 0.1 standard deviations.

Examining individual students' change from 2019/20 to 2020/21, lags in math (relative to pre-pandemic national norms) larger for boys

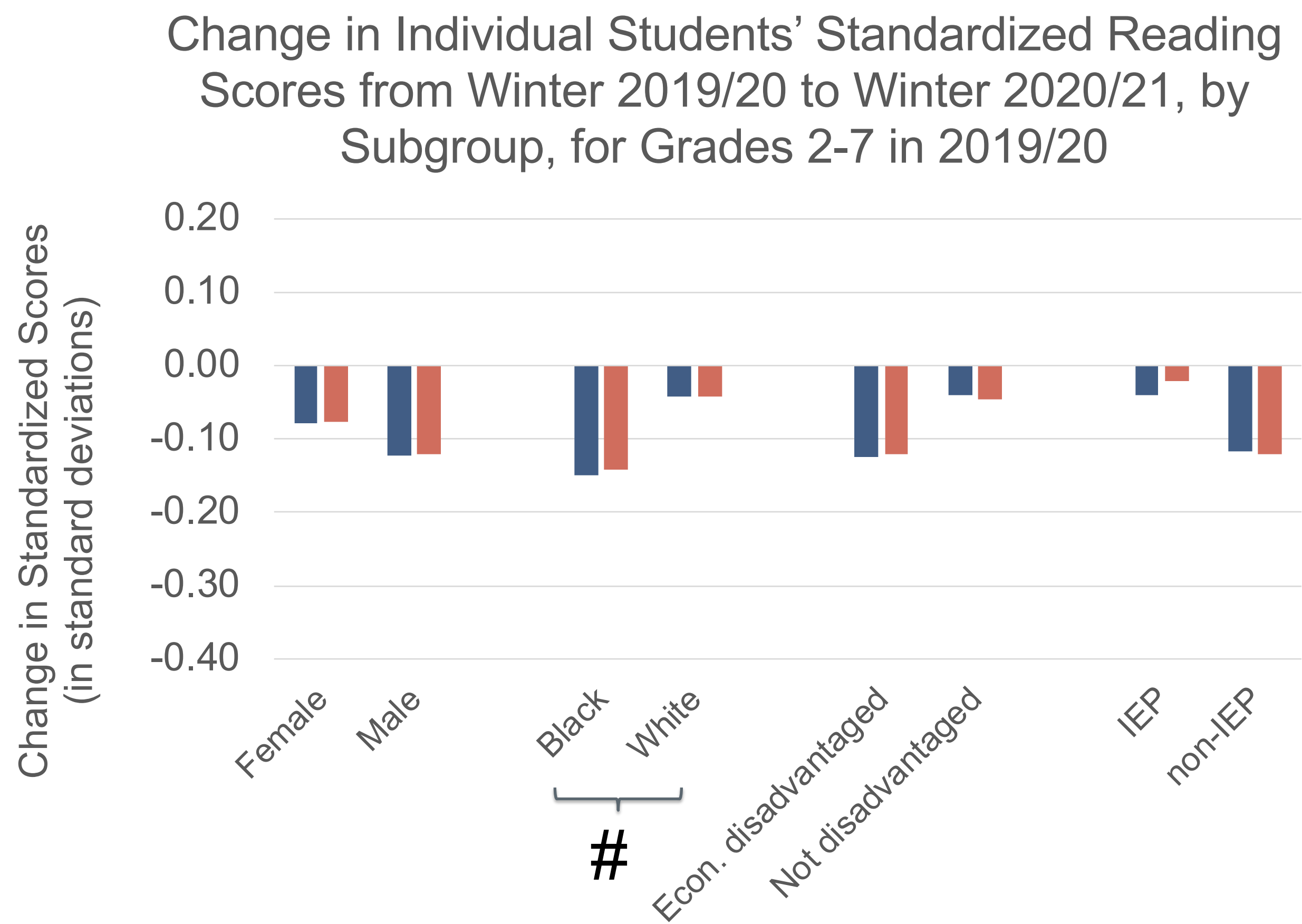
Differences in growth were minimal for Black and White students, economically disadvantaged and non-disadvantaged students, or IEP and non-IEP students.



Note: # indicates difference between the two groups listed was greater or equal to +/- 0.1 standard deviations.

Examining individual students' change from 2019/20 to 2020/21, lags in reading (relative to pre-pandemic national norms) larger for Black students than White students

Differences were smaller for boys vs girls, economically disadvantaged vs non-disadvantaged students, or IEP vs non-IEP students.



Note: # indicates difference between the two groups listed was greater or equal to +/- 0.1 standard deviations.

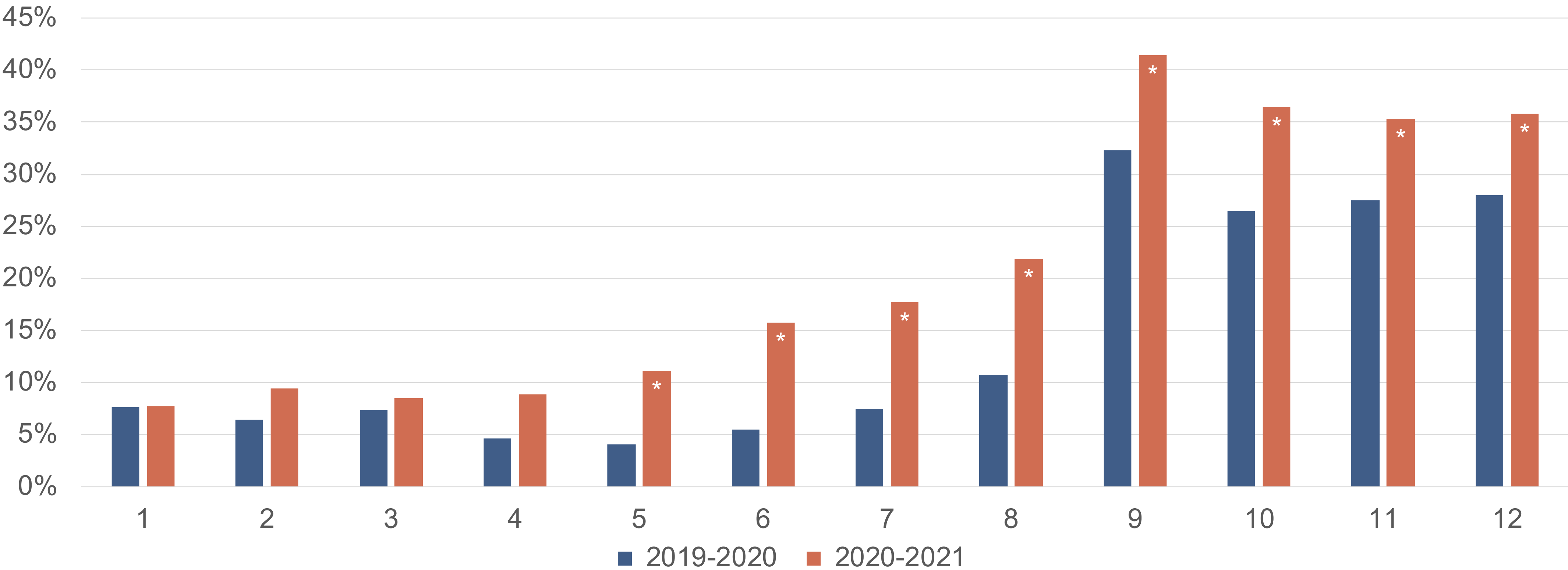
How did course failure rates change during remote instruction, overall and for particular student groups?



- 1. Course failure rates increased substantially, especially in grades 6-12*
- 2. Course failures increased more for economically disadvantaged students, and especially for chronically absent students*

Percentage of students failing courses increased substantially in middle and high school grades

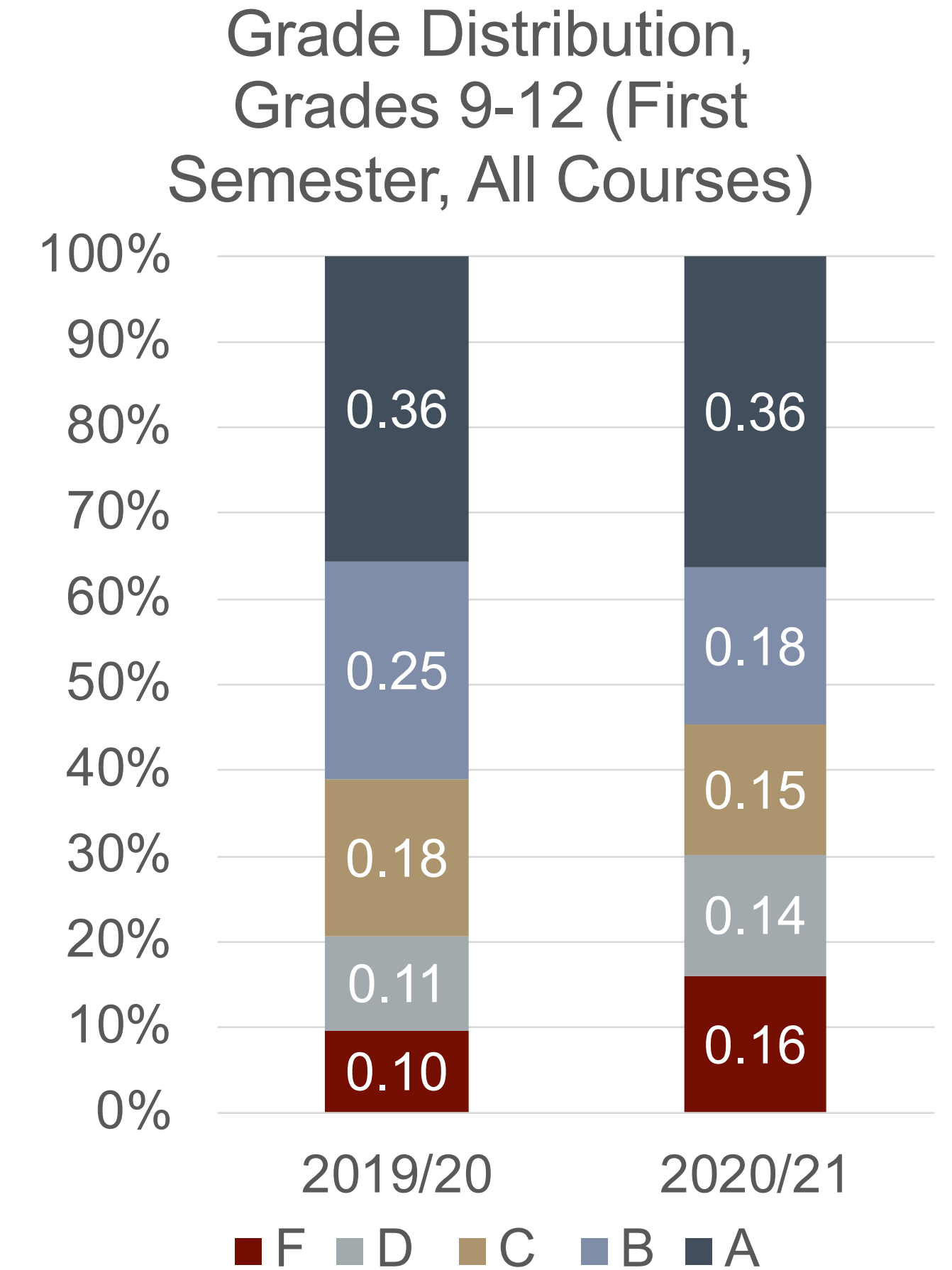
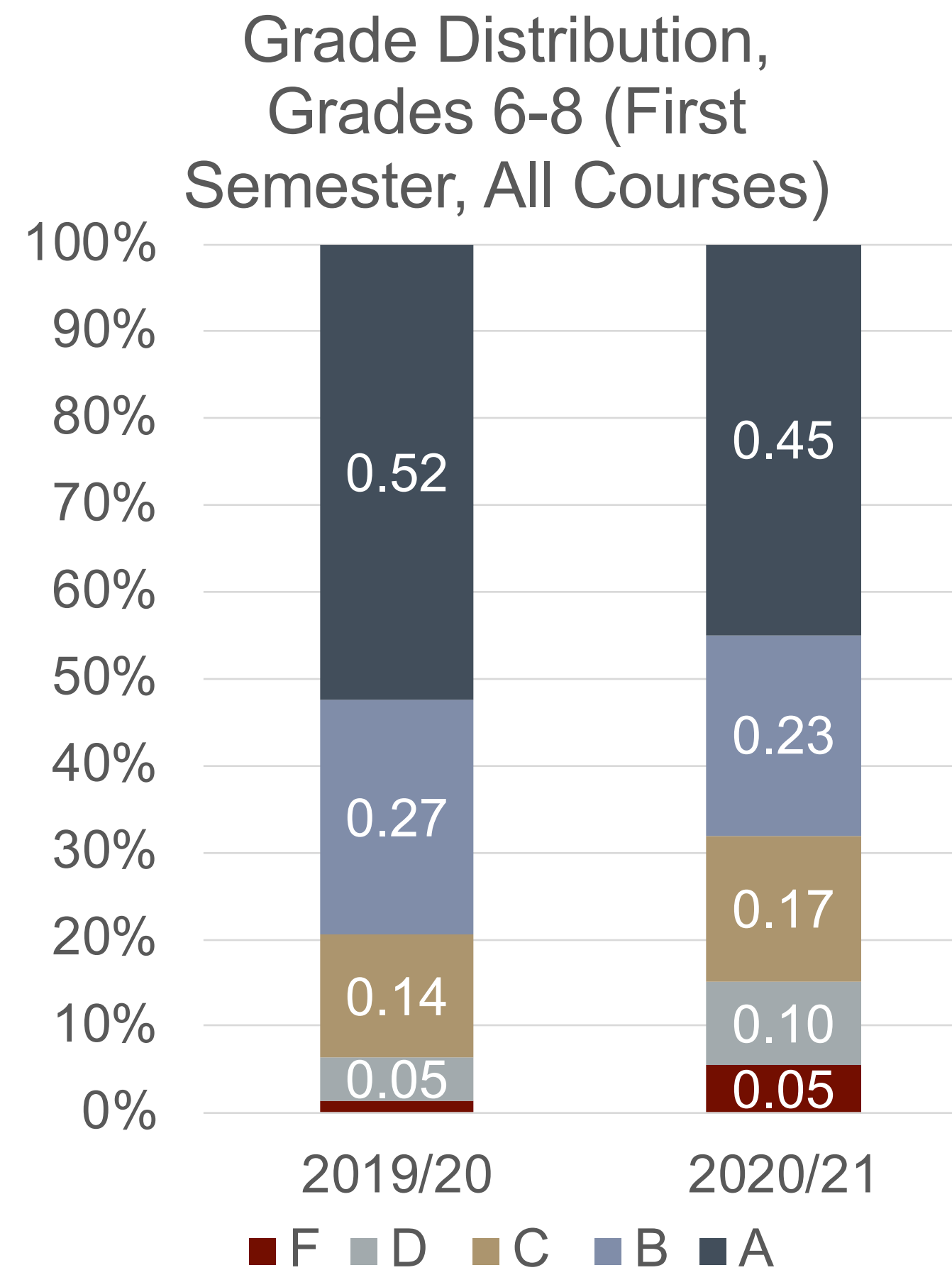
Percentage failing at least one course in fall semester (by grade)



Note: Stars indicate difference between 2019/20 and 2020/21 was greater or equal to 5 percentage points.

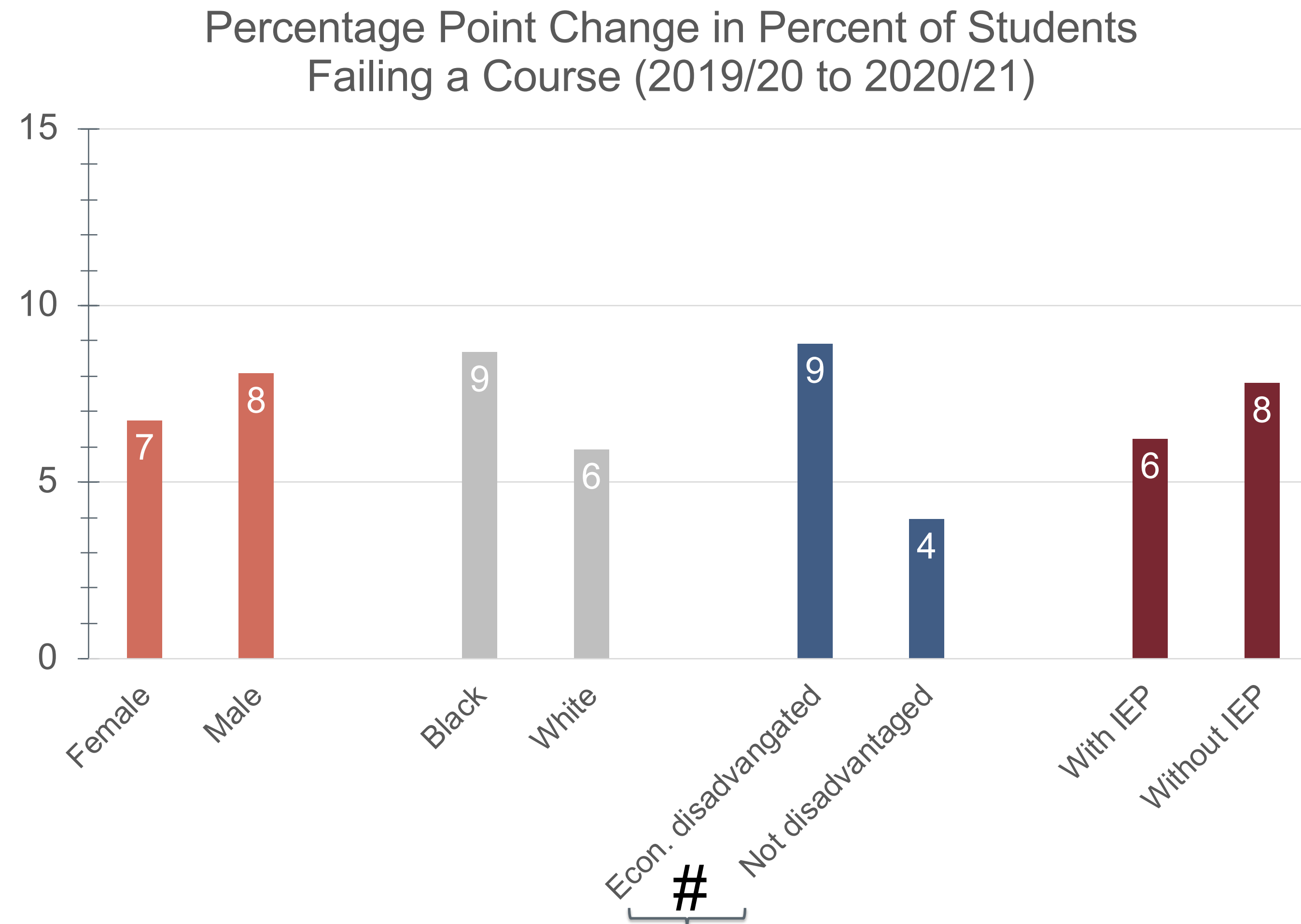
Course-grade distribution shifted downward in middle and high school.

- Fewer grades at the top of the scale (A+B) and more at the bottom (D+F)



The percentage of students failing at least one course increased more for economically disadvantaged students

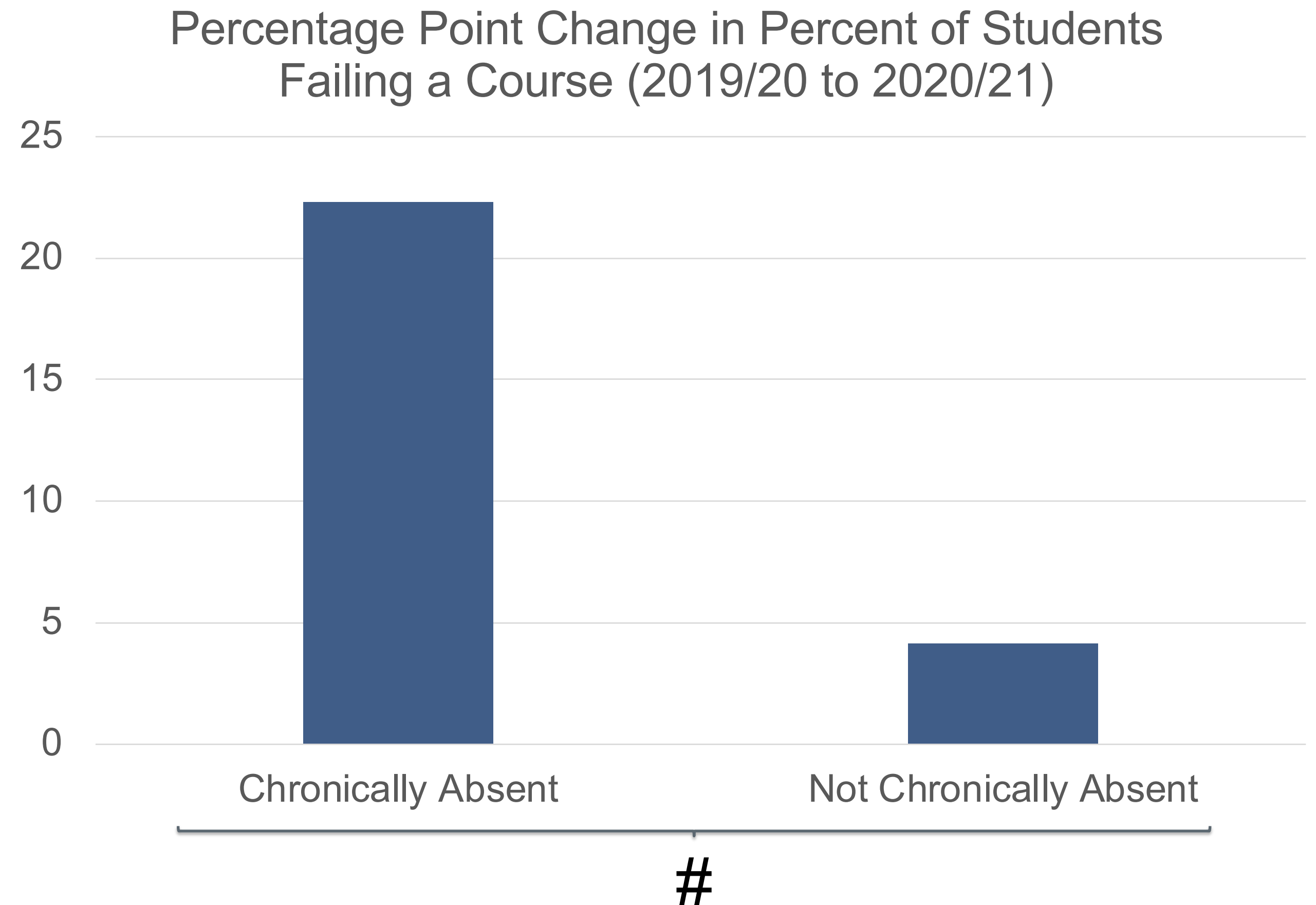
All notable subgroups had increases in failure rates



Note: Sample includes all students in grades 1-12. # indicates difference between groups exceeds 5 percentage points.

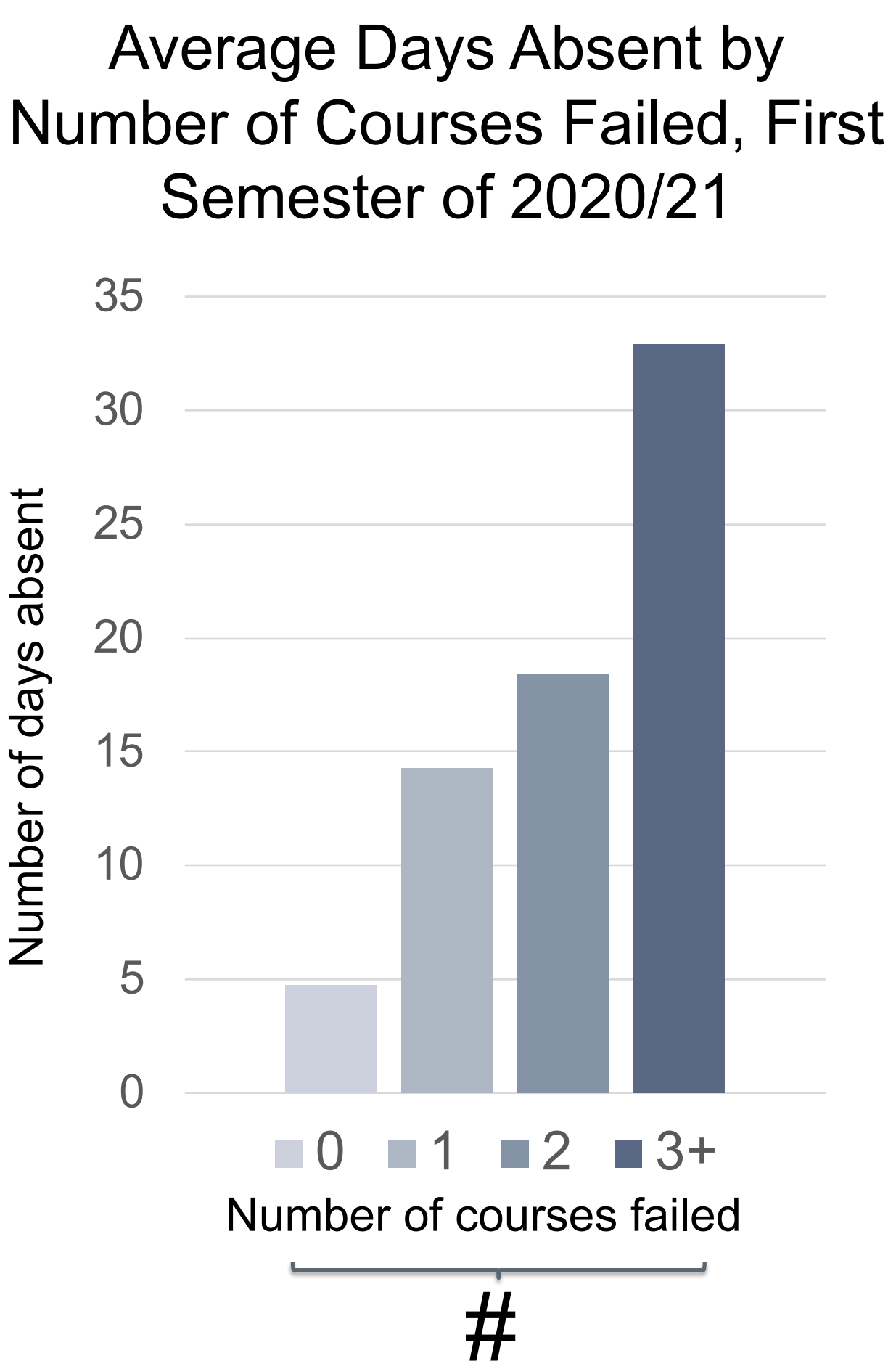
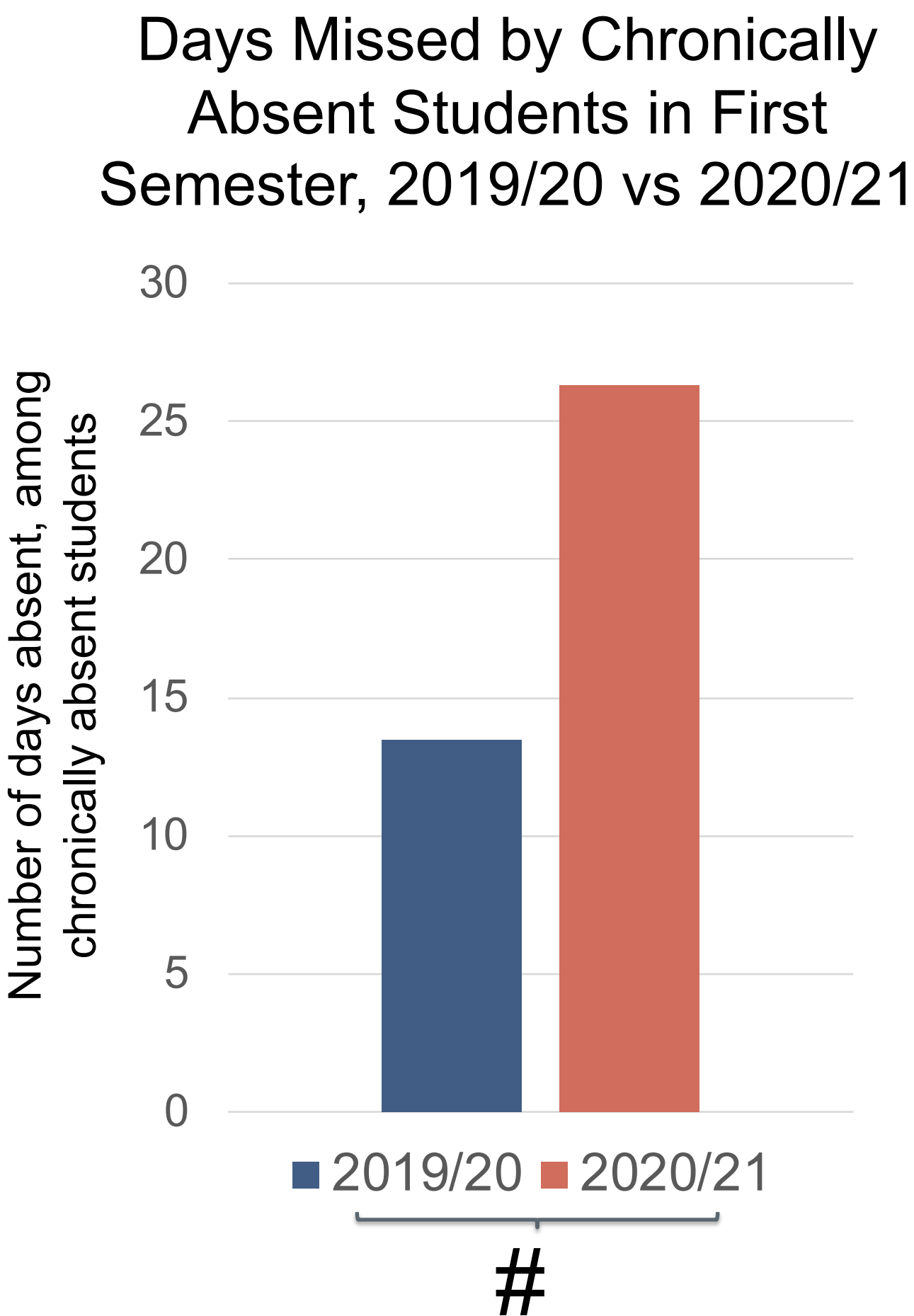
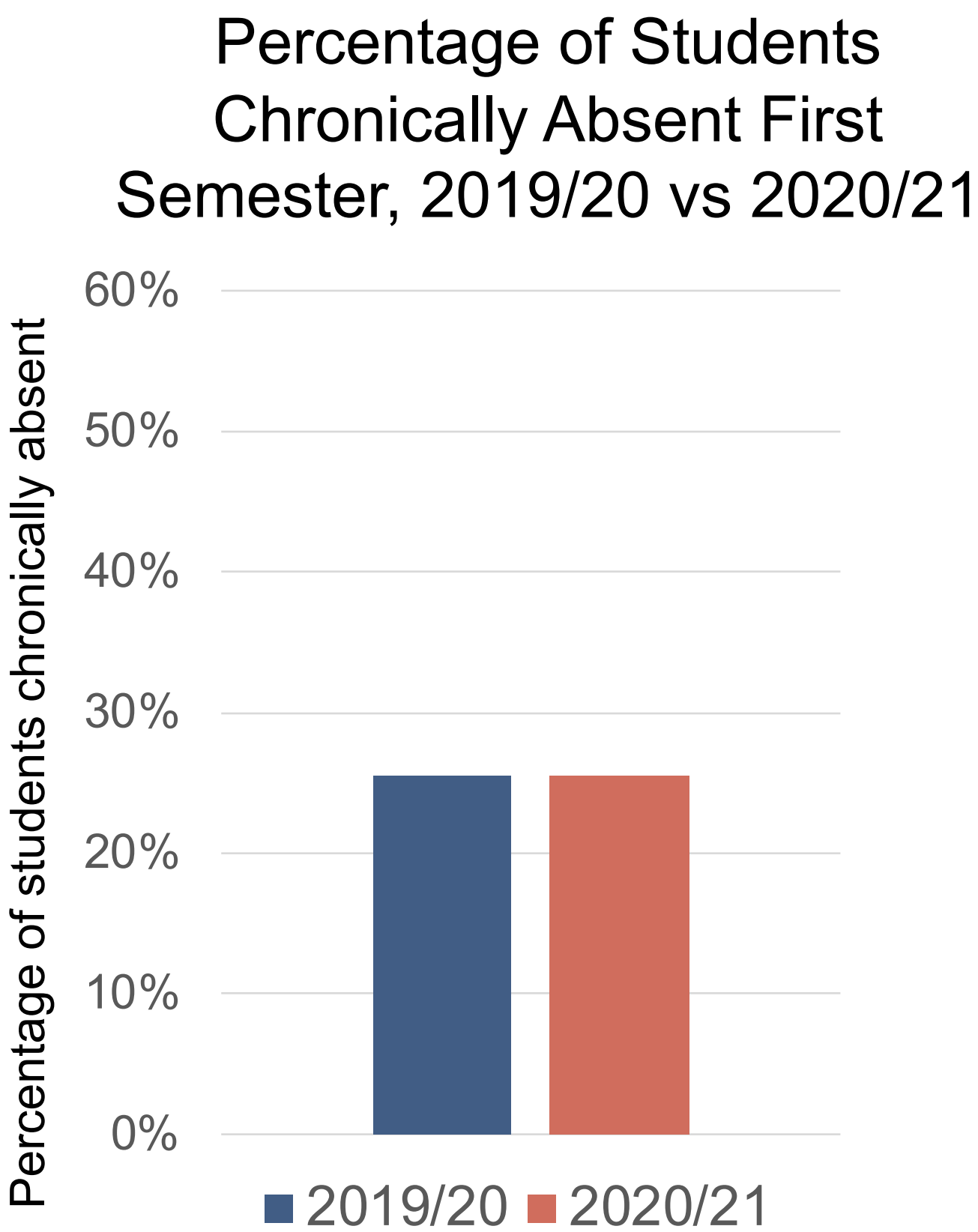
The percentage of students failing at least one course increased dramatically for students who were chronically absent

The percent of students who failed a course **increased by 22 percentage points** for those who were **chronically absent in first semester 2020/21, compared to those who were chronically absent in first semester 2019/20.**



Note: Sample includes all students in grades 1-12. # indicates difference between groups exceeds 5 percentage points.

Chronically absent students missed over 10 more days on average than in prior year. Clear relationship between absences and course failure.



Note: Sample includes all students in grades K-12. # indicates difference between groups exceeds 5 percentage points.

Limitations & Implications



Implications of test-score and grade results

- Test-score results suggest declines relative to pre-pandemic national norms larger for younger students, who might have more trouble learning remotely.
- Substantial increase in course failure, especially in grades 6-12, suggests that test scores alone might provide an overly optimistic picture for middle schoolers (Weren't able to examine high school test scores due to lower test taking rate).
- Fall 2021 assessments will be important for determining size of lags for students who missed assessments last year.
- Supports might be appropriate for students who had largest declines in grades (and also were more likely to miss tests)—notably chronically absent students and economically disadvantaged students.

Limitations of test score and grade analyses

- We do not calculate test score changes for the earliest (K and 1) and highest grades (8-12) because of the low test-taking rates in those grades, particularly in 2020/21. Results may differ for those students.
- Tests were administered remotely in fall 2020 and winter 2021. Test scores in remote environments were found by NWEA to be reliable in grades 3-8 but should be used with caution in earlier grades.⁶
- Criteria for failing a course may have shifted during the pandemic. If teachers applied less stringent grading standards, the change in course failure rates we calculate would understate what the change would have been had the failure criteria stayed constant.

Questions



Contact Info

 Whitney Kozakowski
WKozakowski@mathematica-mpr.com

 Brian Gill
BGill@mathematica-mpr.com

Disclaimer

This work was funded by the U.S. Department of Education's Institute of Education Sciences (IES) under contract ED-IES-17-C-0006, with REL Mid-Atlantic, administered by Mathematica. The content of the presentation does not necessarily reflect the views or policies of IES or the U.S. Department of Education, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. government.



<https://ies.ed.gov/ncee/edlabs/regions/midatlantic/>



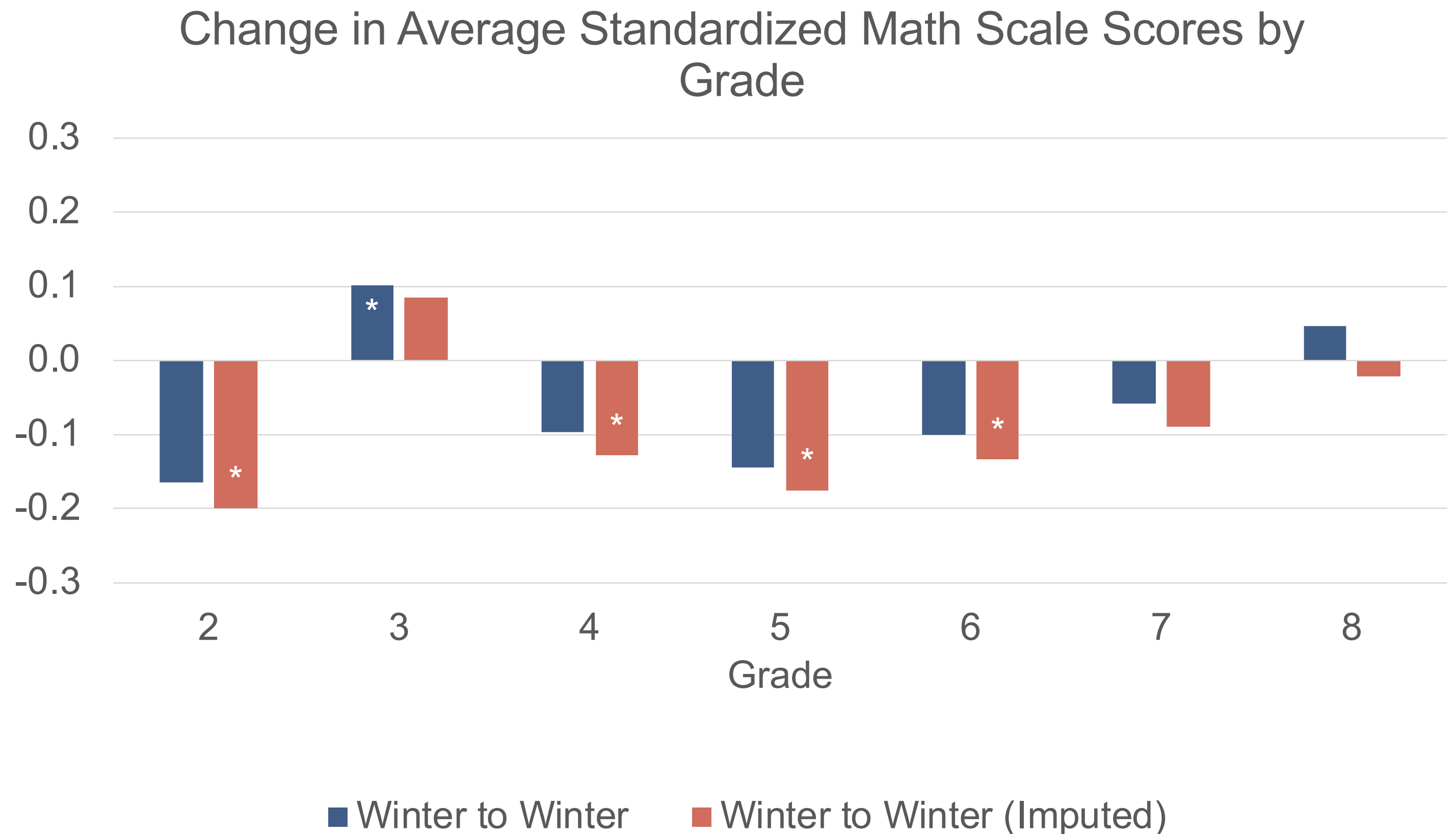
Appendix



Cross-sectional analysis with imputed scores: Comparing successive cohorts in the same grade, there are declines in 2nd and 4th–6th grades in math

Compares students who took the test in a specific grade in 2019/20 to those who took the test in that grade in 2020/21.
(Note: Blue bar does not adjust for any differences between who took the test in different cohorts in 2019/20 vs 2020/21).

Imputed score comparisons help to account for those who did not take the test in 2020/21, but may not fully compensate for differences in the students who are taking the test in 2020/21.



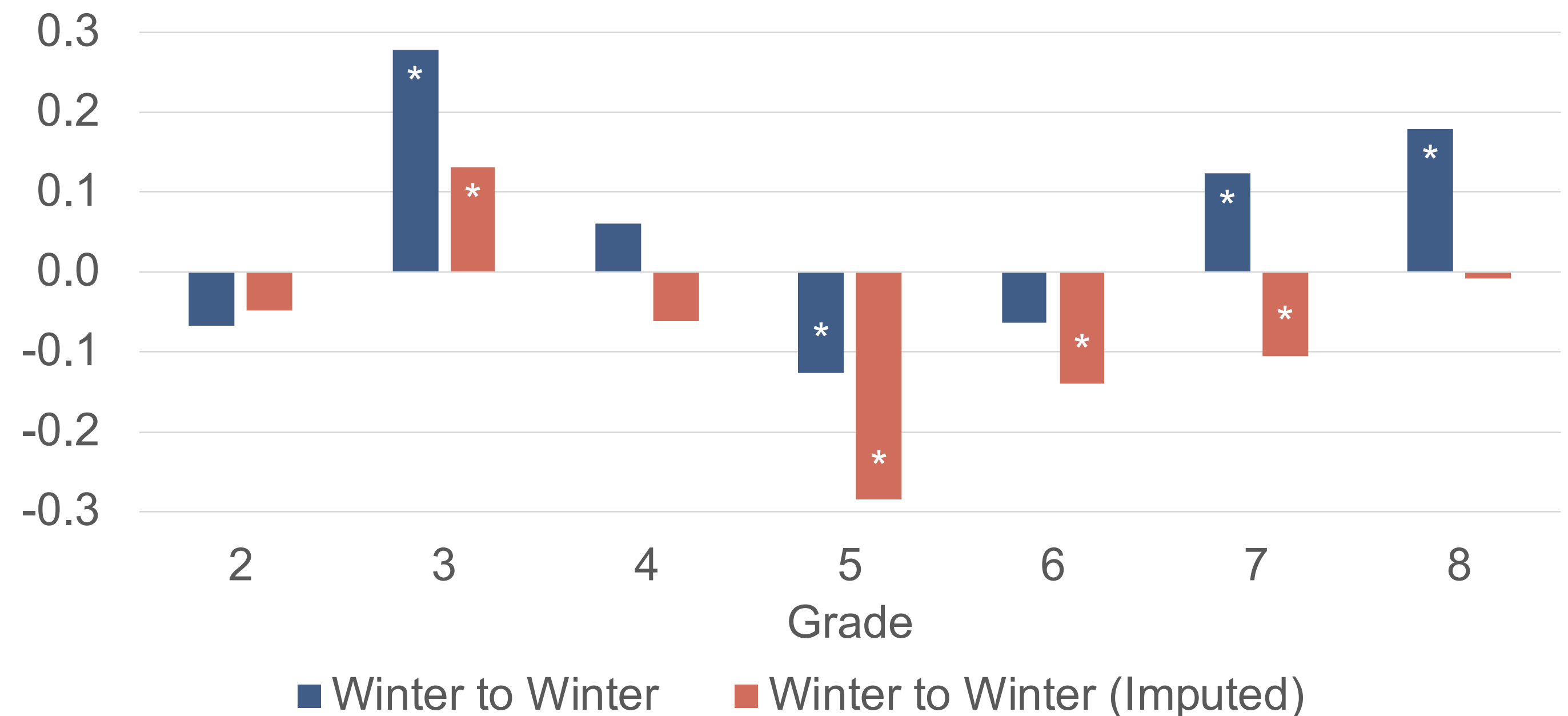
Note: Stars indicate the change in standardized student test scores from winter-to-winter exceeds the absolute value of 0.1 standard deviations.

Cross-sectional analysis with imputed scores: Comparing successive cohorts in the same grade, there are declines in 5th–7th grades in reading but increases in 3rd grade

Compares students who took the test in a specific grade in 2019/20 to those who took the test in that grade in 2020/21.
(Note: Blue bar does not adjust for any differences between who took the test in different cohorts in 2019/20 vs 2020/21).

Imputed score comparisons help to account for those who did not take the test in 2020/21, but may not fully compensate for differences in the students who are taking the test in 2020/21.

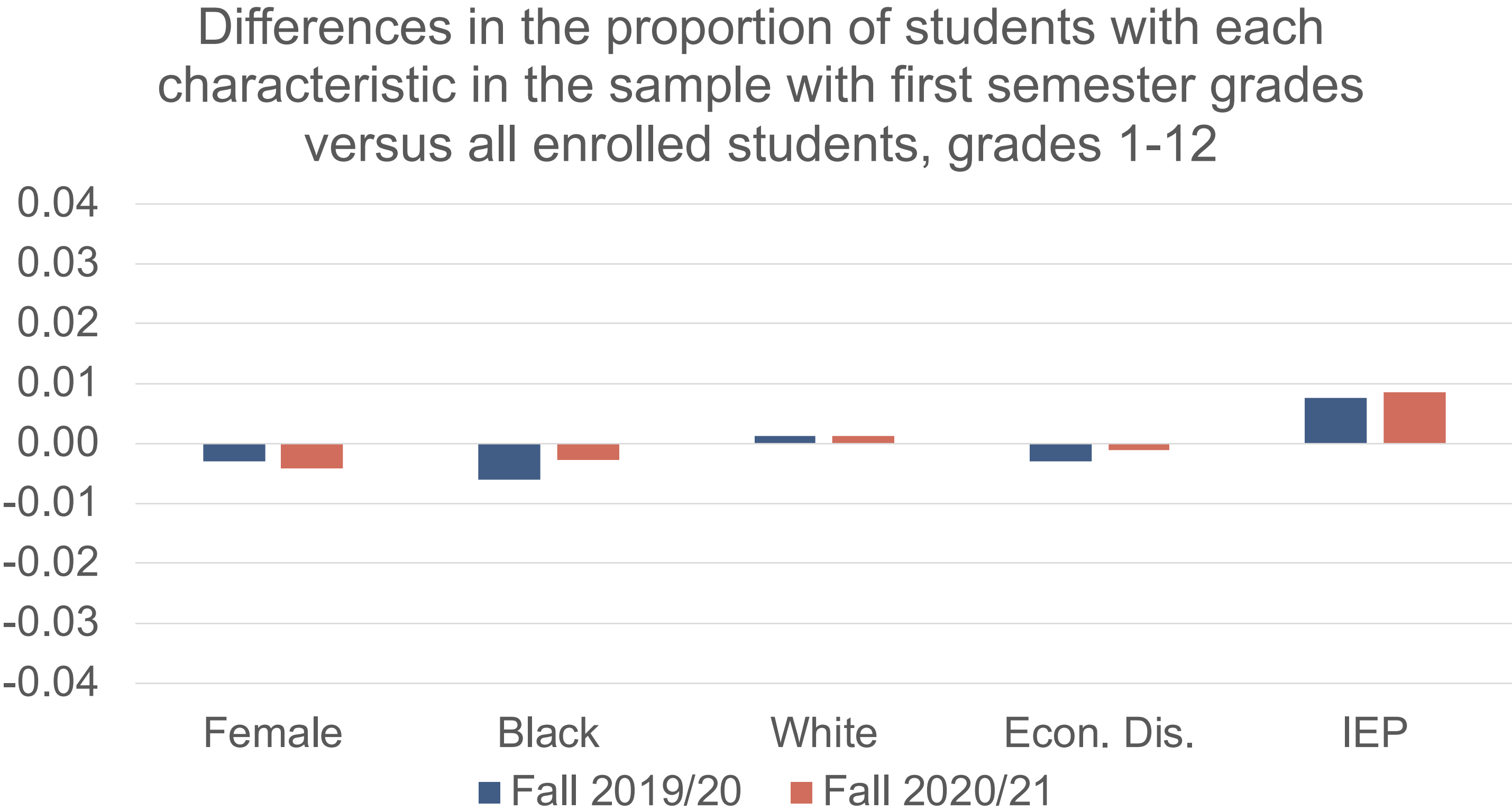
Change in Average Standardized Reading Scores by Grade



Note: Stars indicate the change in standardized student test scores from winter-to-winter exceeds the absolute value of 0.1 standard deviations.

For grades 1-12, demographic composition of students with first semester grades is similar to the demographic composition of the total student body in 2019/20 and 2020/21.

- Standardized differences never exceed 0.01 standard deviations.



Note: Stars indicate the standardized difference between the proportion of students with a given characteristic in the sample with first semester grades and in the enrolled population exceeded 0.05 standard deviations.

Data

NWEA MAP scores	<ul style="list-style-type: none">• Fall, Winter, and Spring from 2019-20 and Fall and Winter from 2020-21• Offered in K-12• Reading and math• Standardize scores relative to national norms (using pre-pandemic data)⁴
Student demographics and enrollment data	<ul style="list-style-type: none">• 2019-20 and 2020-21 school years• Includes school attended, race and ethnicity, gender, economically disadvantaged status, English learner status, and Individualized Education Program (IEP) status
Student grades	<ul style="list-style-type: none">• Focus on first semesters in 2019-20 and 2020-21• Use grades to construct number of courses failed, percentage of courses failed, and GPA

Preliminary Research Question A:

During the 2019/20 to 2020/21 school years, how did the proportion and demographic composition of students (1) taking the NWEA math and reading tests and (2) receiving grades change?



Why start by examining changes in the demographic composition of students taking tests and earning grades?

Pandemic may have disrupted the number of students tested or grades submitted. Comparing averages from either period may not be appropriate if demographic composition of students with data in each period is different.

To assess the scope of this potential problem, we first:

- 1) Describe changes from 2019/20 to 2020/21 in the proportion of students taking NWEA math and reading tests and the proportion of students with reported grades.
- 2) Describe changes in demographic composition of students taking the test or receiving grades.

We focus on fall & winter tests for grades 2-8 due to lower test participation rates in spring and other grades.

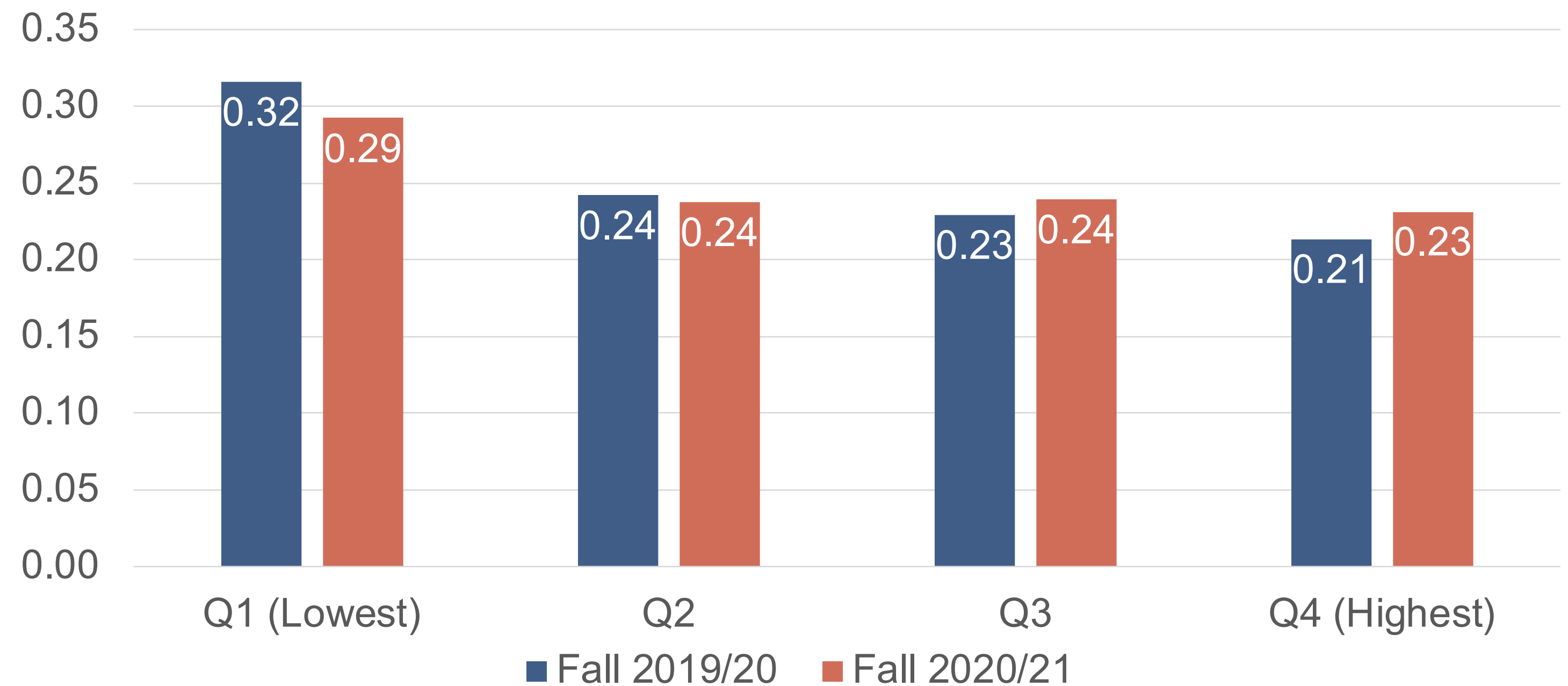
Percentage of enrolled PPS students taking NWEA MAP tests

	Math					Reading				
	2019/20			2020/21		2019/20			2020/21	
	Fall	Winter	Spring	Fall	Winter	Fall	Winter	Spring	Fall	Winter
All	87%	87%	11%	66%	66%	85%	85%	11%	62%	64%
Grade K	78%	94%	6%	2%	1%	76%	94%	5%	3%	1%
Grade 1	93%	95%	5%	9%	2%	93%	94%	5%	12%	2%
Grade 2	94%	95%	4%	80%	86%	93%	94%	6%	77%	85%
Grade 3	94%	95%	9%	87%	87%	94%	95%	8%	86%	88%
Grade 4	93%	93%	9%	86%	87%	93%	92%	9%	84%	85%
Grade 5	93%	94%	7%	88%	87%	92%	94%	10%	85%	88%
Grade 6	93%	94%	24%	86%	86%	93%	93%	28%	83%	84%
Grade 7	92%	92%	25%	84%	82%	91%	89%	22%	82%	81%
Grade 8	91%	90%	25%	84%	82%	90%	91%	26%	83%	82%
Grade 9	82%	77%	9%	67%	73%	78%	68%	5%	58%	65%
Grade 10	80%	76%	7%	66%	73%	75%	64%	7%	62%	67%
Grade 11	76%	71%	6%	67%	66%	73%	69%	3%	56%	64%
Grade 12	66%	56%	4%	44%	42%	67%	64%	3%	37%	40%

Students with lower previous test scores slightly less likely to take test in fall 2020/21—potentially inflating district-wide average scores

- Students scoring in the bottom quartile (relative to national norms) on the fall 2019/20 reading test were a smaller proportion of test-takers in fall 2020/21, while students scoring in the top quartiles were a larger proportion of test-takers in fall 2020/21.
- Students taking the test again in 2020/21 had slightly higher previous test scores.
- Results similar for math.

Proportion of PPS test-takers in each national quartile of the fall 2019/20 reading test distribution who take the Fall reading test in 2019/20 and 2020/21



Note: Sample for blue bars includes all students in grades 2-7 in 2019/20 who took the Fall reading test. Sample for orange bars is the same but is further restricted to those who also took the Fall 2020/21 reading test. Blue bars show the proportion of students taking the reading test in fall 2019/20 who scored in each quartile, relative to national norms. Orange bars show the proportion of students in each quartile of the fall 2019/20 reading test who also took the fall 2020/21 reading test.

But remote instruction did *not* reduce the proportion of students with (first semester) course/subject grades

Vast majority of students enrolled in 2019/20 and 2020/21 have first semester grades, and there was little change in the proportion of students who have grades over time. One exception was kindergarten, which we do not include in the grade analyses.

Differences in the demographic characteristics of those with grades and the eligible student body were small and never exceeded 0.05 standard deviations.

Proportion of students with first-semester course/subject grades

	2019/20	2020/21
K	0.10	0.13
1	0.98	0.98
2	0.98	0.98
3	0.98	0.99
4	0.98	0.98
5	0.98	0.99
6	0.98	0.98
7	0.98	0.99
8	0.98	0.99
9	0.98	0.98
10	0.97	0.98
11	0.98	0.98
12	0.90	0.90

Implications

Test Score Analysis



Changes in students taking the test from 2019/20 to 2020/21 could make **cross-sectional comparisons** of successive cohorts of students in the same grade in 2019/20 and 2020/21 **potentially misleading**.

Grade Analysis



Because almost all students have grades and there is little change in the demographic composition of students with grades in first semester 2019/20 versus first semester 2020/21, **cross-sectional comparisons** of successive cohorts in same grade **should not be misleading** due to sample changes.

Changes in academic achievement: test score analysis

Main approach: Compare individual students' performance to their own performance in a prior period (in a longitudinal analysis):

- Compare a student's score in winter of 2020/21 to winter 2019/20.
- Standardize scores relative to NWEAs national norms (set before the pandemic) for each grade and subject (not year). Ensures common standard of comparison for 2019/20 and 2020/21.

Benefit: Hold the set of students in the sample in 2019/20 and 2020/21 constant.

Drawback: Can't examine students that were not present in both testing windows.

Sensitivity Analysis: Impute scores for those with scores in Winter 2019/20 who do not have them in 2020/21.

- Predict scores based on the Winter 2019/20 score; GPA, number of course failures, and absences in first semester 2020/21; and demographic characteristics.

Changes in academic achievement: course grade analysis

Compare successive cohorts of students in the same grades or subgroups in a cross-sectional analysis:

- Calculate difference between average outcomes (GPA or whether a student fails a course) for students in the same group (e.g. 3rd grade) in the first semester of 2019/20 to 2020/21.
- Comparing individual students' performance in 2020/21 to 2019/20 less ideal here because of natural increases in course failure with some grade transitions (e.g., 8th to 9th grade) that would be conflated with effects of COVID-19.

NWEA national study provides useful comparison, though their study sample has more attrition in test-taking than PPS experienced

- Useful to benchmark findings to what has occurred in other districts this year.
- NWEA conducted a study using districts that administer the MAP test in the U.S. (about 10% of the U.S. 3rd -8th graders in 2019/20).^{5,6}
- Among students who took the math MAP test in fall 2019/20, PPS had a higher proportion of students take the test again in winter 2019/20 and fall 2020/21 than in the NWEA sample.*
- Demographically, the NWEA sample has a larger proportion of White (about 50% vs. 30% in PPS) and Hispanic students (about 20% vs 4% in PPS), while PPS has a much larger proportion of Black students (53% vs. about 15% in NWEA).

NWEA Study Sample (Math)			
Grade in 2019/20	Took Test Fall 19/20	Took Test Fall 19/20, Winter 19/20, & Fall 20/21	Proportion
3	441,301	329,752	0.75
4	447,049	325,346	0.73
5	462,520	257,667	0.56
6	433,165	260,857	0.60
7	420,810	258,290	0.61
PPS (Math)			
Grade in 2019/20	Took Test Fall 19/20	Took Test Fall 19/20, Winter 19/20, & Fall 20/21	Proportion
3	1,667	1,348	0.81
4	1,519	1,223	0.81
5	1,518	1,210	0.80
6	1,590	1,271	0.80
7	1,615	1,283	0.79

*NWEA study sample used students who took the test in Fall 2019/20, Winter 2019/20, and Fall 2019/20.

References

1. Lewis, K., Kuhfeld, M., Ruzek, E., & McEachin, A. (2021). *Learning during COVID-19: Reading and math achievement in the 2020-21 school year*. NWEA. <https://www.nwea.org/research/publication/learning-during-covid-19-reading-and-math-achievement-in-the-2020-2021-school-year/>
2. Sawchuk, S. (2020, December 11). Should schools be giving so many failing grades this year? *Education Week*. <https://www.edweek.org/leadership/should-schools-be-giving-so-many-failing-grades-this-year/2020/12>
3. Thum, Y. M., & Kuhfeld, M. (2020). NWEA 2020 MAP Growth Achievement Status and Growth Norms Tables for Students and Schools. NWEA Research Report. Portland, OR: NWEA.
4. Kuhfeld, M., Ruzek, E., Johnson, A., Tarasawa, B., & Lewis, K. (2020). *Technical appendix for: Learning during COVID-19: Initial findings on students' reading and math achievement and growth*. NWEA. <https://www.nwea.org/research/publication/technical-appendix-for-learning-during-covid-19-initial-findings-on-students-reading-and-math-achievement-and-growth/>
5. U.S. Department of Education, National Center for Education Statistics, Statistics of Public Elementary and Secondary School Systems, 1980-81; Common Core of Data (CCD), "State Nonfiscal Survey of Public Elementary/Secondary Education," 1985-86 through 2018-19; and National Elementary and Secondary Enrollment Projection Model, 1972 through 2029. ([Table 203.10](#). Enrollment in public elementary and secondary schools, by level and grade: Selected years, fall 1980 through fall 2029).
6. Kuhfeld, M., Lewis, K., Meyer, P., & Tarasawa, B. (2020). Comparability analysis of remote and in-person MAP Growth testing in fall 2020. NWEA. <https://www.nwea.org/research/publication/comparability-analysis-of-remoteand-in-person-map-growth-testing-in-fall-2020/>