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Regional Educational Laboratory  
at Mathematica

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# Understanding changes in academic achievement and online learning application use in Pittsburgh Public Schools during remote instruction in the COVID-19 pandemic

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# Introduction

The COVID-19 pandemic has caused dramatic disruption in the education system (e.g., remote learning) and outside of it. REL Mid-Atlantic is partnering with Pittsburgh Public Schools (PPS) to address two questions:

## 1) Changes in academic achievement:

- a) During the 2019/20 to 2020/21 school years, was there a change in the proportion of students (1) taking the NWEA math and reading tests and (2) receiving grades, and if so, did the demographic characteristics of included students change?
- b) **How has academic achievement, as measured by test scores and grades, changed during the pandemic?** How do changes in academic achievement vary across grades and demographic groups?



**Goal:** Inform planning for the school year, including identifying groups needing more support

## 2) Online learning application use:

- a) **How much and in what ways do students access and use online learning applications while learning remotely?** How do access and usage vary across grades and demographic groups? How do access and usage vary over time in the 2020/21 school year? Is there more variation between schools, between teachers in a school, or between students with the same teacher?
- b) **How are logins and measures of activity in the learning management system related to grades and absences?**



**Goal:** Inform discussions about expected use and participation and identify guidance to support use

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# Research question 1:

## *Changes in achievement*

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# How did the COVID-19 pandemic and disruptions to instructions affect student achievement?

- National evidence of declines relative to typical performance (Lewis et al., 2021).
- Students learning remotely typically experienced less instruction, were more likely to be absent, and failed to complete assignments more than those learning in person (Kaufman & Diliberti, 2021).
- Reports from some districts suggest proportion of students receiving failing grades has increased in 2020/21 relative to 2019/20 (Sawchuk, 2020).

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



# Preview of key findings on test scores and grades (RQ1) through winter 2020/21

- On average, PPS students' scores on winter NWEA MAP assessments declined in math and reading within the pre-pandemic national distribution.
  - Decrease was largest for elementary students in both subjects, for boys in math, and for Black students in reading.
- Students in most grades experienced test score growth, but the growth was lower than typical pre-pandemic growth nationally.
  - Compared to other districts that administer the NWEA MAP test, PPS students grew the same or slightly more than other districts from winter 2019/20 to fall 2020/21.
- Rates of course failure in PPS 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 suggest there is an identifiable group of students who was most negatively affected by the pandemic and remote instruction.

# Data

<b>NWEA MAP scores</b>	<ul style="list-style-type: none"><li>• Fall, winter, and spring from 2019/20 and fall and winter from 2020/21</li><li>• Offered in K–12</li><li>• Reading and math</li><li>• Standardize scores relative to national norms (using pre-pandemic data)</li></ul>
<b>Student demographics and enrollment data</b>	<ul style="list-style-type: none"><li>• 2019/20 and 2020/21 school years</li><li>• Include race, gender, economically disadvantaged status, and Individualized Education Program (IEP) status</li></ul>
<b>Student grades</b>	<ul style="list-style-type: none"><li>• Focus on first semesters in 2019/20 and 2020/21</li><li>• Used to construct number of courses failed, percentage of students failing a course, and GPA</li></ul>

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# Research question 1a:

*During the 2019/20 to 2020/21 school years, was there a change in the proportion of students (1) taking the NWEA math and reading tests and (2) receiving grades, and if so, did the demographic characteristics of included students change?*

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

- The 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 and 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

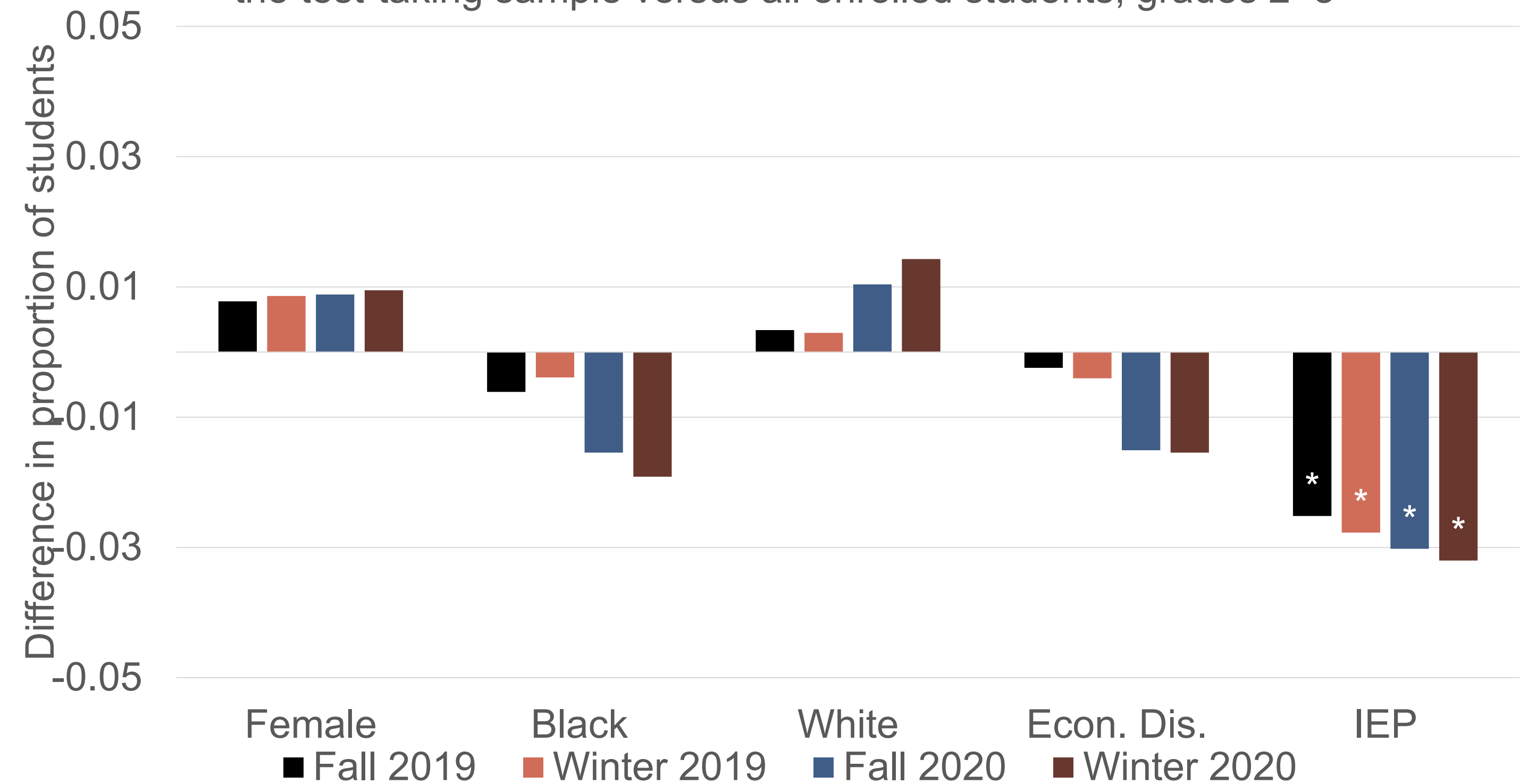
	Math					Reading				
	2019/20			2020/21		2019/20			2020/21	
	Fall	Winter	Spring	Fall	Winter	Fall	Winter	Spring	Fall	Winter
All	87%	87%	11%	66%	66%	85%	85%	11%	62%	64%
Grade K	78%	94%	6%	2%	1%	76%	94%	5%	3%	1%
Grade 1	93%	95%	5%	9%	2%	93%	94%	5%	12%	2%
Grade 2	94%	95%	4%	80%	86%	93%	94%	6%	77%	85%
Grade 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%

# For grades 2–8, changes in the composition of students taking the test (relative to the total student body) were small from 2019/20 to 2020/21

Compared to the population of students in PPS, the test-taking sample in 2020/21 had fewer students who were **Black** or **economically disadvantaged**, though these differences were small in magnitude and the standardized differences did not exceed 0.05 standard deviations.

- In both 2019/20 and 2020/21, students with an **IEP** were substantially less likely to take the test.

Differences in the proportion of students with each characteristic in the test-taking sample versus all enrolled students, grades 2–8

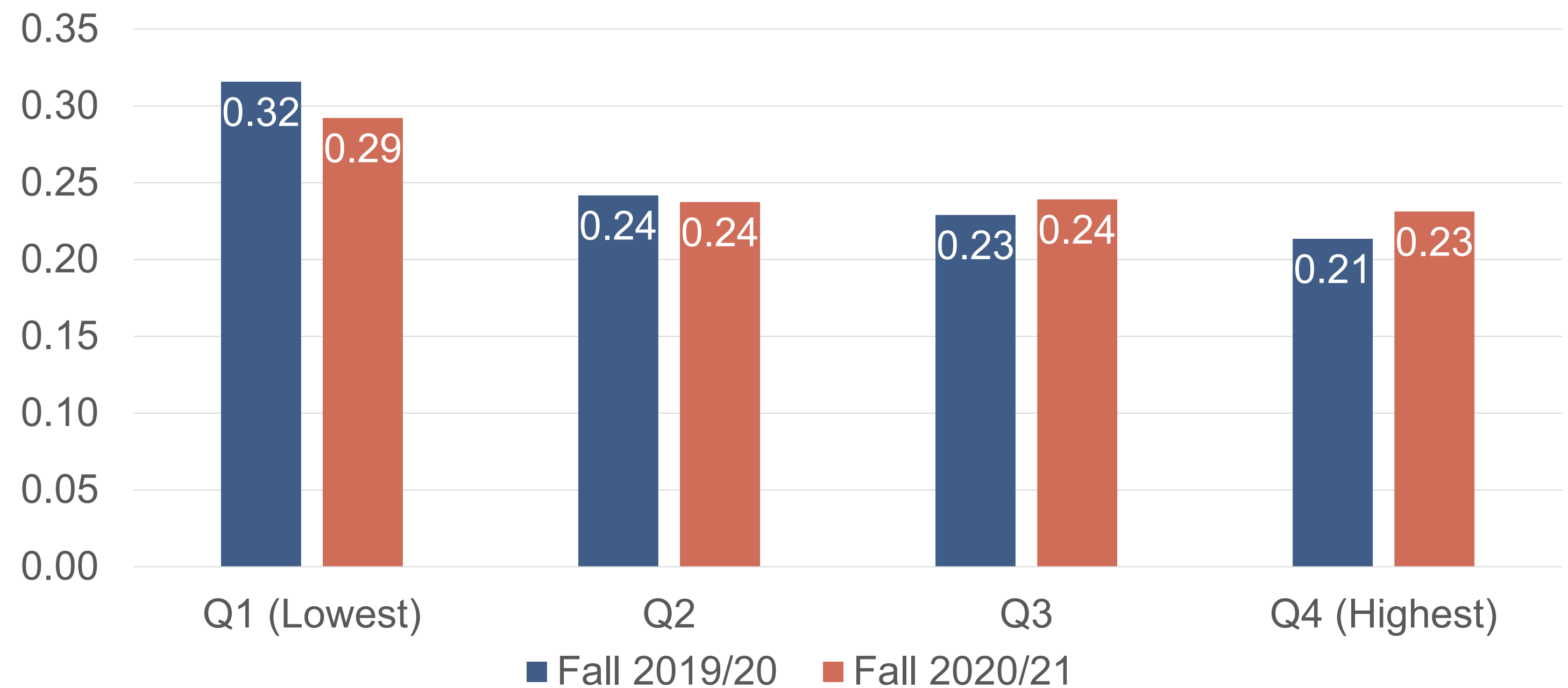


Note: \* indicate the standardized difference between the proportion of students with a given characteristic in the test-taking population and in the enrolled population exceeded 0.05 standard deviations.

# Students with low prior test scores were slightly less likely to take test in fall 2020/21—potentially inflating district-wide average scores

- A smaller proportion of students scoring in the bottom quartile (relative to national norms) on the fall 2019/20 reading test took the test in fall 2020/21, whereas students scoring in the top quartiles represented a larger proportion of test takers in fall 2020/21.
- Students taking the test again in 2020/21 had slightly higher prior 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 had 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 the same grade **should not be misleading** due to sample changes.



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# Research question 1b:

- *How has academic achievement, as measured by test scores and grades, changed during the pandemic?*
  - *How do changes in academic achievement vary across grades and demographic groups?*
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# 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 2020/21 to winter 2019/20.
- Standardize scores relative to NWEA's national norms (set before the pandemic) for each grade and subject (not year) (Thum & Kuhfeld, 2020). Ensures common standard of comparison for 2019/20 and 2020/21.

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

**Drawback:** Can't examine students who 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 course failure) for students in the same group (e.g., grade 3) 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., grade 8 to 9) that would be conflated with pandemic-related disruptions.

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# Research question 1b:

## *Findings for test outcomes*

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# How do individual students' scores change over time, relative to prior national norms?

*PPS students' test score growth in remote instruction was lower than average growth nationally in pre-pandemic years.*

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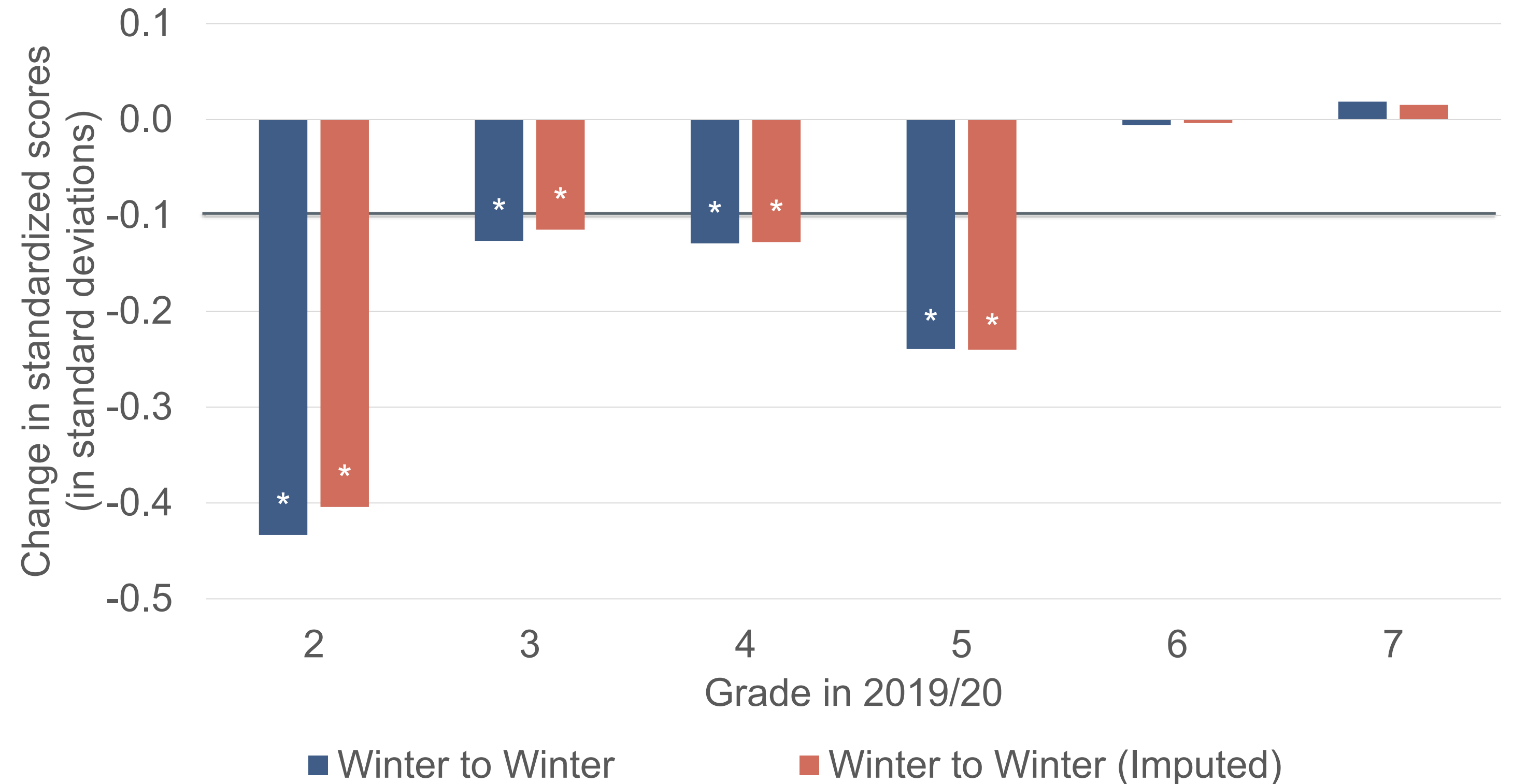




# Comparing individual students' scores in 2019/20 to 2020/21, largest declines in math scores (relative to pre-pandemic national norms) were in elementary grades

- 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 that large decline for 2<sup>nd</sup> graders may be related to having unusually *high* scores before the pandemic (2019 2<sup>nd</sup> graders scores were about 0.4 SDs higher than 1<sup>st</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> graders in fall and winter 2019).
- Findings very similar when imputing scores for those missing them.

Change in individual students' standardized math scores from winter 2019/20 to winter 2020/21

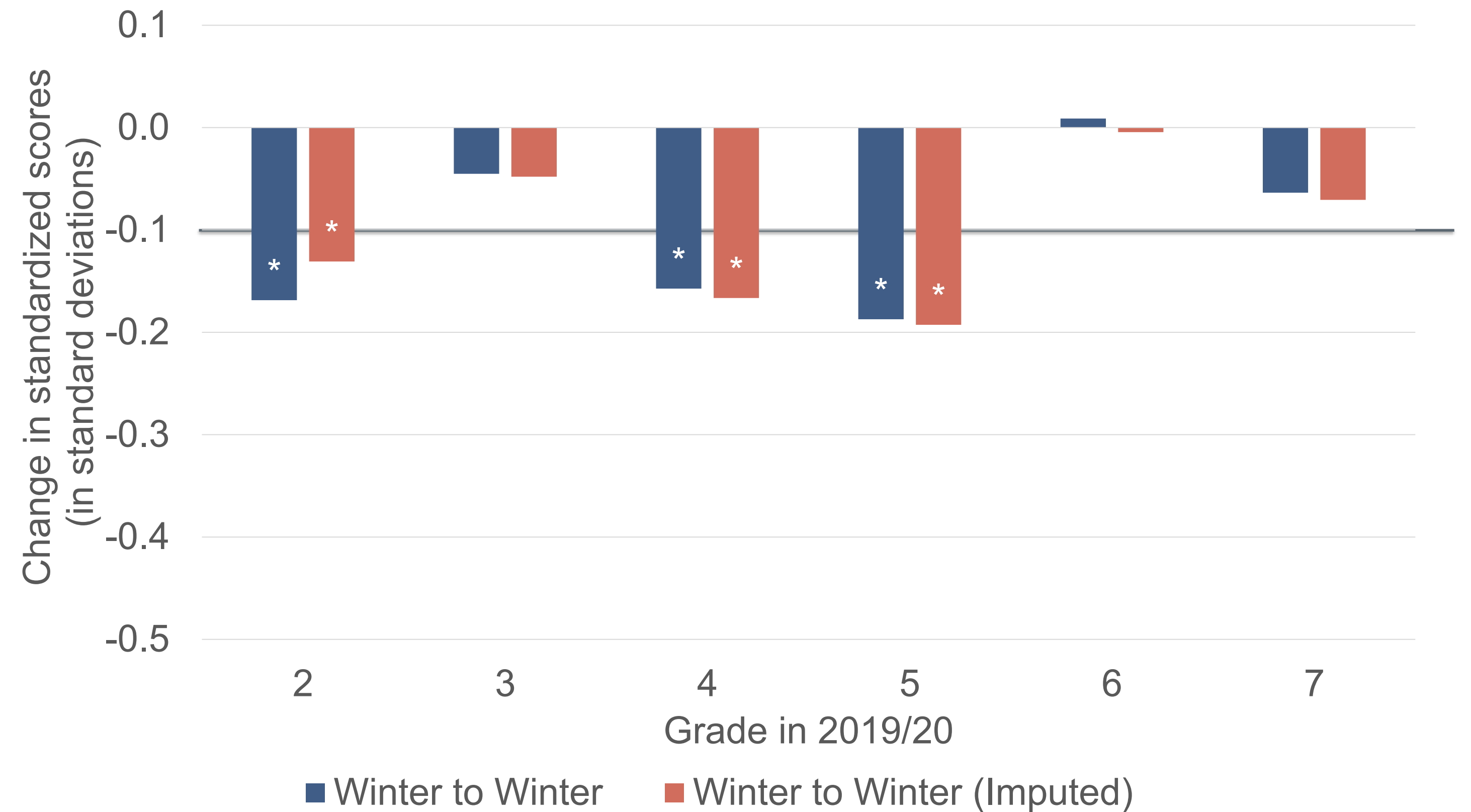


Note: \* indicates change was greater or equal to +/- 0.1 standard deviations.

# Comparing individual students' scores in 2019/20 to 2020/21, declines 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 in reading.**
- Findings very similar when imputing scores for those missing them.

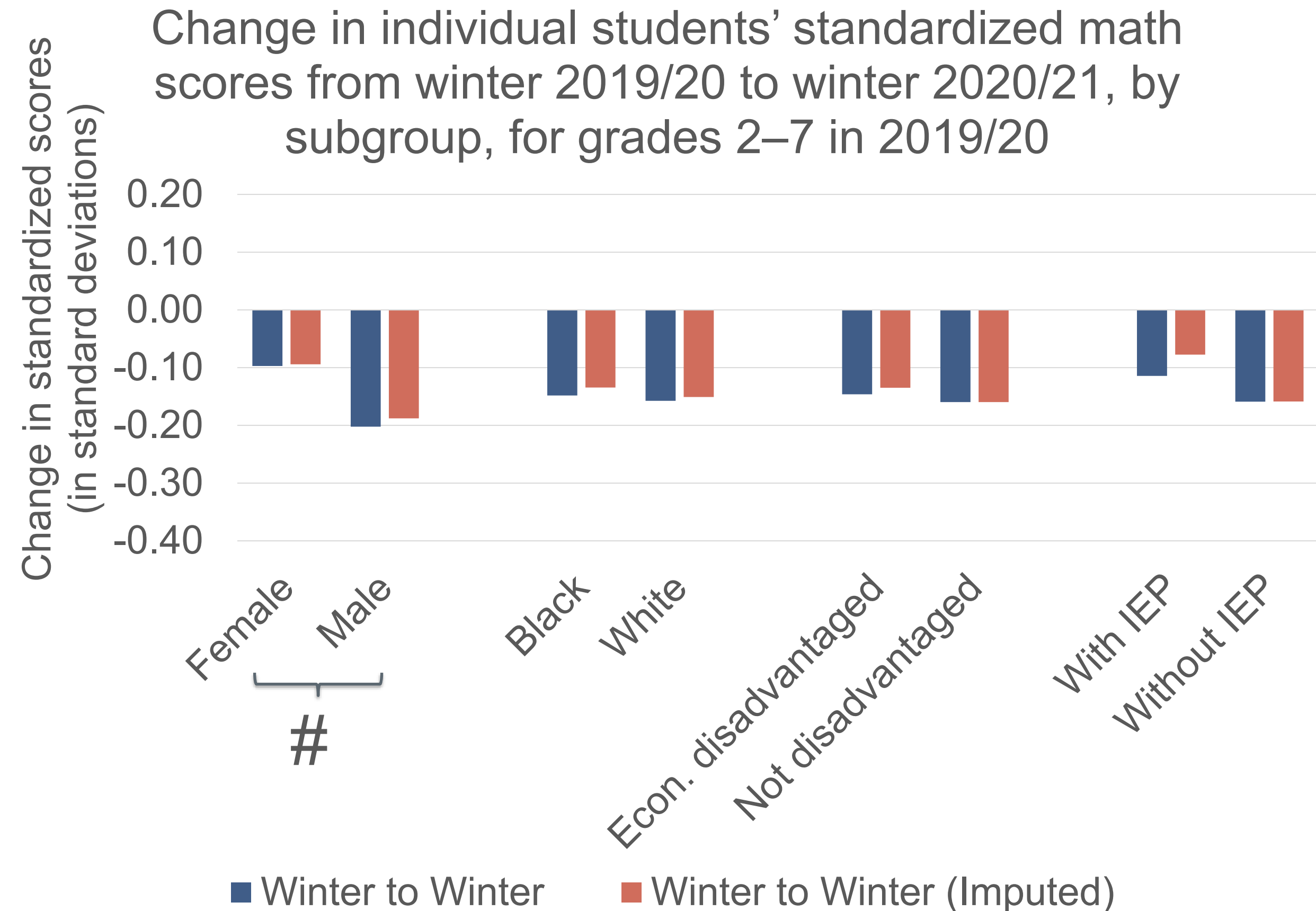
Change in individual students' standardized reading scores from winter 2019/20 to winter 2020/21



Note: \* indicates change was greater or equal to +/- 0.1 standard deviations.

# Comparing individual students' scores in 2019/20 to 2020/21, declines 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 students with or without an **IEP**.
- Findings similar when imputing scores for those missing them.

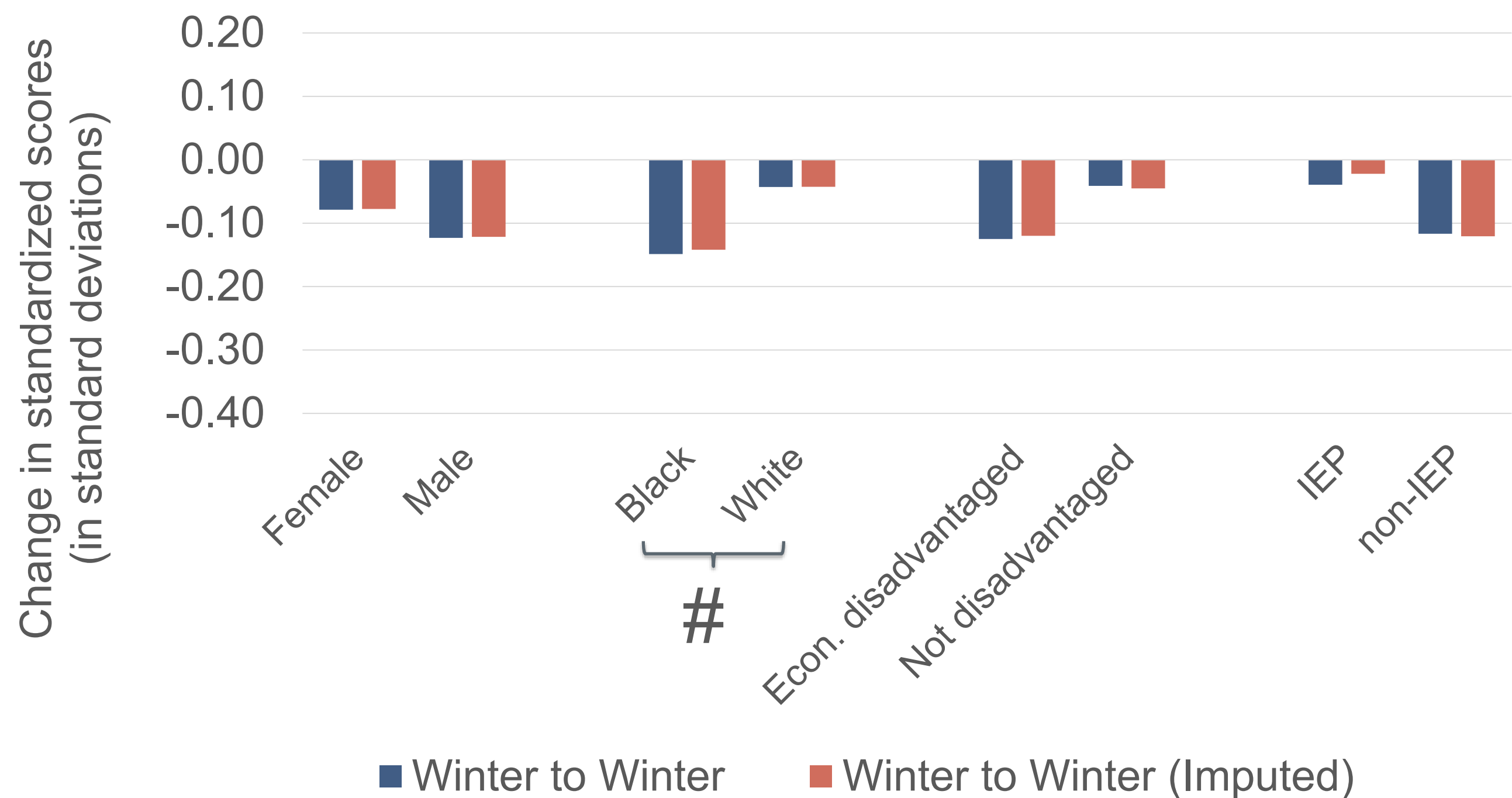


Note: # indicates difference between the two groups listed was greater or equal to +/- 0.1 standard deviations.

# Comparing individual students' scores in 2019/20 to 2020/21, declines in reading (relative to pre-pandemic national norms) larger for Black students than White students

- **Black students experienced larger declines** from winter to winter than White students.
- Differences between other groups of students were smaller than between Black and White students.

Change in individual students' standardized reading scores from winter 2019/20 to winter 2020/21, by subgroup, for grades 2–7 in 2019/20



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



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**Have individual students' test scores grown at all in the past year, and how does their growth compare to other districts this past year?**



- 1. Students' test scores have increased, but less than average growth nationally pre-pandemic.***
  - 2. Growth in PPS similar to or slightly larger than other districts from winter 2019/20 to fall 2020.***
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# NWEA national study provides useful comparison, though its 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 U.S. students in grades 3–8 in 2019/20) (Kuhfeld, Ruzek, et al., 2020).
- Among students who took the math MAP test in fall 2019/20, a higher proportion of the PPS sample took the test again in winter 2019/20 and fall 2020/21 than 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

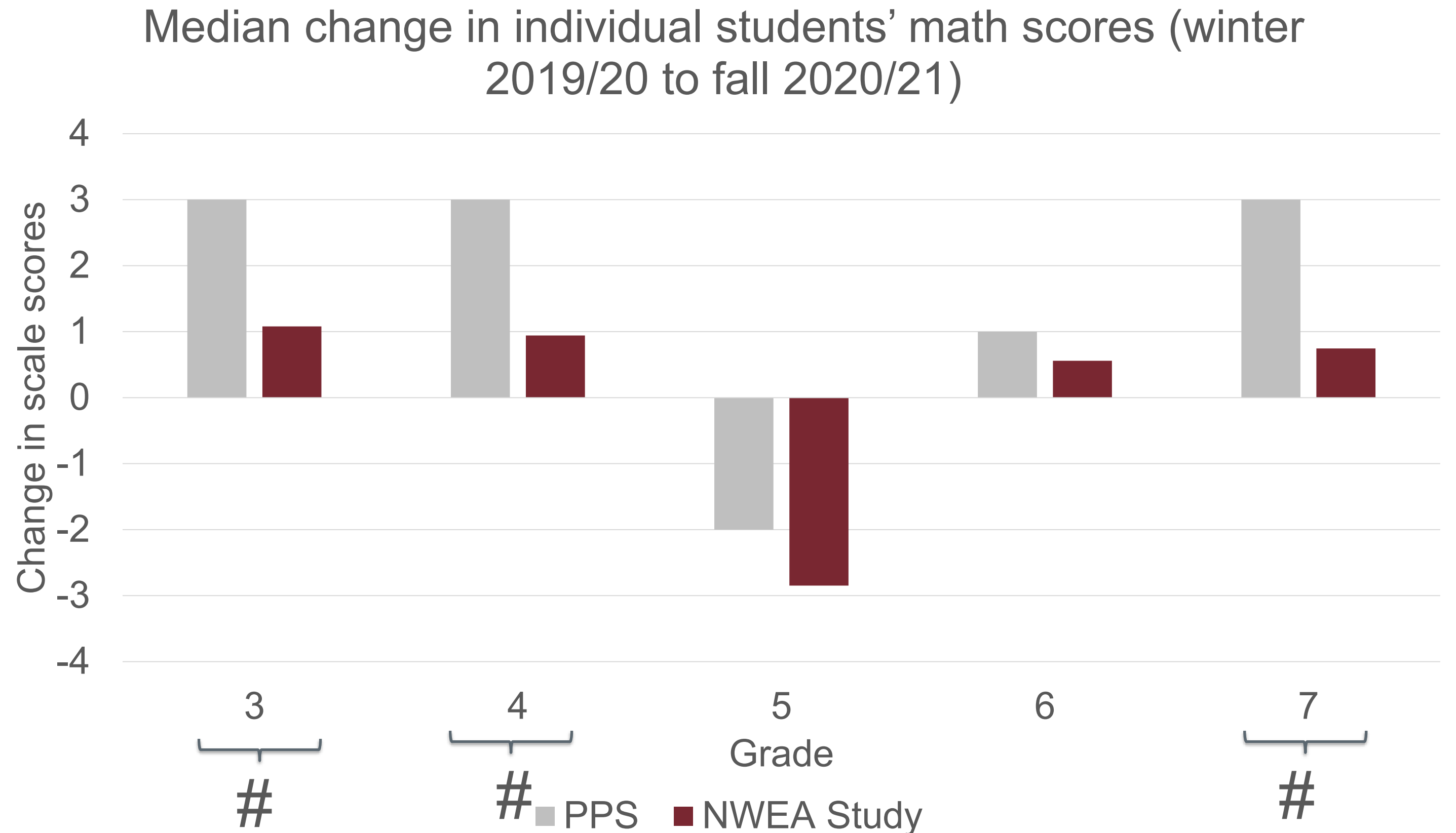
  

PPS (math)			
Grade in 2019/20	Took test fall 19/20	Took test fall 19/20, winter 19/20, & fall 20/21	Proportion
3	1,667	1,348	0.81
4	1,519	1,223	0.81
5	1,518	1,210	0.80
6	1,590	1,271	0.80
7	1,615	1,283	0.79

\* NWEA study sample used students who took the test in fall 2019/20, winter 2019/20, and fall 2020/21.

# PPS students' math score growth *through fall 2020* was similar to or slightly better than the NWEA study sample's growth

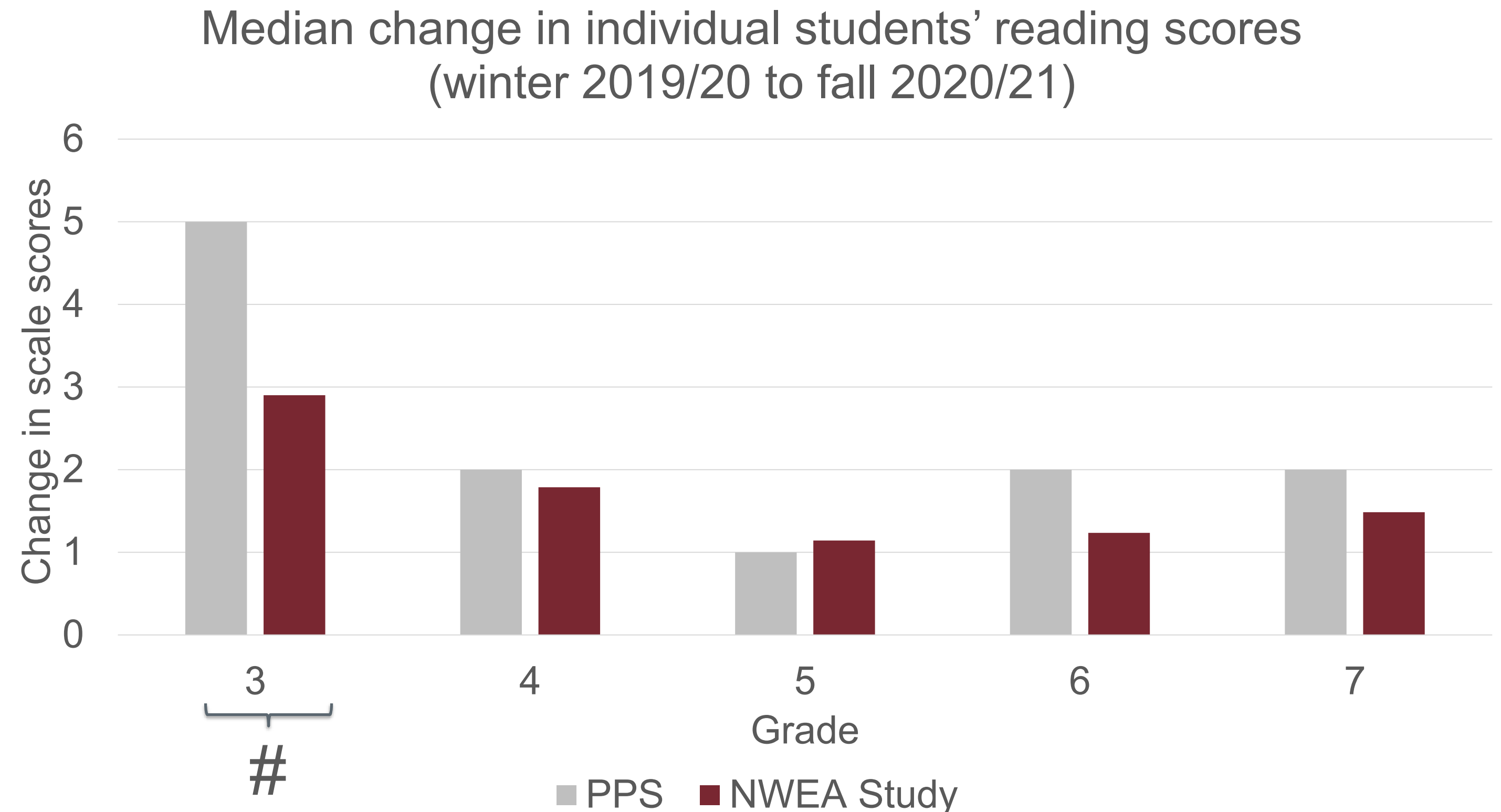
- For students who took the **math** test in both winter 2019/20 and fall 2020/21, **PPS students scored higher in fall 2020/21 than in winter 2019/20** in almost all grades, indicating learning occurred.
- Median of PPS's **Winter-to-Fall growth was about 2 scale score points higher than the median growth in the NWEA study** in grades 3, 4, and 7 in 2019/20 and **about the same** in grades 5 and 6.



Note: # indicates difference between the PPS and NWEA study results for a given grade was greater than or equal to the scale score equivalent of +/- 0.1 standard deviations in the national distribution (based on pre-pandemic norms).

# PPS students' reading score growth *through fall 2020* was similar to or slightly better than the NWEA study sample's 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.
- Median of **winter-to-fall growth for PPS** was about the same as the median growth in the NWEA study in grades 4–7 and higher in grade 3.



Note: # indicates difference between the PPS and NWEA study results for a given grade was greater than or equal to the scale score equivalent of +/- 0.1 standard deviations in the national distribution (based on pre-pandemic norms).

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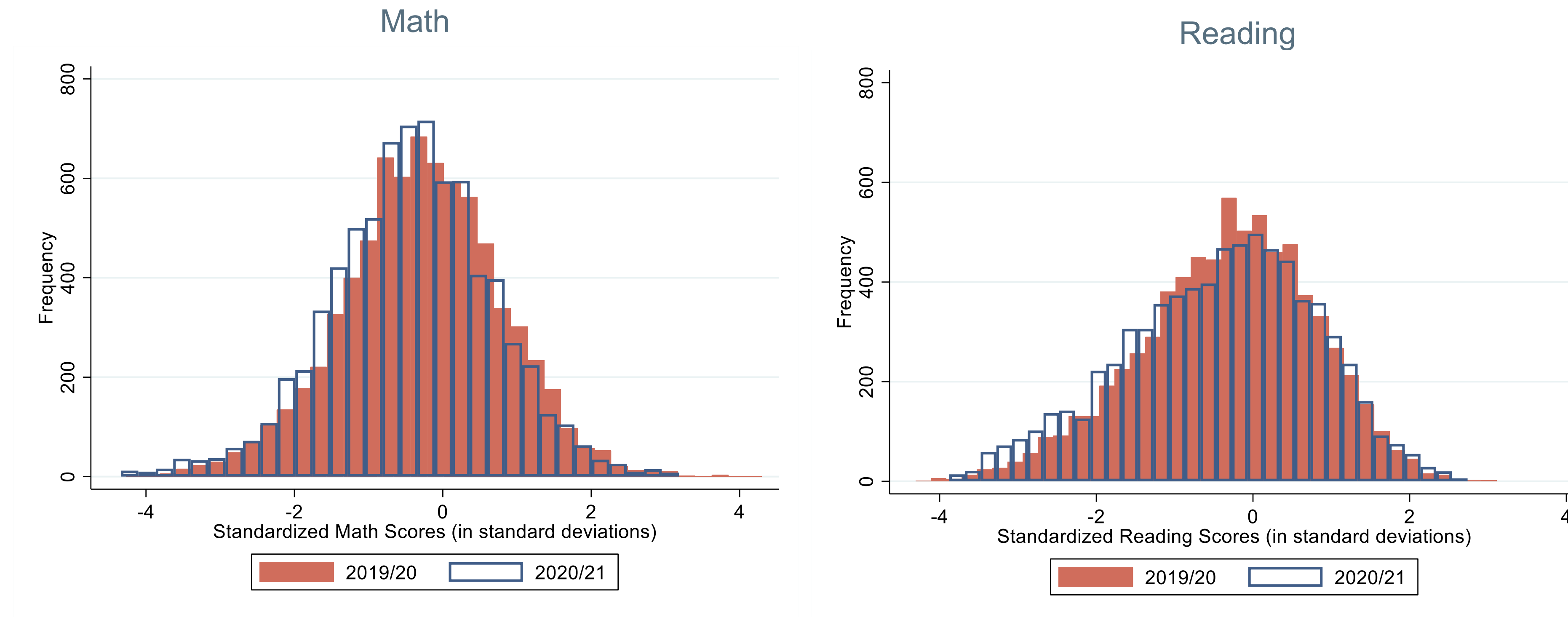
**How did the test score distribution change, and how did declines differ based on students' winter 2019/20 scores?**

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Math distribution in PPS shifted uniformly left, indicating declines across the distribution. For reading, shift was mainly from center to left half, and upper part of the distribution largely unchanged

Test score histograms for winter 2019/20 and winter 2020/21 for students in grades 2–7 in 2019/20 who have test scores in both winters



Note: Conducting a Kolmogorov–Smirnov test, we reject the null hypothesis that the distributions for 2019/20 and 2020/21 are equal for both math and reading.



# For math, declines across quintiles exceeded gains relative to pre-pandemic national norms

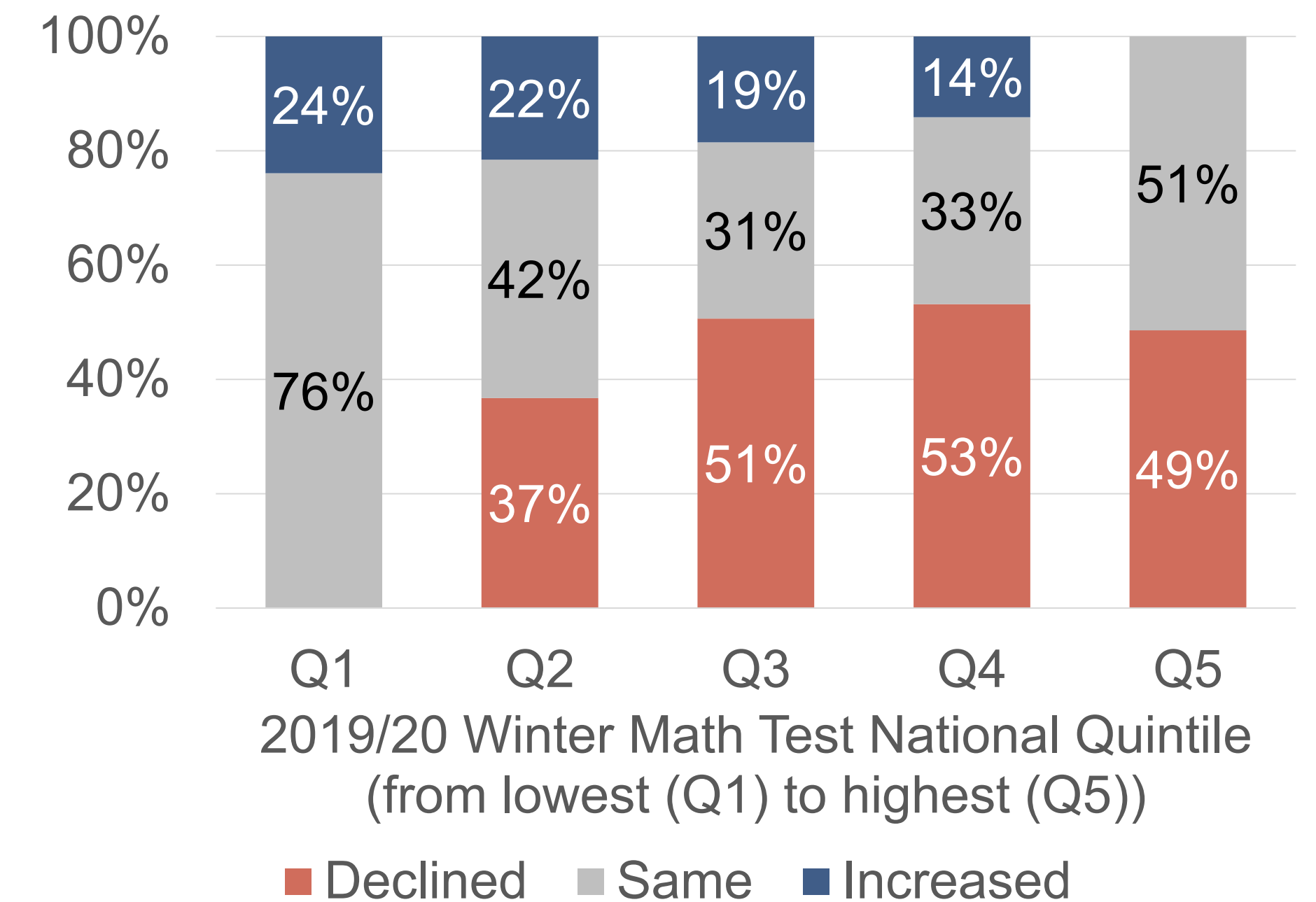
Percentage of students in each quintile of the national distribution in math in winter 2019/20 who scored in each quintile in winter 2020/21

		Winter 2020/21				
		Q1	Q2	Q3	Q4	Q5
Winter 2019/20	Q1	76%	16%	4%	2%	2%
	Q2	37%	42%	14%	5%	3%
	Q3	14%	37%	31%	14%	5%
	Q4	5%	17%	32%	33%	14%
	Q5	1%	2%	13%	32%	51%

■ Declined ■ Same ■ Increased



Percentage of students in each quintile of the national distribution in math in winter 2019/20 who declined, stayed the same, or increased their quintile in winter 2020/21



Note: Includes students in grades 2–7 in 2019/20.

# For reading, declines across quintiles likewise exceeded gains relative to national distribution, though differences were smaller than in math

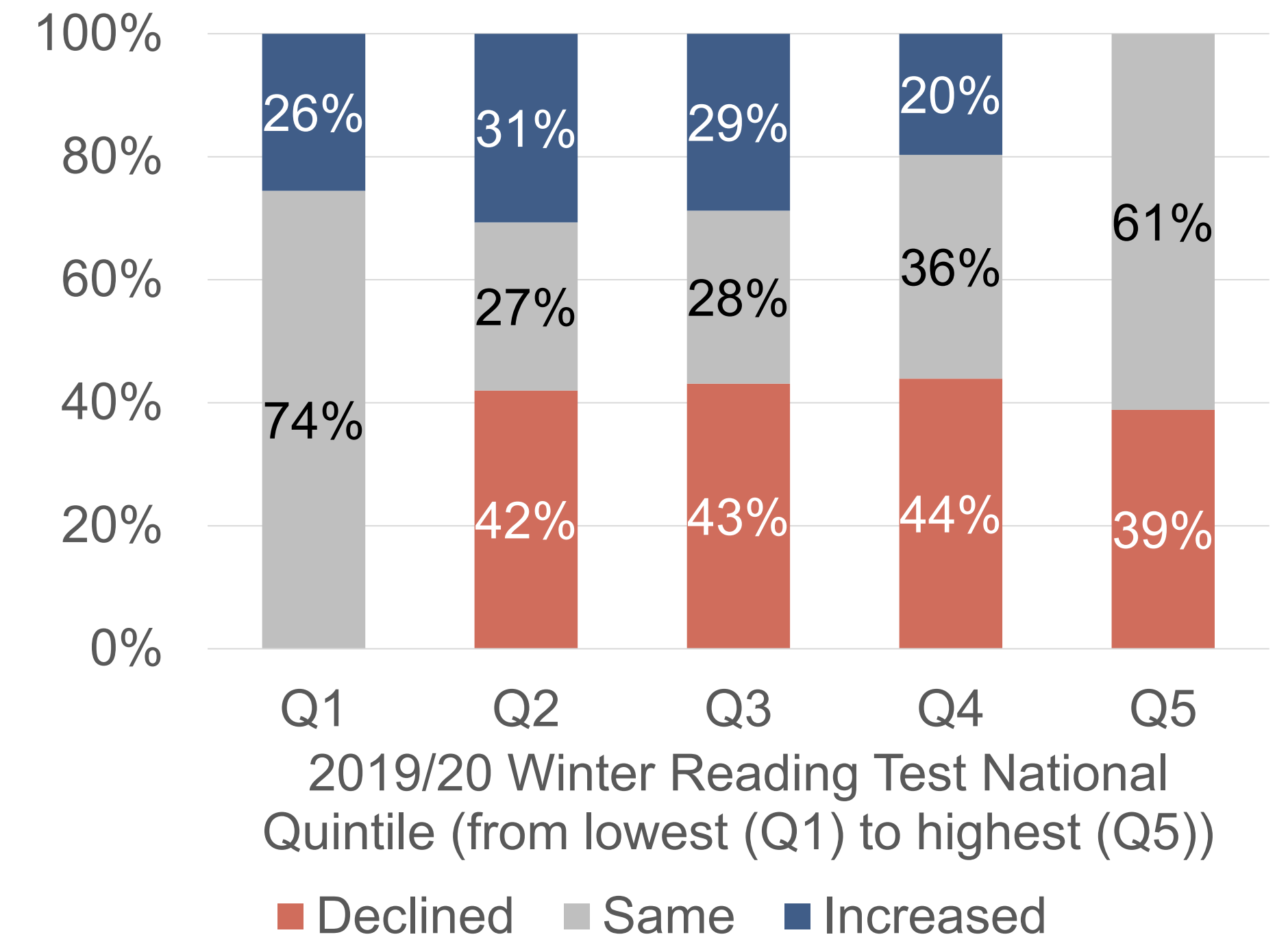
Percentage of students in each quintile of the national distribution in reading in winter 2019/20 who scored in each quintile in winter 2020/21

		Winter 2020/21				
		Q1	Q2	Q3	Q4	Q5
Winter 2019/20	Q1	74%	14%	6%	3%	2%
	Q2	42%	27%	19%	8%	3%
	Q3	19%	25%	28%	22%	7%
	Q4	6%	12%	26%	36%	20%
	Q5	1%	2%	7%	28%	61%

■ Declined    ■ Same    ■ Increased



Percentage of students in each quintile of the national distribution in reading in winter 2019/20 who declined, stayed the same, or increased their quintile in winter 2020/21



Note: Includes students in grades 2–7 in 2019/20.

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# Research question 1b:

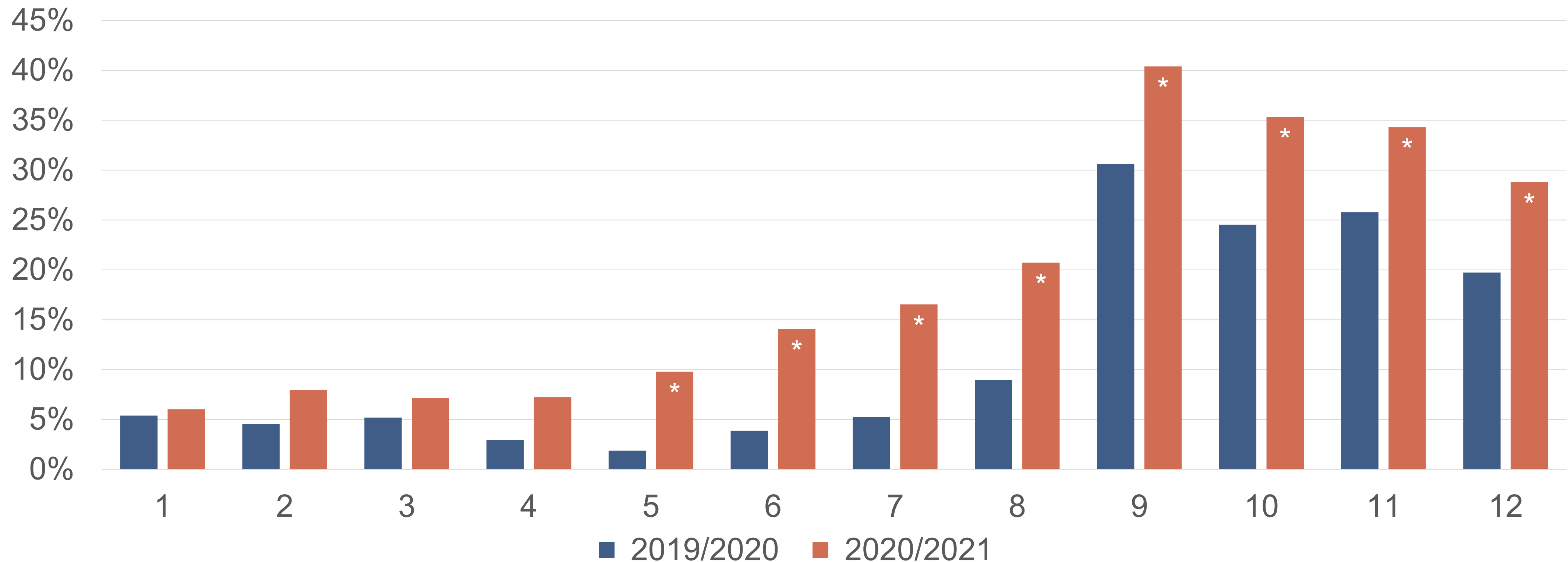
## *Findings for grade outcomes*

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

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



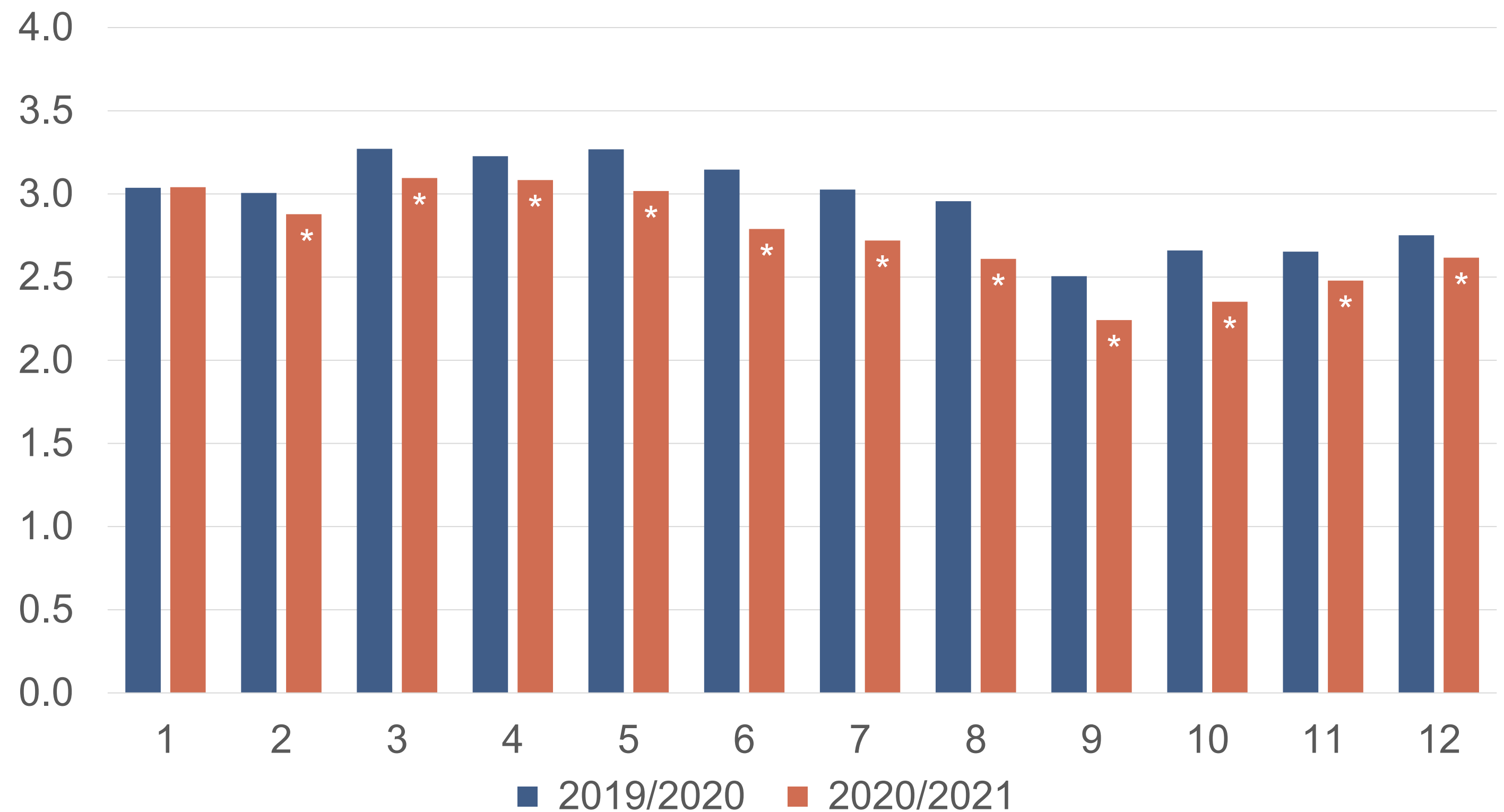
Note: \* indicates difference between 2019/20 and 2020/21 was greater than or equal to 5 percentage points.



# Average GPA declined in nearly every grade

- Average GPA declined in all grades but grade 1 from 2019/20 to 2020/21.
- Average decline across all grades is -0.20 GPA points on a 4.0 scale.
- Larger declines (about 0.3 GPA points) in grades 6–8 and 10.

Average GPA (fall semester, all courses/subjects)

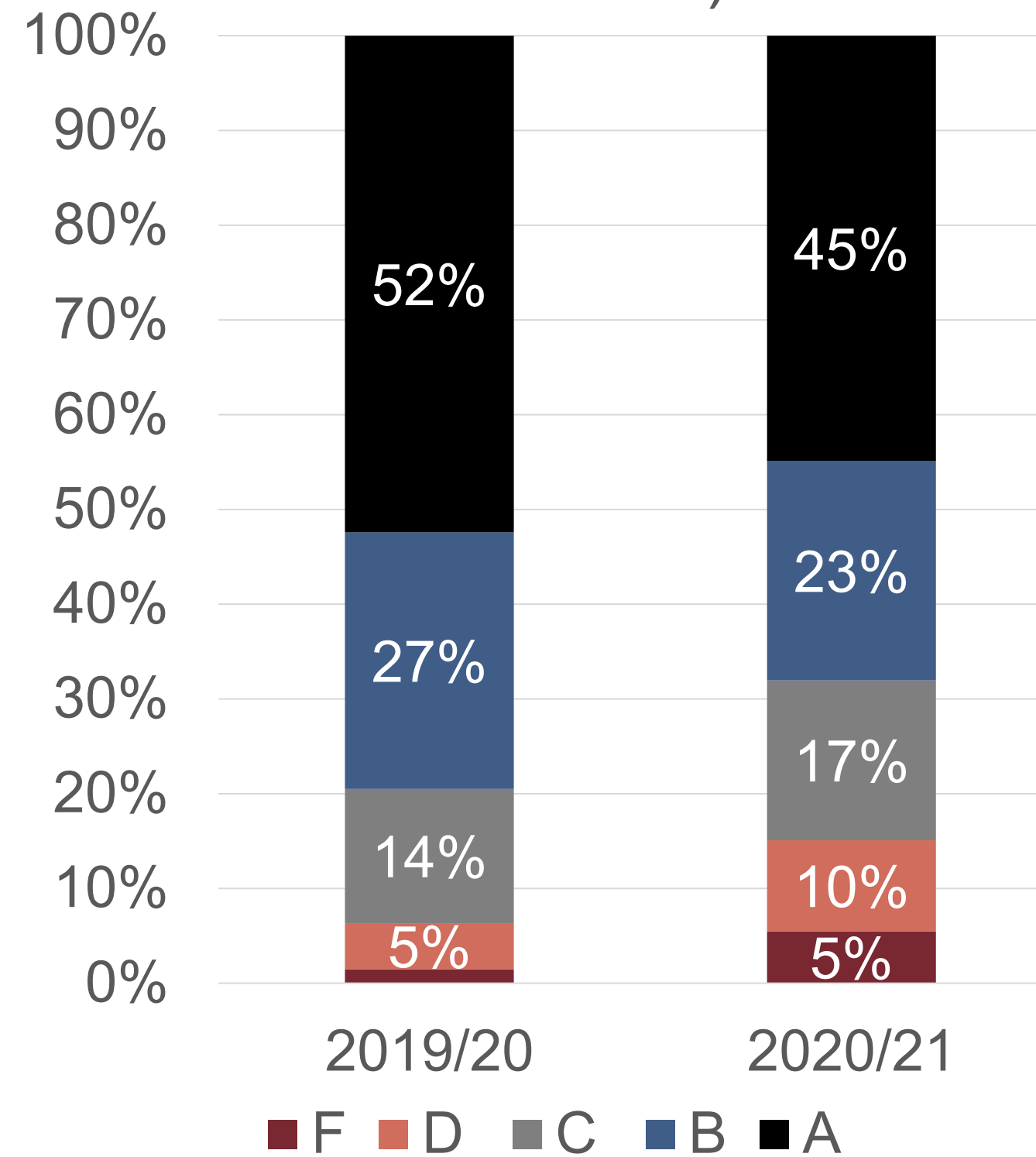


Note: \* indicates difference of 0.1 GPA points or more between 2019/20 and 2020/21.

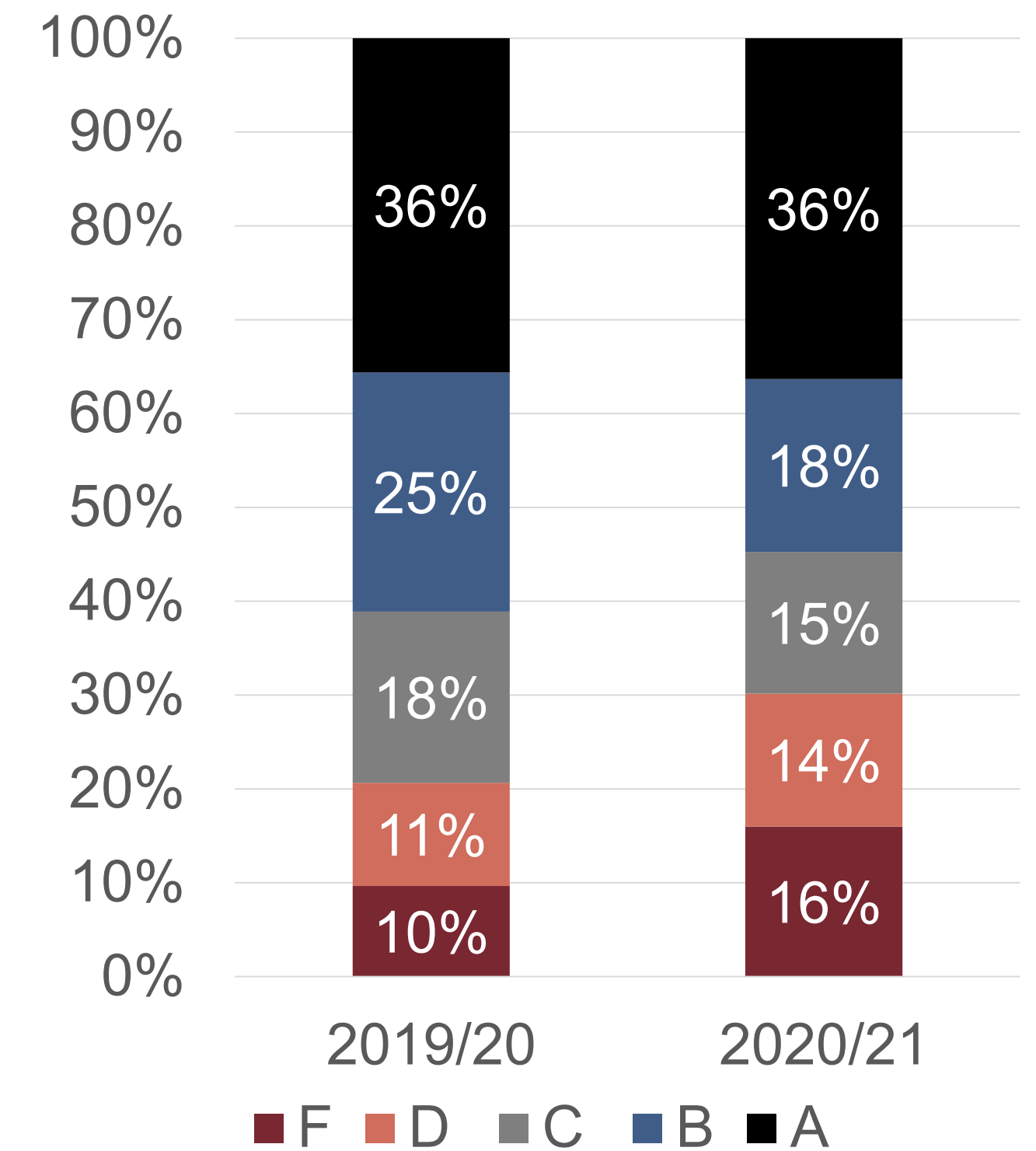
# Course-grade distribution shifted downward in middle and high school

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

Grade distribution, grades 6-8 (first semester, all courses)

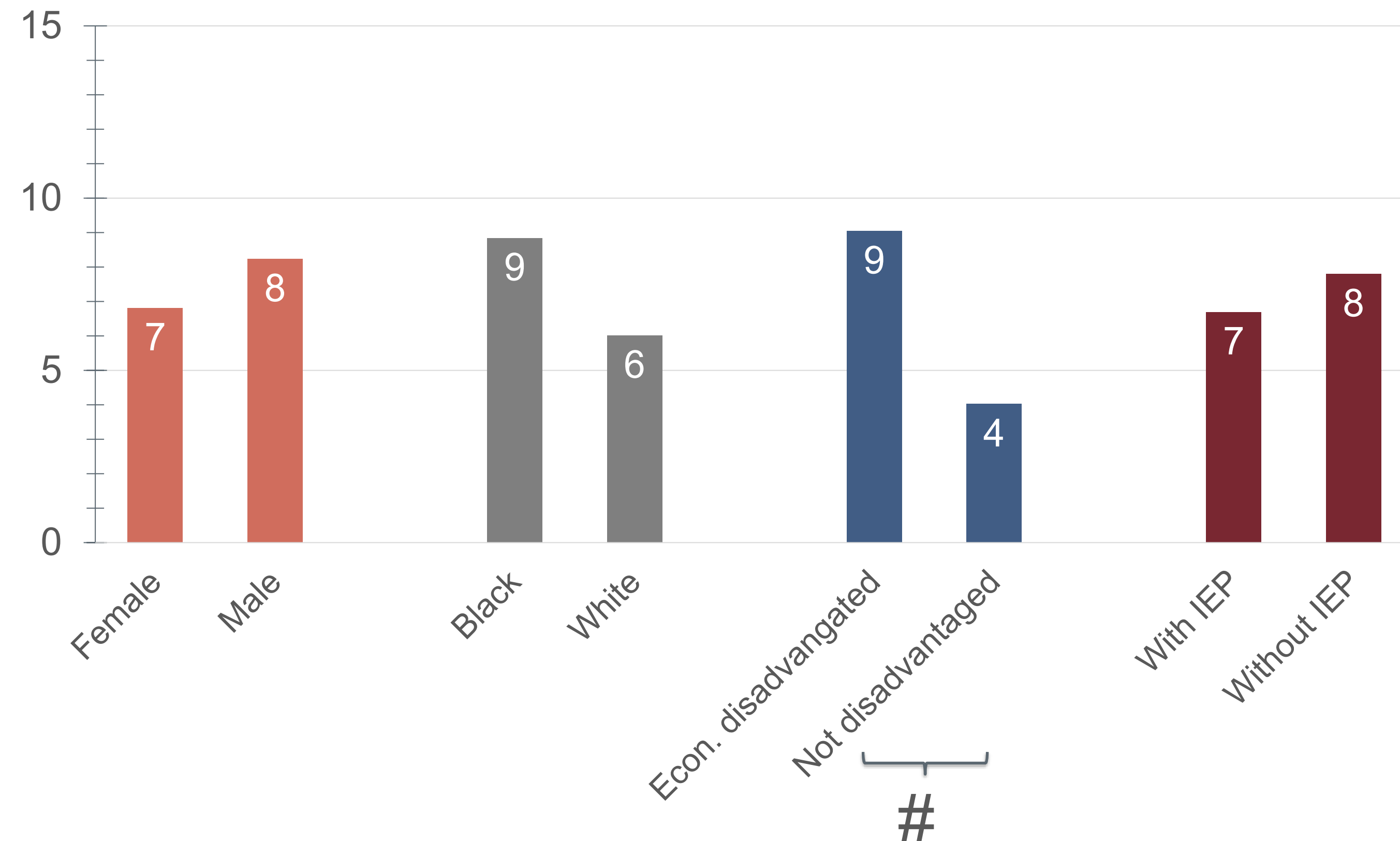


Grade distribution, grades 9-12 (first semester, all courses)



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

Percentage point change in percent of students failing a course (2019/20 to 2020/21)

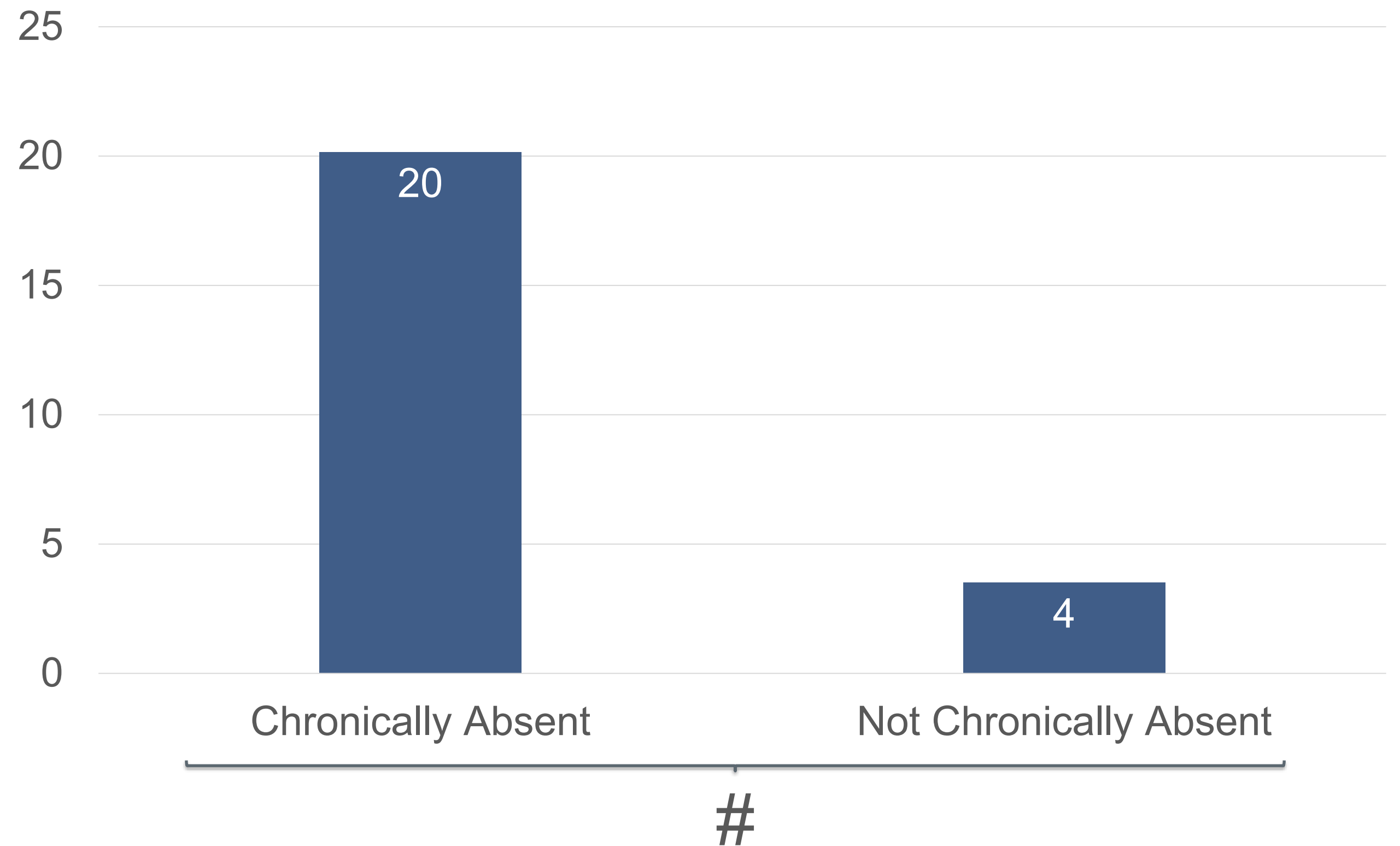


Note: Sample includes all students in grades 1–12. # indicates difference between groups exceeds 5 percentage points.

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

- The percentage of students who failed a course **increased by 20 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**.

Percentage point change in percent of students failing a course (2019/20 to 2020/21)

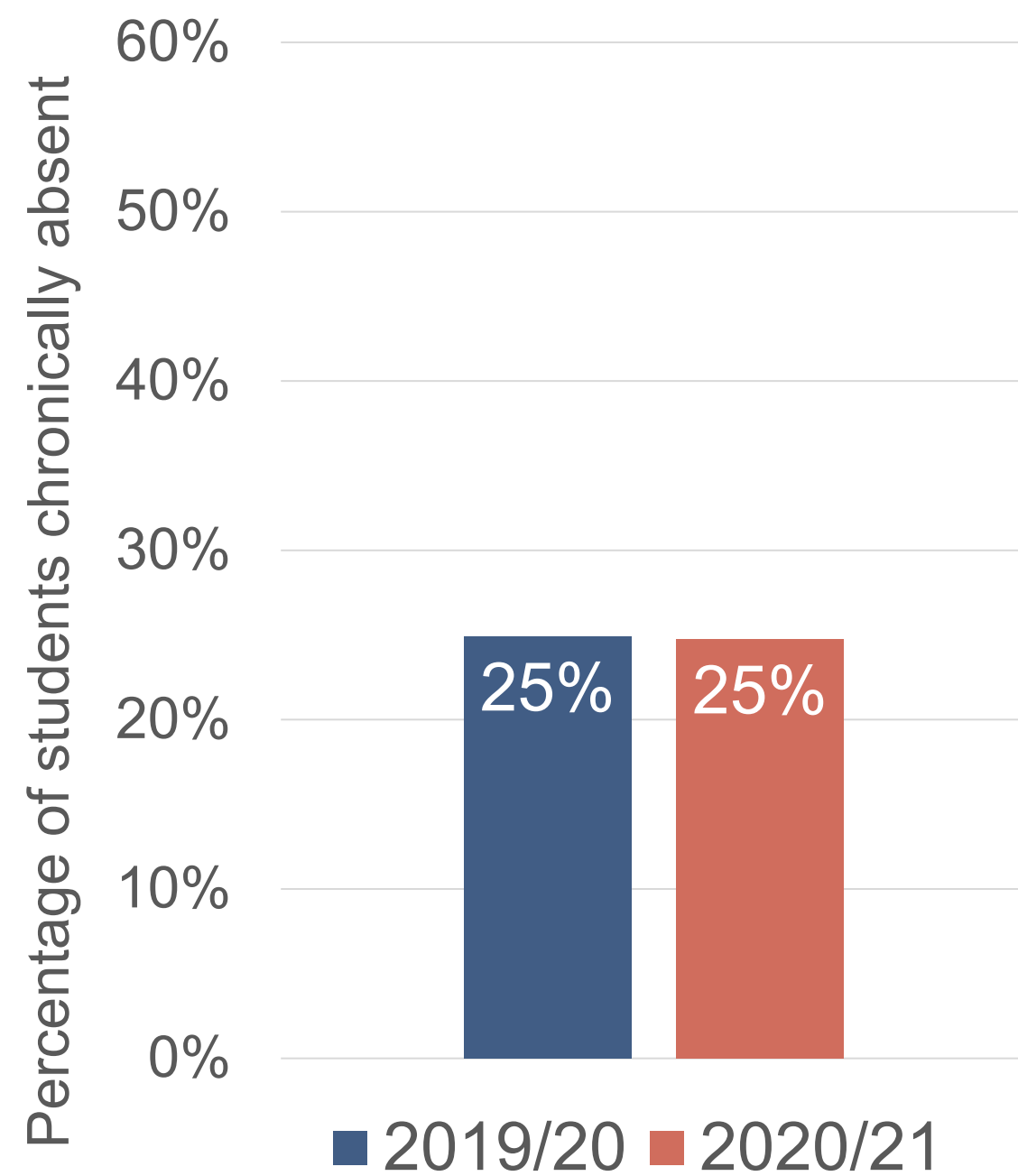


Note: Sample includes all students in grades 1–12. # indicates difference between groups exceeds 5 percentage points. Chronically absent is having missed more than 10% of instructional days.

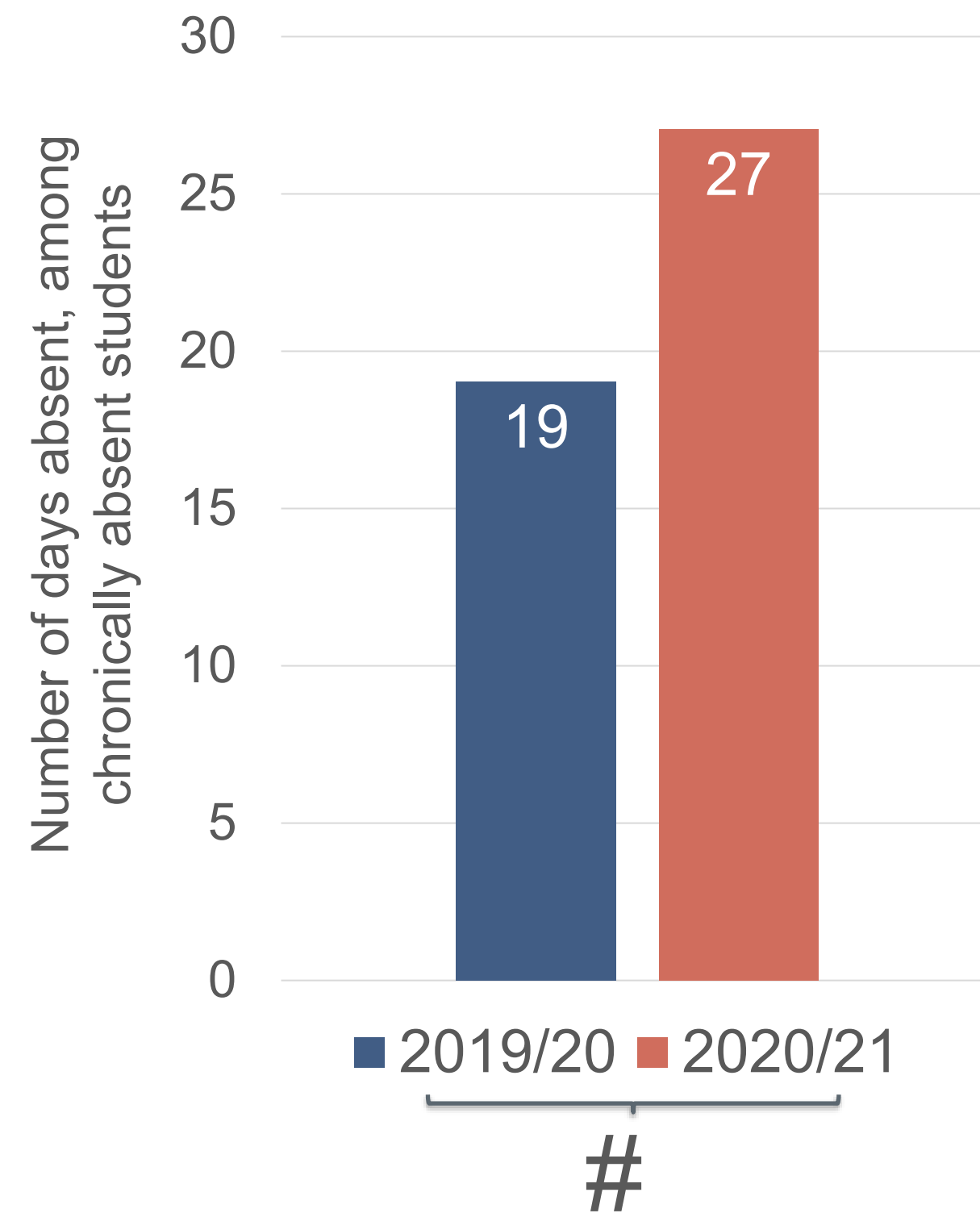


# Chronically absent students missed 8 more days on average than in prior year. Clear relationship between absences and course failure

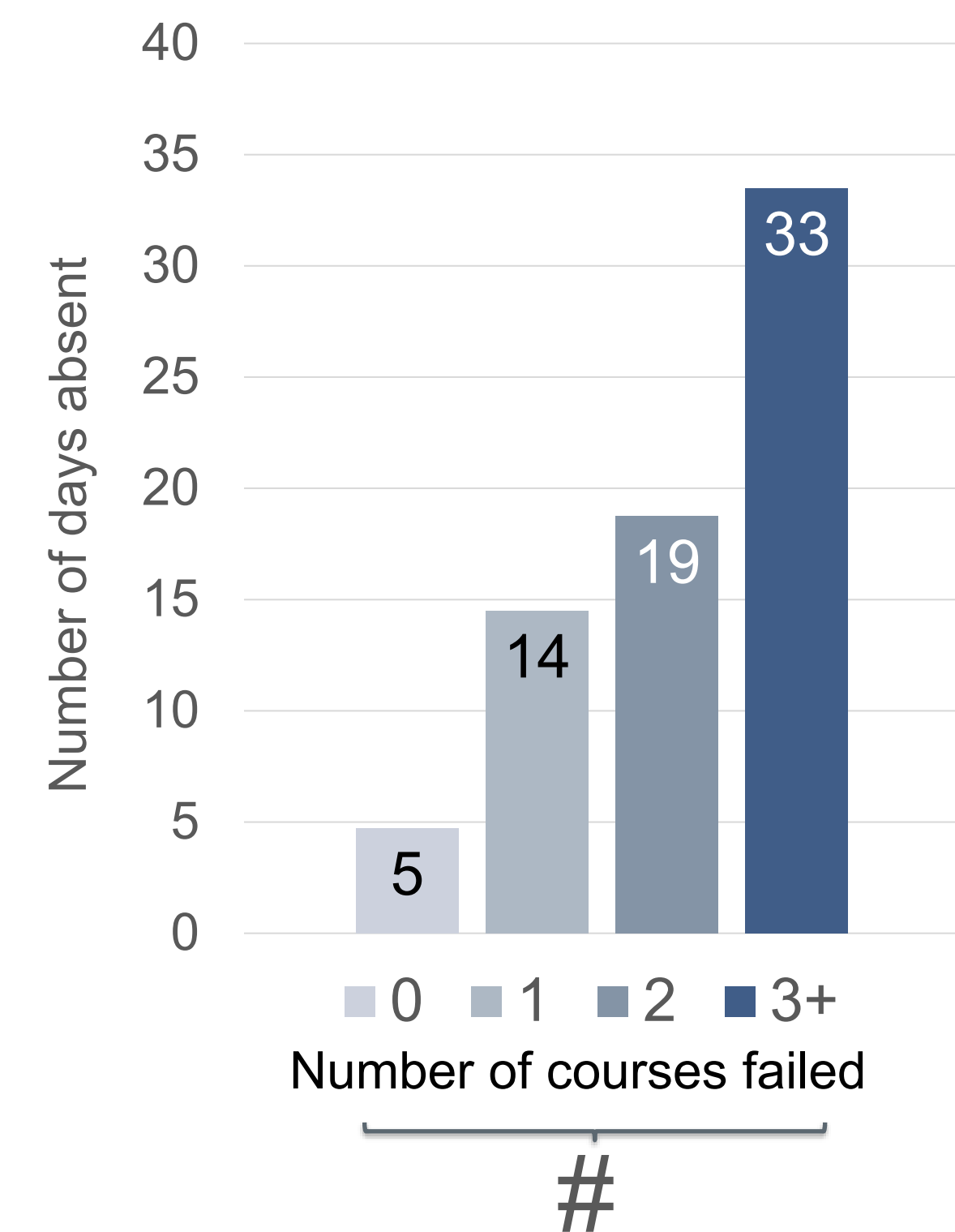
Percentage of students chronically absent first semester, 2019/20 vs. 2020/21



Days missed by chronically absent students in first semester, 2019/20 vs. 2020/21



Average days absent by number of courses failed, first semester of 2020/21



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# Research question 1b:

## *Limitations and implications*

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# 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. NWEA found test scores in remote environments to be reliable in grades 3–8 but should be used with caution in earlier grades (Kuhfeld, Lewis, et al., 2020).
- 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.

# Implications of test score and grade results

- Although elementary school students had the largest declines in test scores, the **substantial increase in course failures in middle and high school suggests older students also struggled.**
- Increase in **course failure rates were heavily concentrated among chronically absent students**, suggesting there's an identifiable group of students that disengaged from school and could use **additional support** reengaging and catching up.
- **Size of the declines in test scores suggests they can be addressed**, but only with additional, evidence-based programs to address the gap. “Business as usual” will not be enough.
- Fall 2021 assessments will be important for determining size of lags for students who missed assessments last year.



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# Research question 2:

*How much and in what ways do students access and use online learning applications while learning remotely?*

Background, data, and research design

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# How are students using online learning applications during remote learning in 2020/21?

- Switch to remote learning raises questions about how students are using online applications while learning remotely and how usage varies across students.
- Prior research has shown:
  - Students who engage with their online courses for more than 2 hours per week have better course outcomes (Pazzaglia, et al., 2016).
  - Students who engage more with learning management systems, as measured by logins, time spent logged in, the number of modules accessed, and posts to discussion boards, have higher final grades (Liu & Cavanaugh, 2011).
- This study describes student usage of a learning management system, a single sign-on system, and three supplementary online learning programs (focused on math and reading) in PPS.
  - Also examines relationship between online learning system use and course grades and absenteeism.

# Data

- Used usage data for products from 4 vendors for the 2020/21 school year.
- Examined period before the return to in-person schooling April 5, 2021 (Goldstein, 2021).

<b>Schoology</b>	<ul style="list-style-type: none"><li>• Learning management system used by all students in all grades.</li><li>• Daily records of who logs in and what actions they take, including opening course materials, submitting assignments, submitting assessments, and posting to discussion boards.</li><li>• We linked Schoology actions with PPS course data to describe these activities for math, English, social studies, and science courses.</li></ul>
<b>Clever</b>	<ul style="list-style-type: none"><li>• Single sign-on service.</li><li>• Has daily information on who logs into Clever, the number of resources accessed, and the name of resources accessed (including Schoology, Teams, Edmentum, and other math or reading products).</li><li>• All students in all grades encouraged to use it, but students can log in to resources without going through Clever.</li></ul>

# Data

<b>Edmentum (Exact Path)</b>	<ul style="list-style-type: none"><li>• Supplemental math and reading program intended to be used 45 minutes/week by all students in all grades (Tier 1)</li><li>• Students take diagnostic assessment and get personalized learning path</li><li>• Mastery-based: Focuses on helping students master skills</li></ul>
<b>Edmentum (Study Island)</b>	<ul style="list-style-type: none"><li>• Supplemental math and reading program targeted at students based on needs (Tier 2 intervention)</li><li>• Primarily focused on practice to improve assessment scores</li><li>• Aligned with standards assessed on state tests</li></ul>
<b>iLit</b>	<ul style="list-style-type: none"><li>• Reading intervention targeted at students in grades 3-12 with lower reading scores (Tier 2)</li><li>• Focus on iLit20, a flexible model intended to be “used 15-20 minutes per day, two to five times per week, to supplement a core ELA curriculum”<sup>1</sup> since other versions of iLit used much less frequently</li></ul>



# Sample and research design

- Calculated means (or medians) for usage measures for all students in the district, except for iLit, which uses grades 3–12 as the sample of interest (because it is not used in earlier grades).
- Some measures calculated only for students who used the product. These cases indicated clearly with phrasing such as “among users” or “among students who complete at least one math task.”
- Report usage by the following categories:

## **Type of school day:**

- Full day - synchronous
- Full day - asynchronous
- Half day synchronous/half day asynchronous
- Half day – synchronous

## **Student characteristics:**

- Gender
- Race/ethnicity
- Economically disadvantaged
- IEP
- Chronically absent in 2019/20 (defined as missing more than 10% of instructional days)
- 2019/20 fall math and reading score quartiles (nationally)



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# Research question 2:

## *Findings*

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# Preview of findings on use of online systems during remote learning (in 2020/21)

1. Modest **declines in use over** the course of the **school year**, as indicated by logins and course material submission.
2. Use of learning management system **lower on asynchronous instructional days and half days**.
3. **Disparities** in use:
  - Early elementary students and 12<sup>th</sup> graders used Schoology less than other grades.
  - Students who are Black, economically disadvantaged, have an IEP, were chronically absent, or have lower test scores logged in fewer days and opened fewer course materials).
4. Schools account for a small part of the variance in submitting course materials via the learning management system. **Most of variance split between teachers in the same school and students with the same teacher**.
5. Students who were **chronically absent or failing more courses logged in on fewer instructional days and opened and submitted fewer course materials** on average per week.
6. **Supplemental products** were **used less widely or intensively** than initially expected.



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# Findings

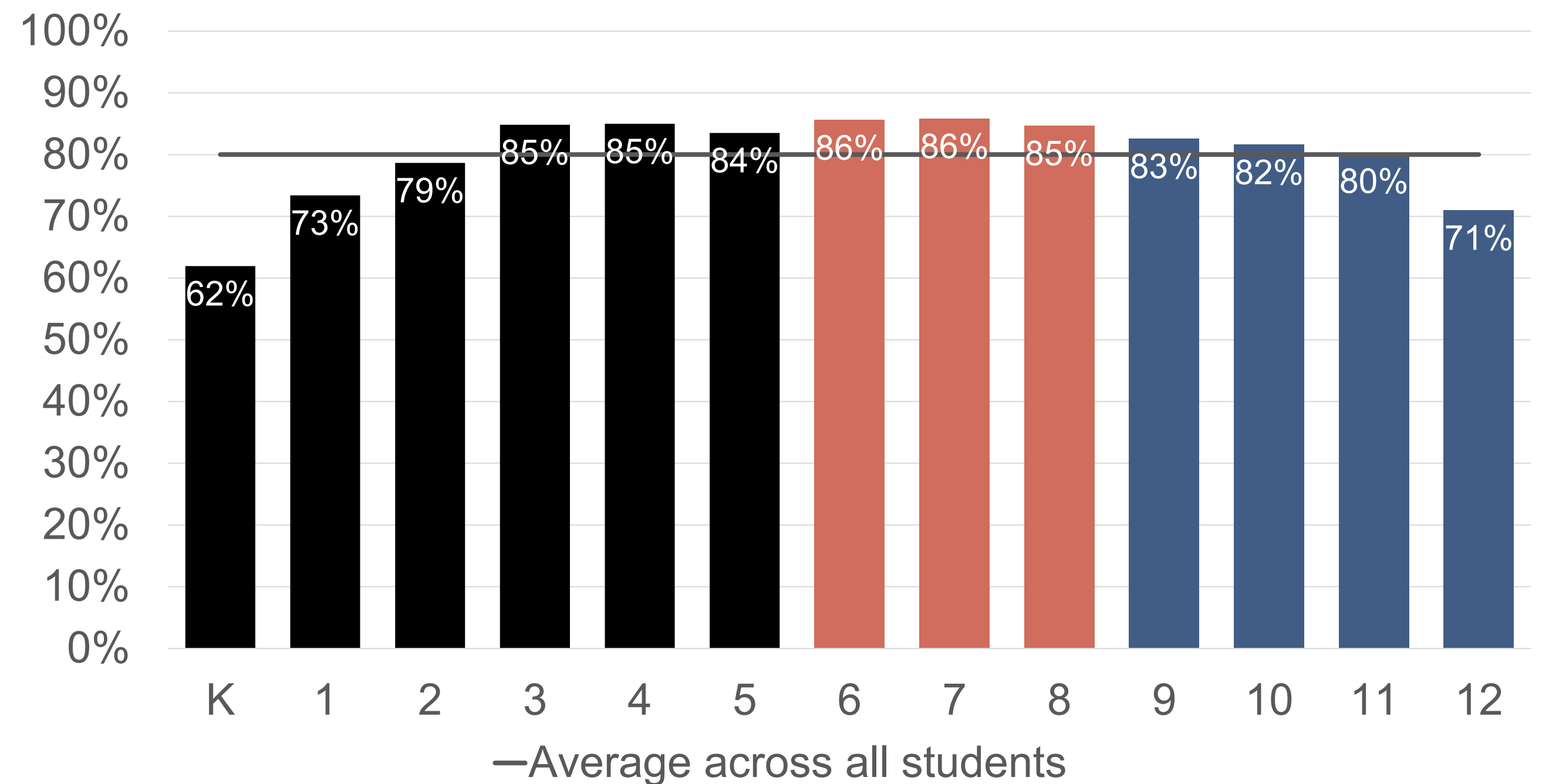
- ➔ **Access and use of learning management system**
- **Opening and submitting course materials in learning management system**
  - **Use of supplemental programs**
- 



# Students logged into Schoology on average for 80% of instructional days

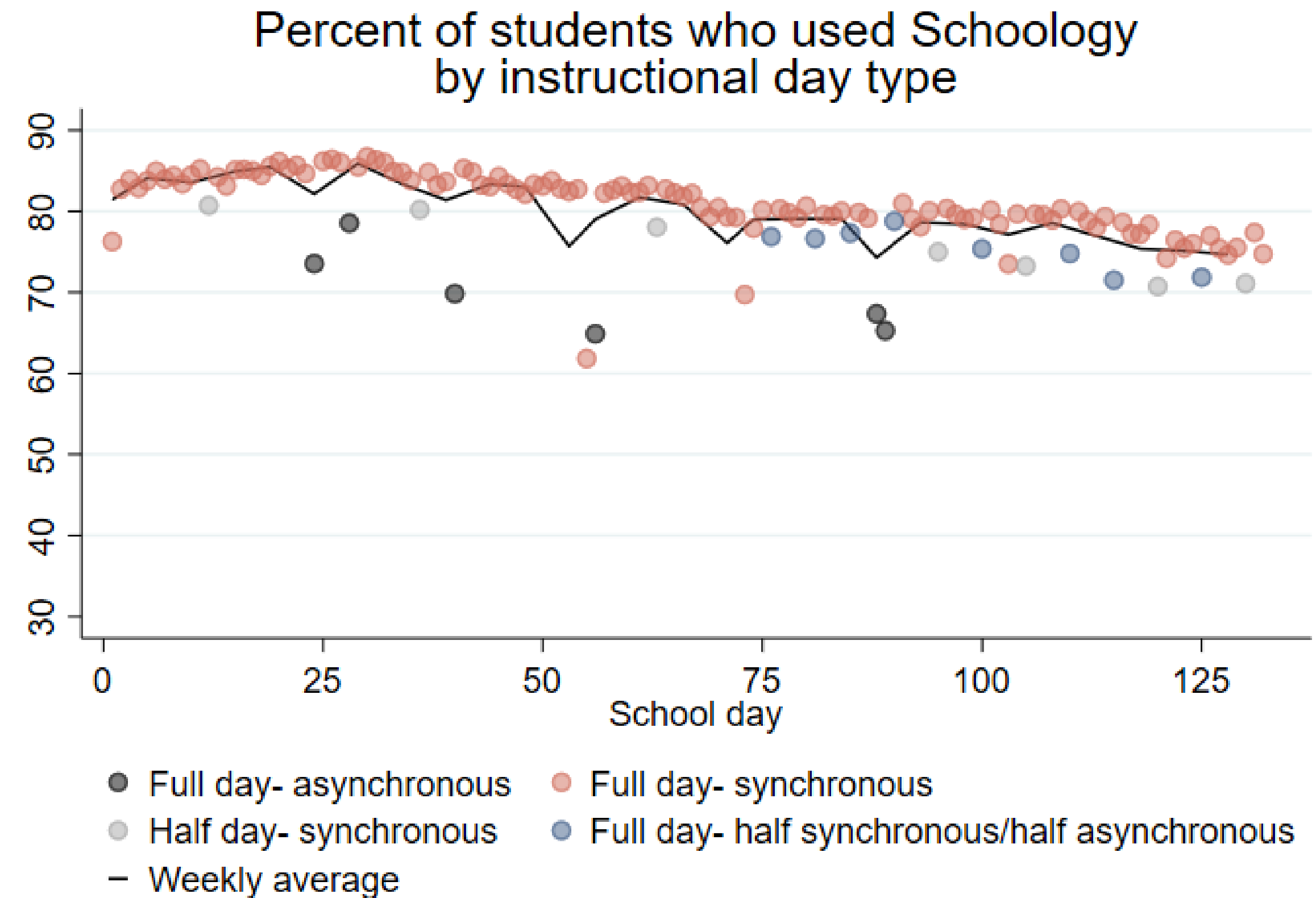
- 98% of students logged into Schoology at least once.
- **Students in kindergarten, grade 1, and grade 12** logged in fewer instructional days than other grades.

Average percentage of instructional days logged into Schoology



# Percentage of students using Schoology on a given day declined through the year

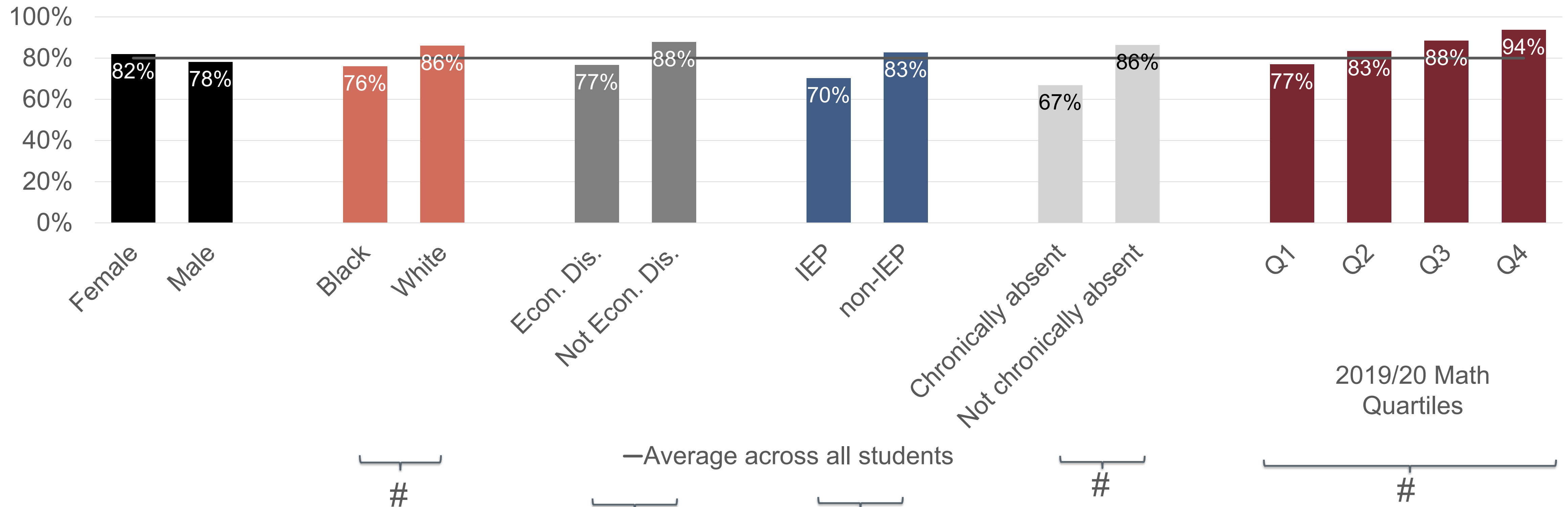
- Fewer students logged in on days with fully asynchronous instruction compared to other instructional days.
- Students were slightly less likely to log in on days in which half the day was synchronous instruction.





# Students who are Black, economically disadvantaged, have an IEP, were chronically absent (2019/20), or have lower test scores logged into Schoology on fewer instructional days

Average percent of instructional days logged into Schoology



Note: # indicates difference between groups exceeds 5 percentage points. Chronically absent is having missed more than 10% of instructional days.

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# Findings

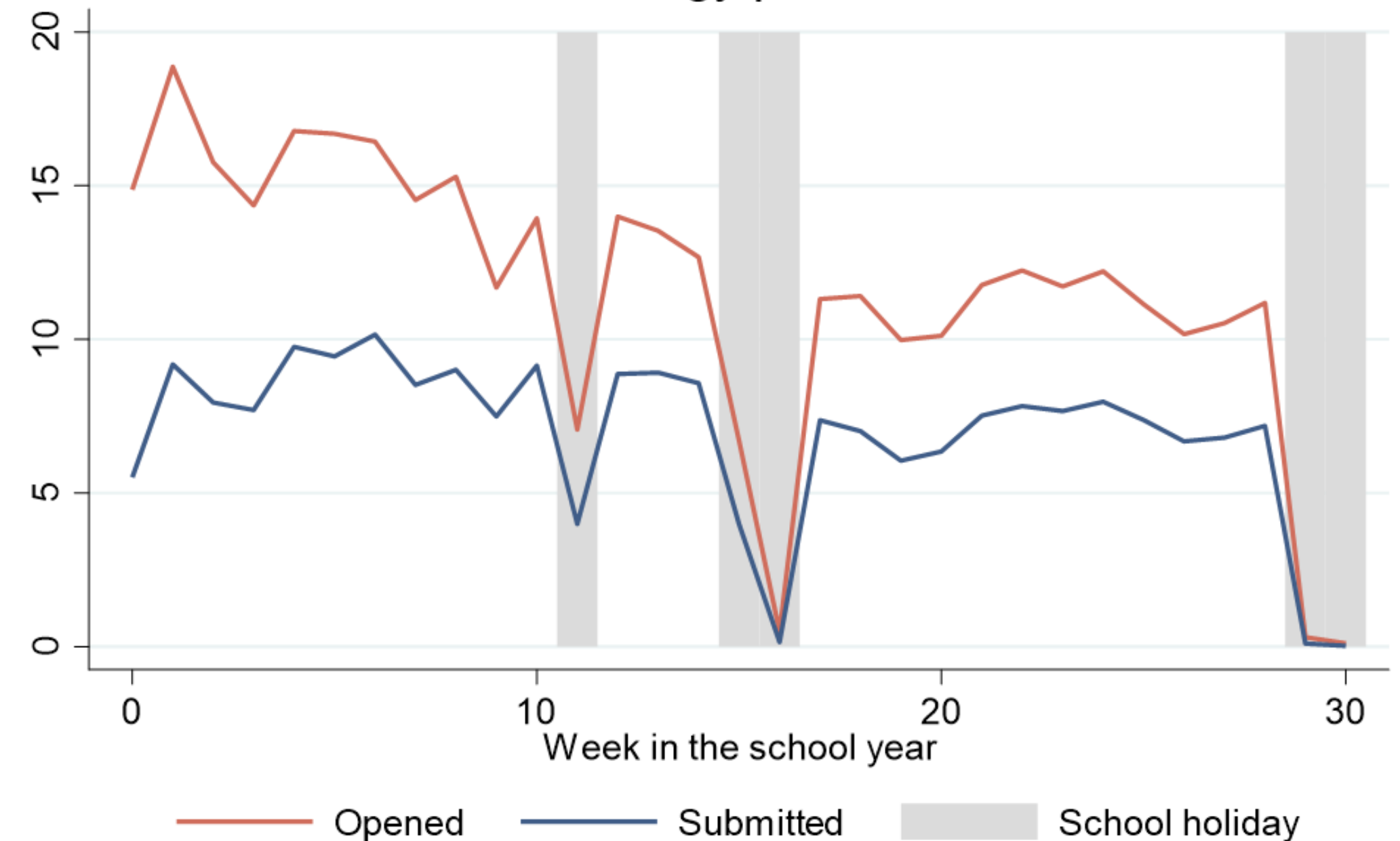
- Access and use of learning management system
  - ➔ Opening and submitting course materials in learning management system
  - Use of supplemental programs
- 



# On average, students opened 11.5 course materials (such as readings, videos, or worksheets) each week and submitted 6.9 items

- **97%** of students opened at least one course material in Schoology.
- **93%** of students submitted at least one assignment, assessment, or discussion post during the school year.
- **Average number of course materials opened and submitted declined** over the school year.
- Decline observed in all grades, by whether a student is Black or White, and by economic disadvantage status.
- Large swings in volume of activity are around school vacations.

Average number of course materials interacted weekly in Schoology per student

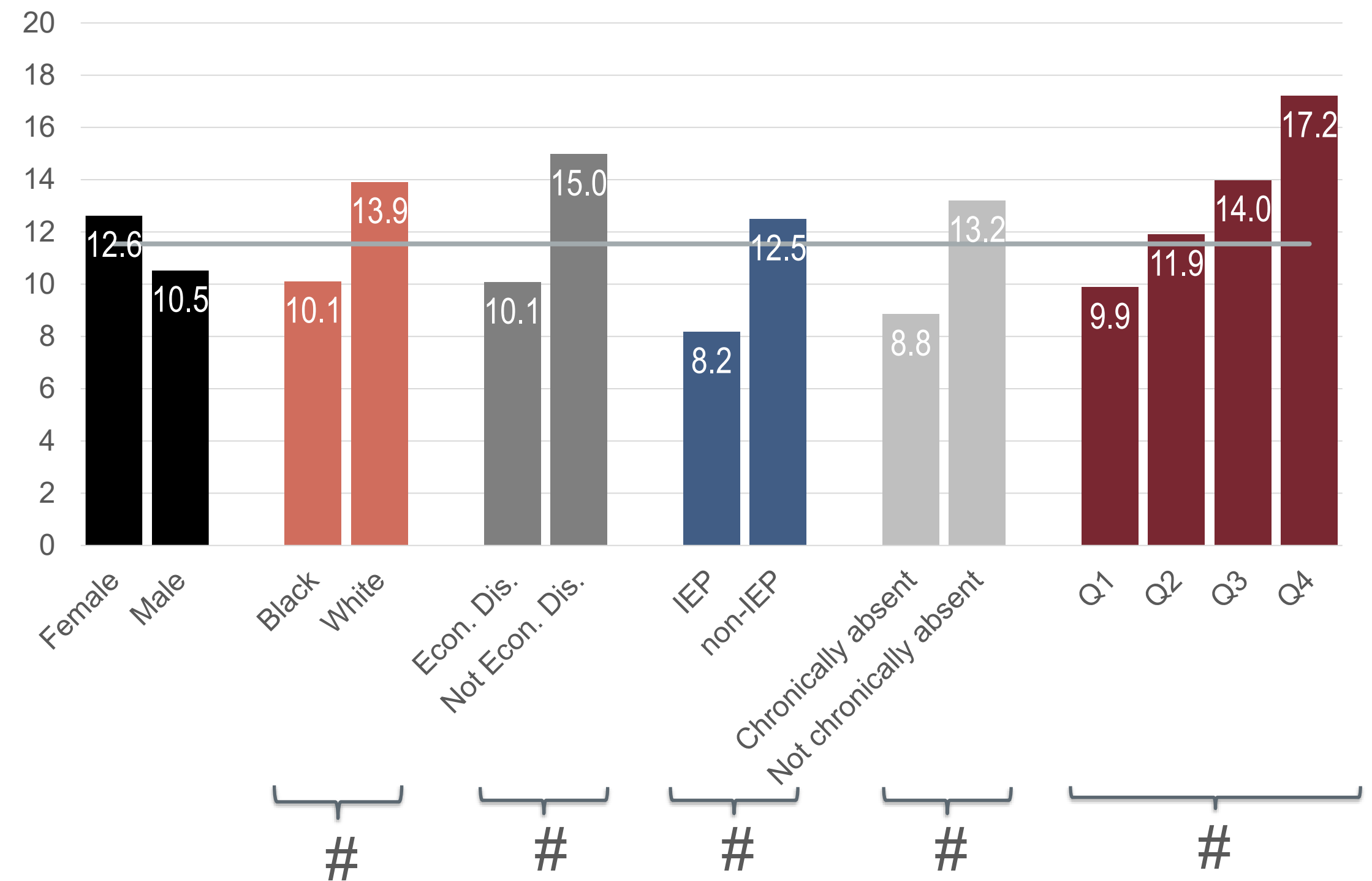


Note: “Opened” counts documents, links, and other course material that a student would not hand in for credit, while “submitted” counts assignments, assessments, and discussions.

# Students who are Black, economically disadvantaged, have an IEP, are chronically absent in 2019/20, or have lower test scores opened and submitted fewer course materials

- Similar patterns exist in the average number of course materials submitted each week (see appendix).

Average number of course materials opened each week

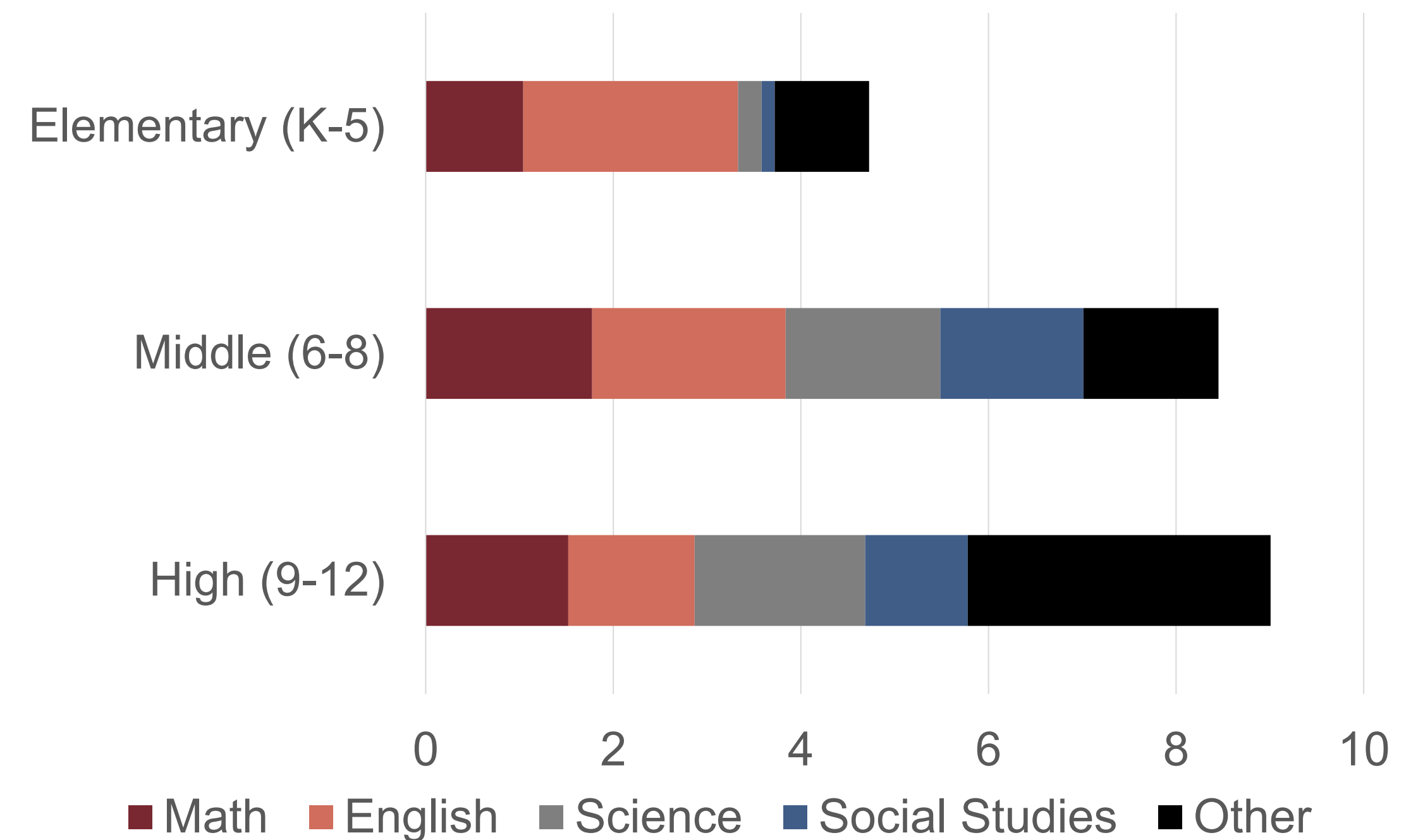


Note: # denotes a difference of at least three course materials per week. Chronically absent is having missed more than 10% of instructional days.

# Students in grades K–5 submitted fewer materials overall. High school students submitted materials in a broader range of subjects than middle schoolers

- Elementary school students submitted the most course material for English classes, which includes handwriting, spelling, and reading.
- High school students submitted slightly more work overall and submitted work in a broader range of subjects than middle schoolers.

Average number of course materials submitted each week by subject



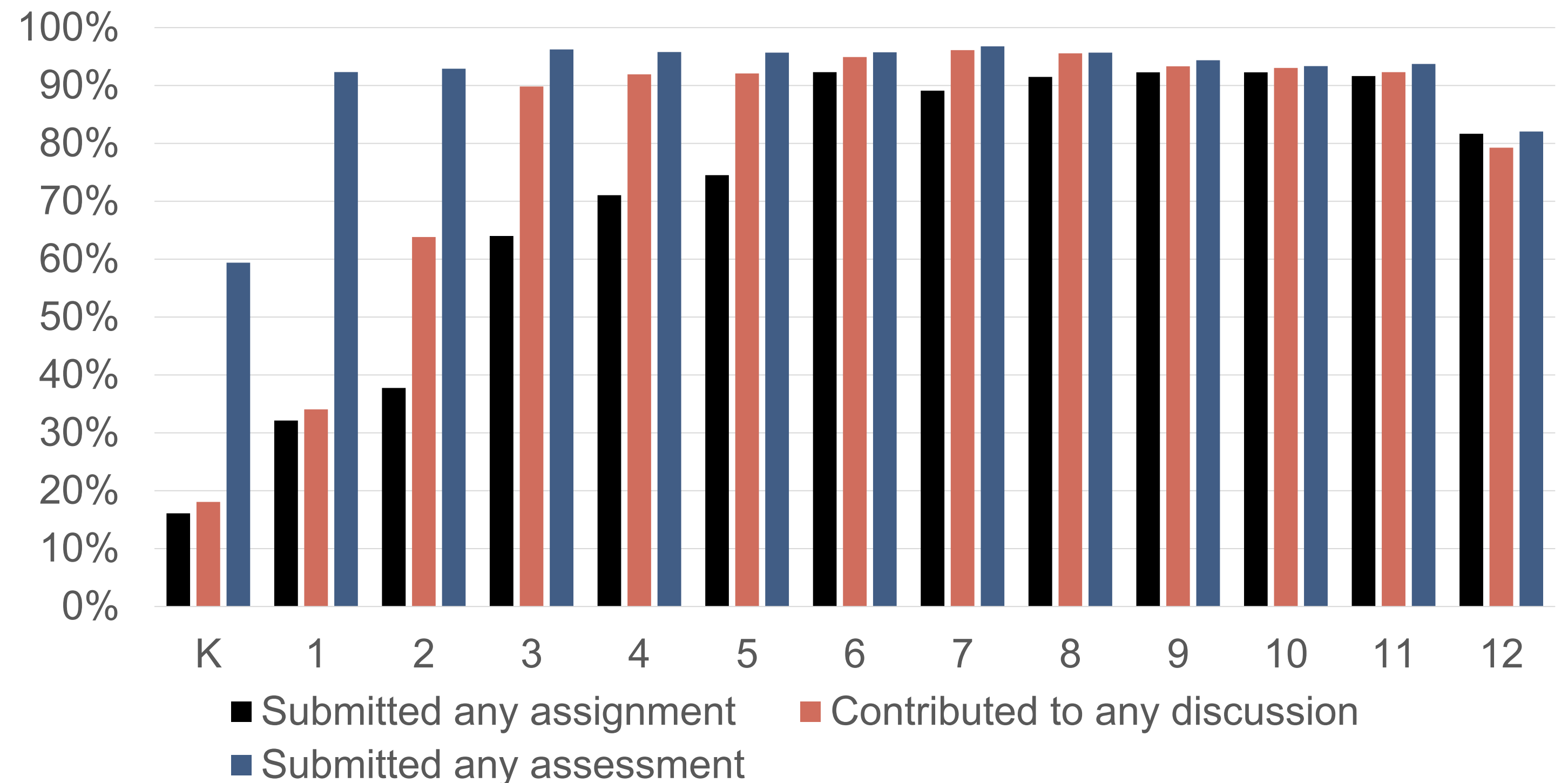
Note: The English category in elementary grades includes handwriting, reading, and spelling courses in addition to English language arts .



# A larger share of students submitted assessments than discussion posts or assignments in elementary grades

- **94% of students submitted assessments** via Schoology in all grades but kindergarten (59%) and 12<sup>th</sup> grade (82%).
- **Percentage of students submitting assignments or contributing to discussions is low in kindergarten but rises through elementary school.**
- **90% of middle and high schoolers** submitted at least one **assignment**, except for 12<sup>th</sup> graders (82%).
- From 3<sup>rd</sup> to 11<sup>th</sup> grade, about **93%** of students **contributed to at least one discussion**.

Percentage of students who submitted course material by type

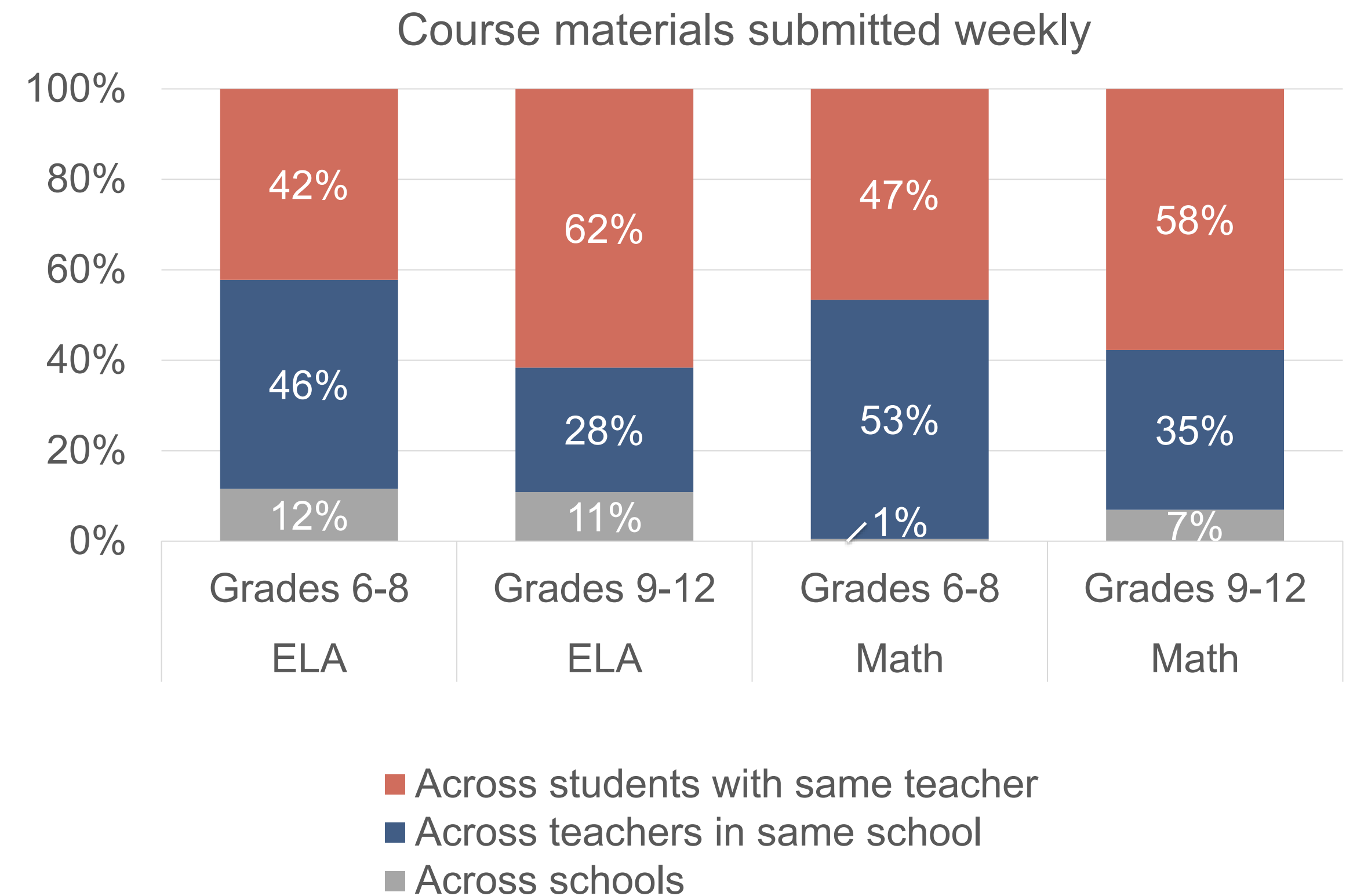


Note: “Contributed to any discussion” counts the number of unique discussion boards to which a student submitted any response.

# Most variation in course materials submitted in ELA or math courses is between teachers in the same school or among students with the same teacher

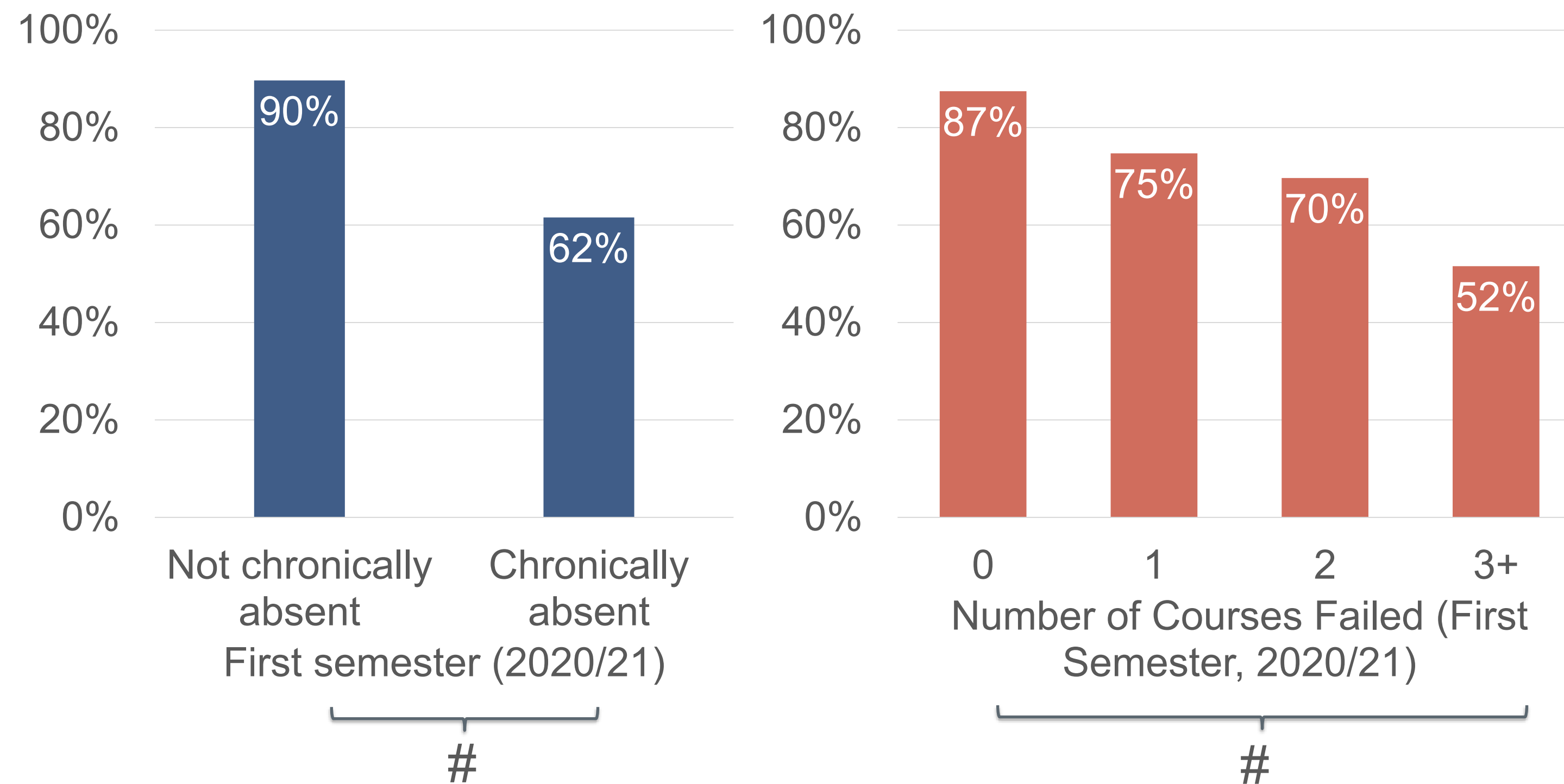
- In ELA and math courses in grades 6–8 and grades 9–12, we decomposed variation in the average number of materials submitted each week by school, teacher, and student.
- Variance across teachers in same school and among students with the same teacher are both important contributors to the total variance.
- Not all variation is determined by students: teachers also matter.

Percentage of variance across schools, across teachers within same school, or across students with same teacher (grades 6-12, ELA and Math)



# Students who were chronically absent or failed 3 or more courses logged in for far fewer instructional days than those who were not chronically absent or failing a course

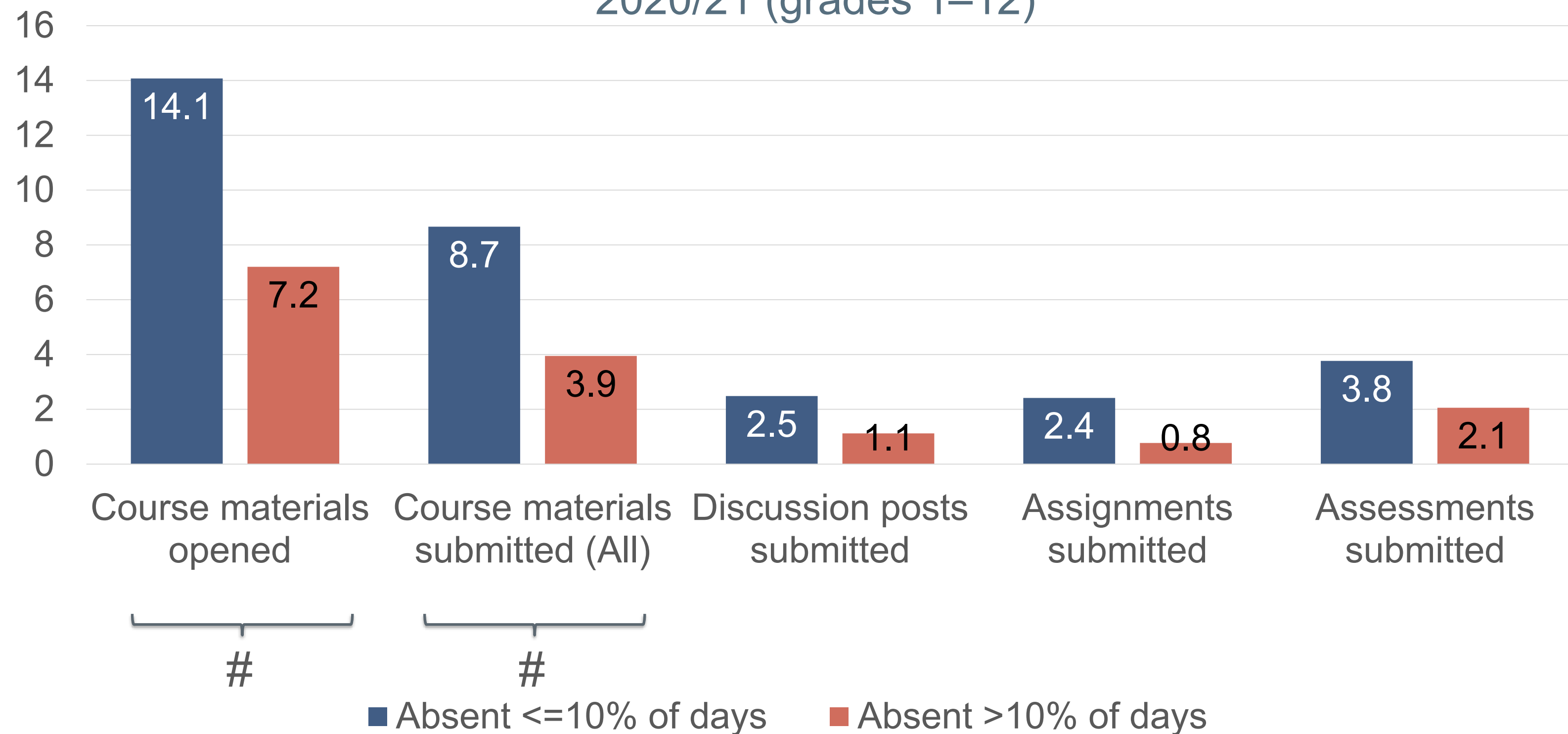
Percentage of instructional days logged into Schoology (All year, grades 1–12)



Note: Chronically absent is having missed more than 10% of instructional days. # indicates difference between groups equals or exceeds 5 percentage points.

Students who were chronically absent in the first semester of 2020/21 opened and submitted about half as many course materials through April 2021 as those who were not

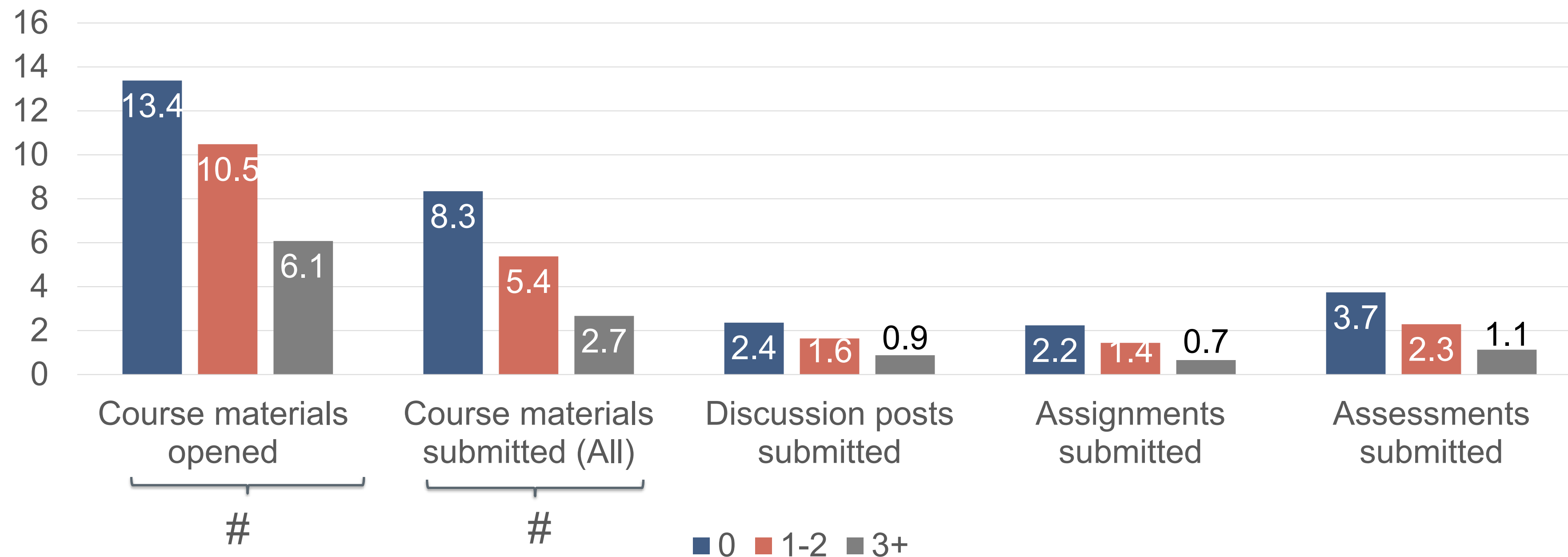
Course materials opened and submitted per week in Schoology, by chronic absence in first semester 2020/21 (grades 1–12)



Note: # denotes a difference of at least three course materials per week

Students who failed 3 or more courses in the first semester of 2020/21 opened and submitted less than half as many course materials through April 2021 as those who did not fail a course

Course materials opened and submitted per week in Schoology, by number of courses failed in first semester 2020/21 (grades 1–12)

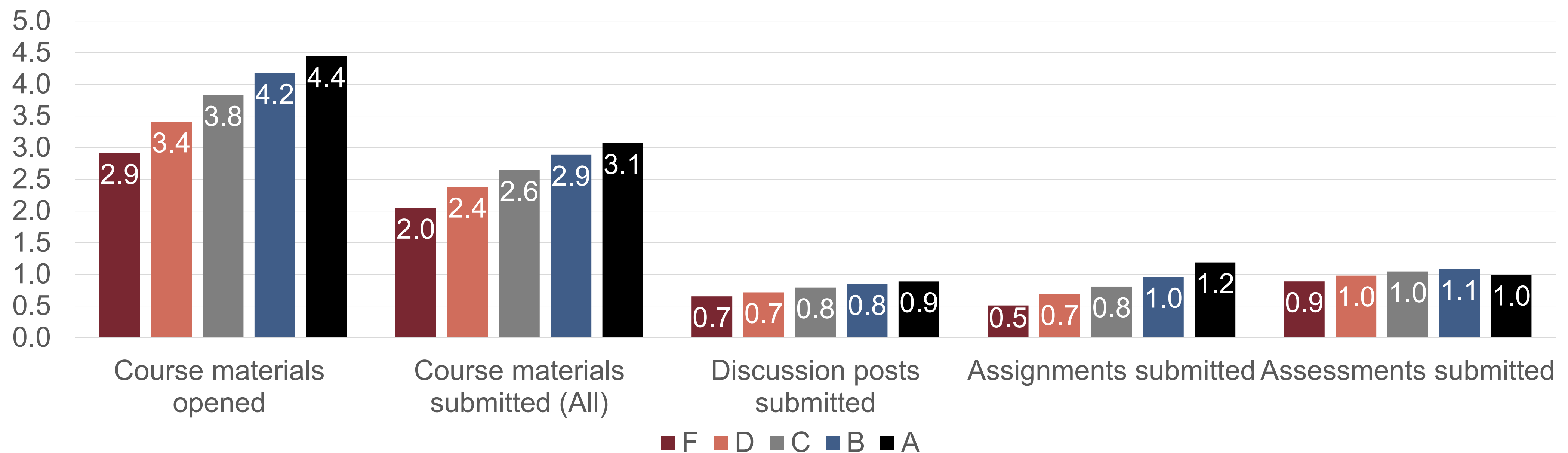


Note: # denotes a difference of at least three course materials per week between students failing 0 courses and 3+ courses.



# In core courses in grades 6–12, students who opened and submitted fewer materials in the course had a lower grade in the course

First semester course grades and materials opened and submitted in Schoology in first semester 2020/21 for core courses (grades 6–12)



Note: Core courses include math, science, social studies, and English.

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# Findings

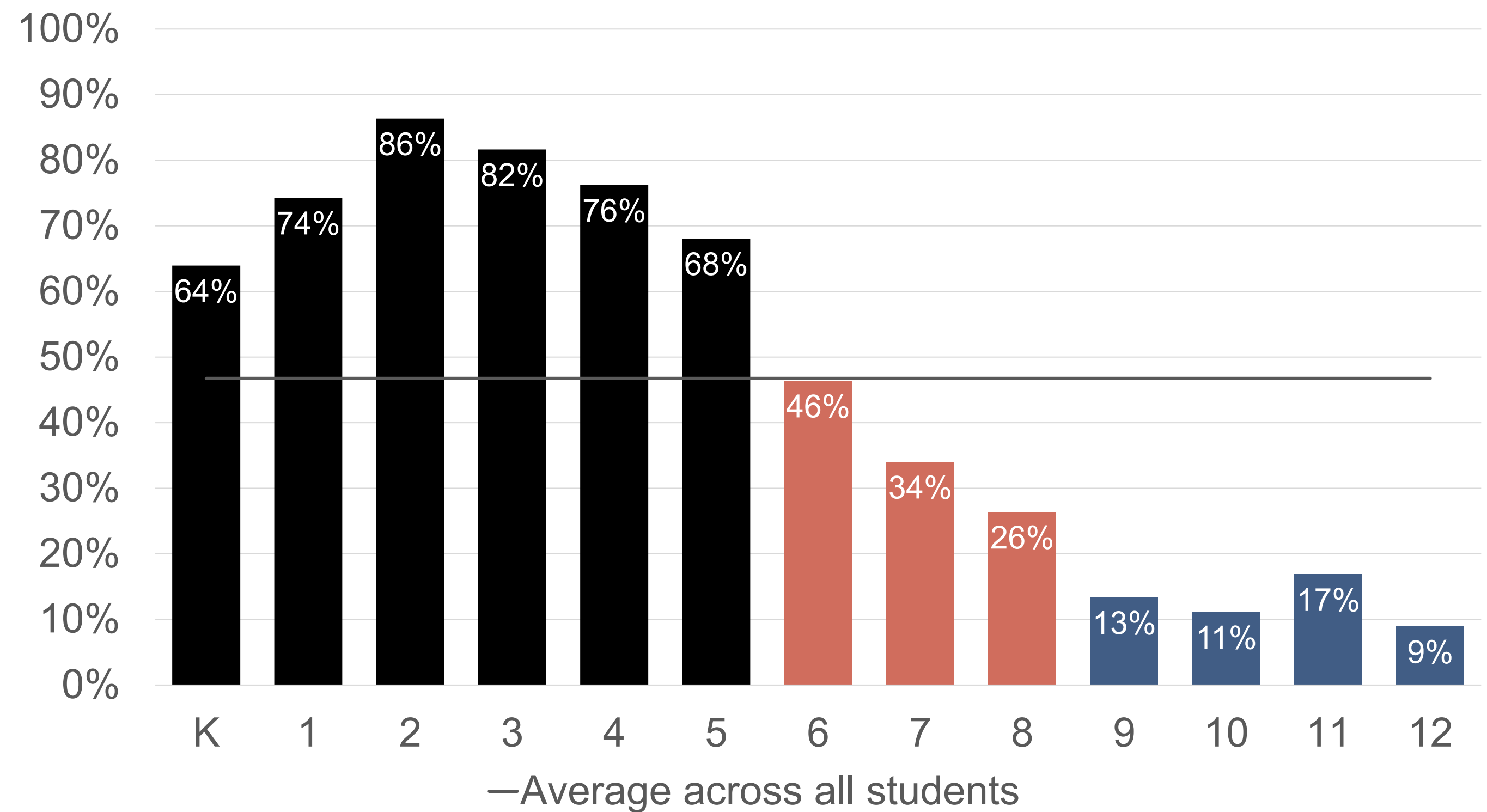
- Access and use of learning management system
- Opening and submitting course materials in learning management system
- Use of supplemental programs
  - ➔ Edmentum Exact Path
    - Edmentum Study Island
    - iLit
    - Other supplemental products



# More students started any activity in Exact Path in elementary grades than in middle or high school

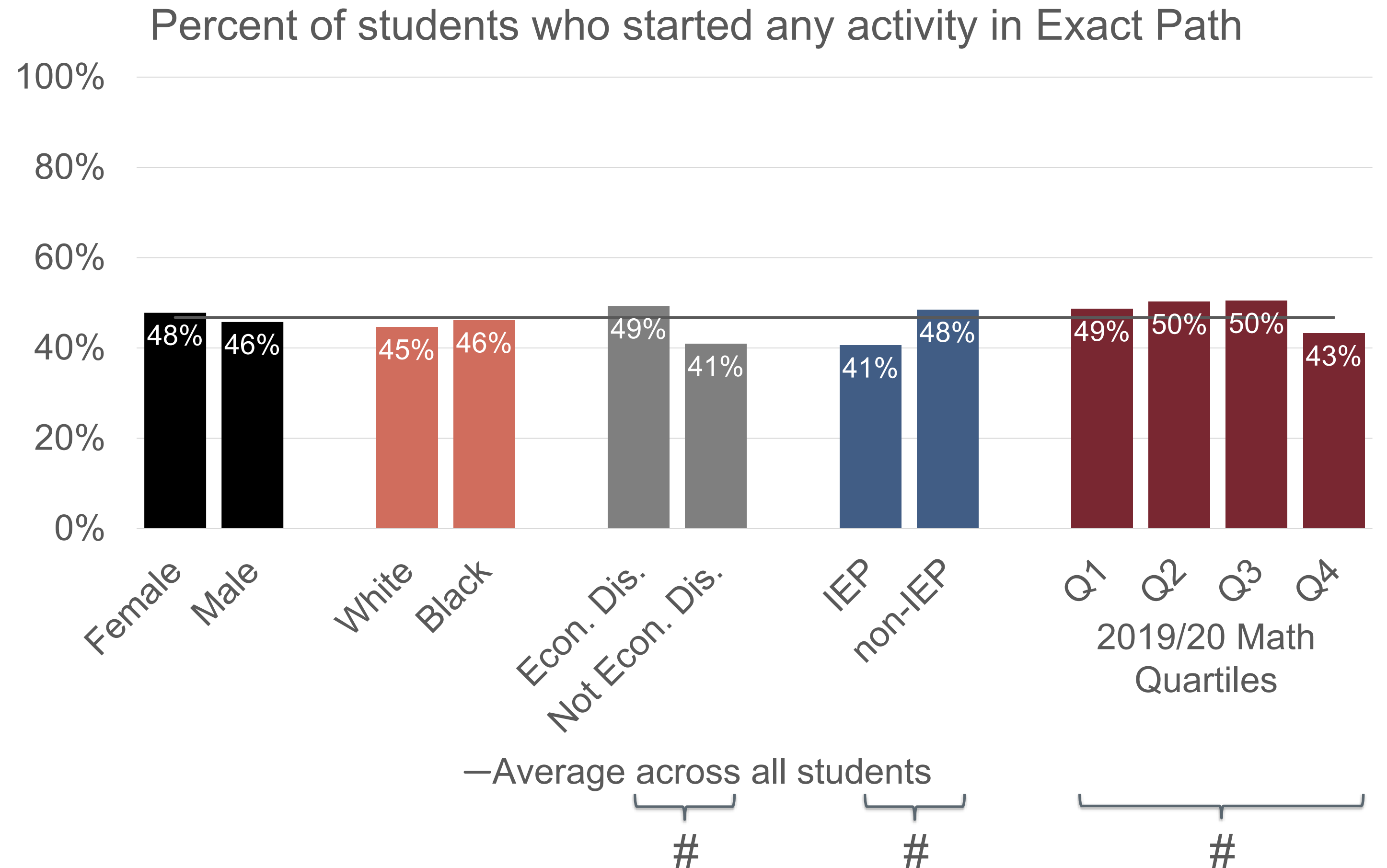
- Districtwide, 63% of students ever logged into Exact Path, but only 47% of students have started any activity in Exact Path.

Percent of students who started any activity in Exact Path



Students who are economically disadvantaged were more likely to start any activity in Exact Path. Students with the highest test scores were less likely to.

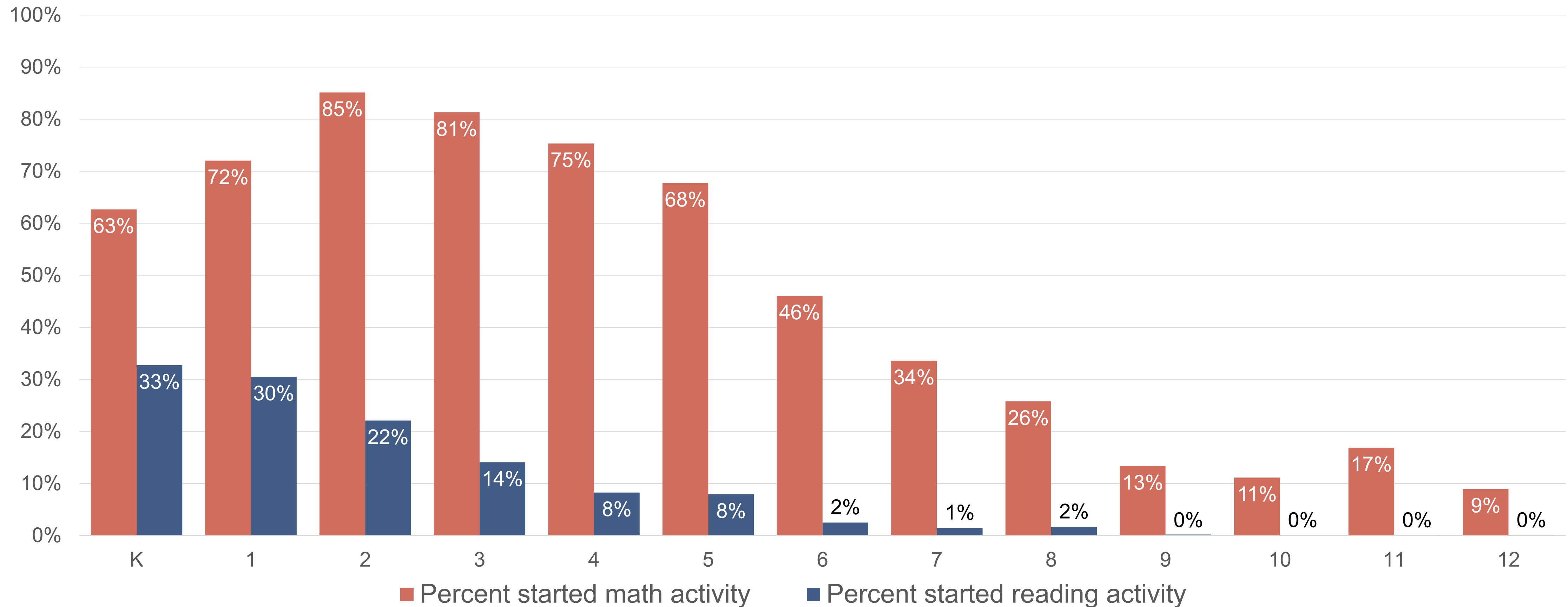
- Gender and racial differences in use of Exact Path were minimal.
- Students who do not have an IEP were also more likely to start any activity.



Note: # indicates difference between groups exceeds 5 percentage points.

# More students used Exact Path for math than reading

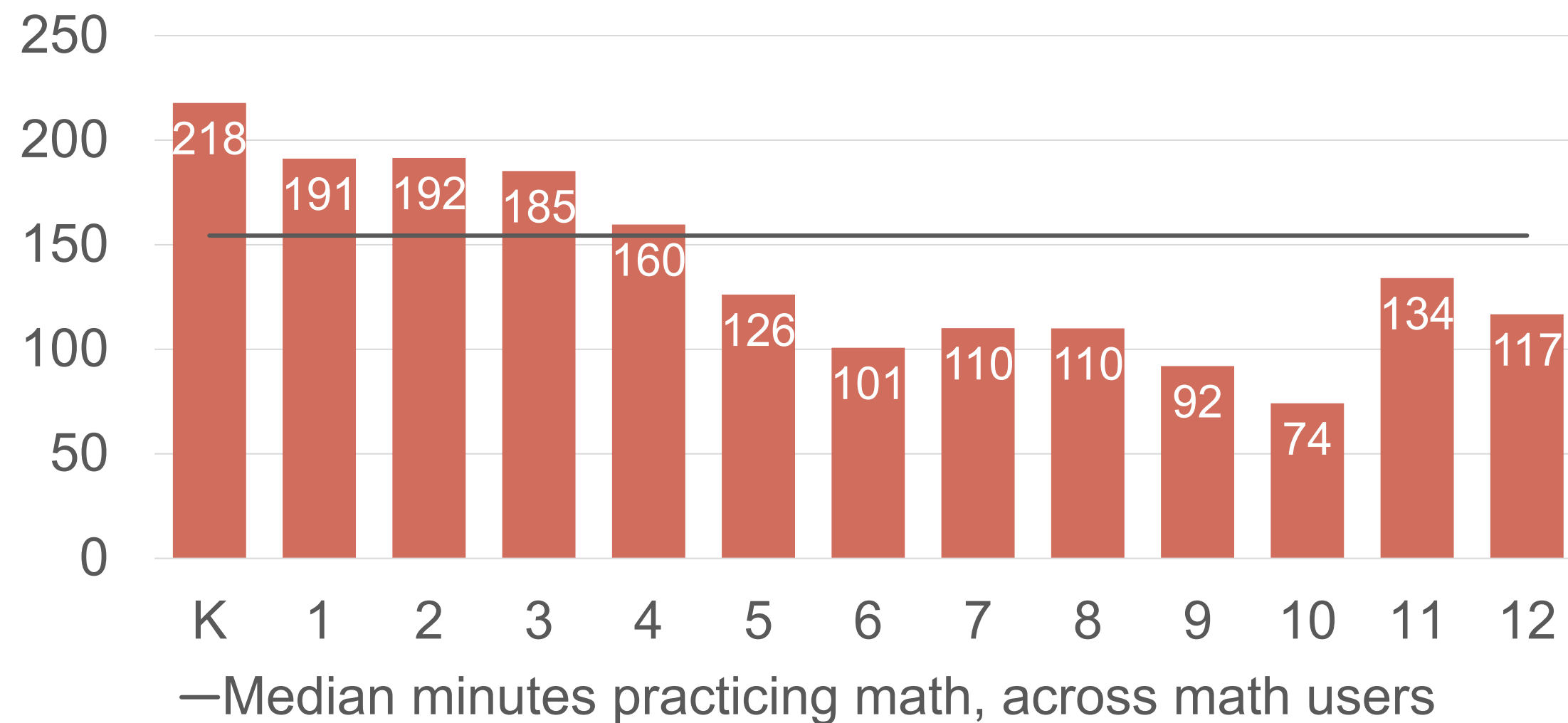
Percent of students who started a math activity and who started a reading activity



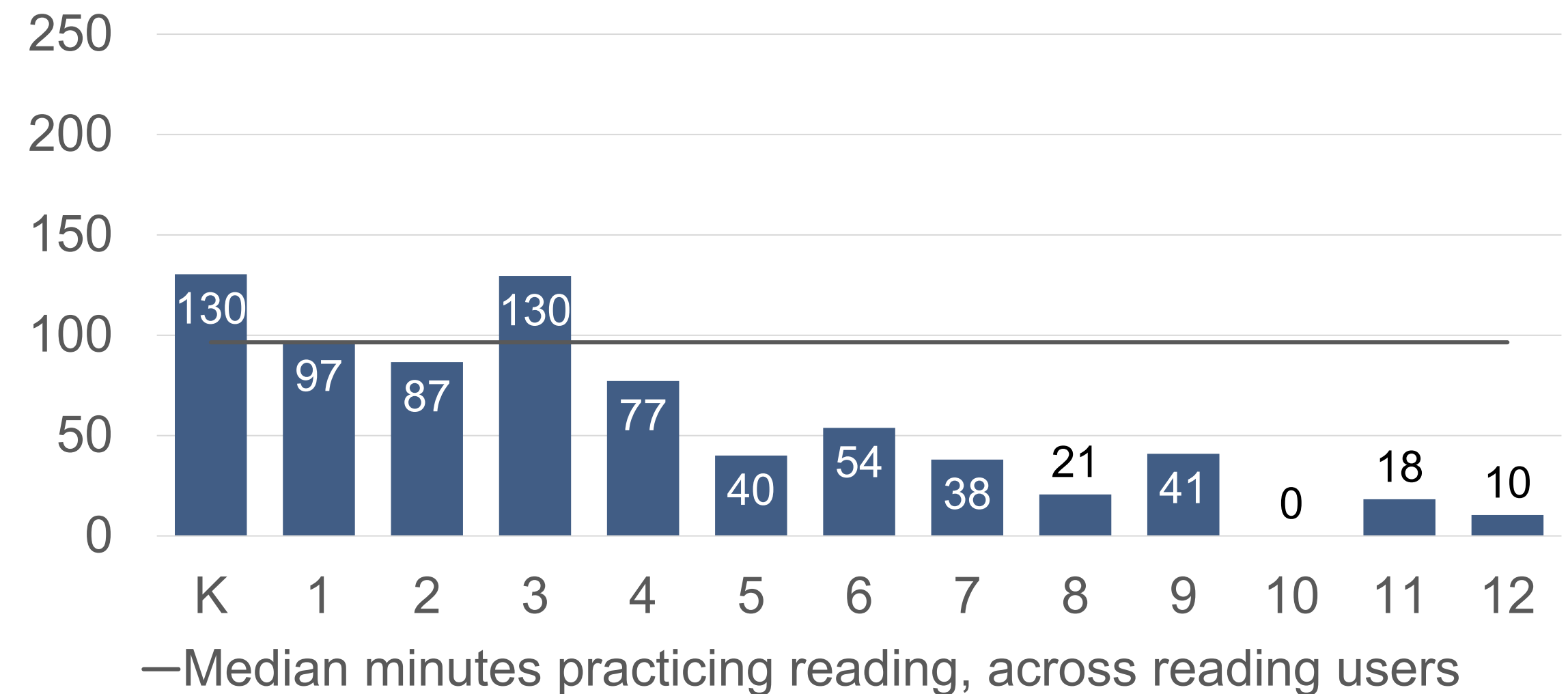


# Exact Path users spent more time using it in elementary grades, but far less time than intended across all grades

Median total minutes spent on math activities among those who practiced math



Median total minutes spent on reading activities among those who practiced reading

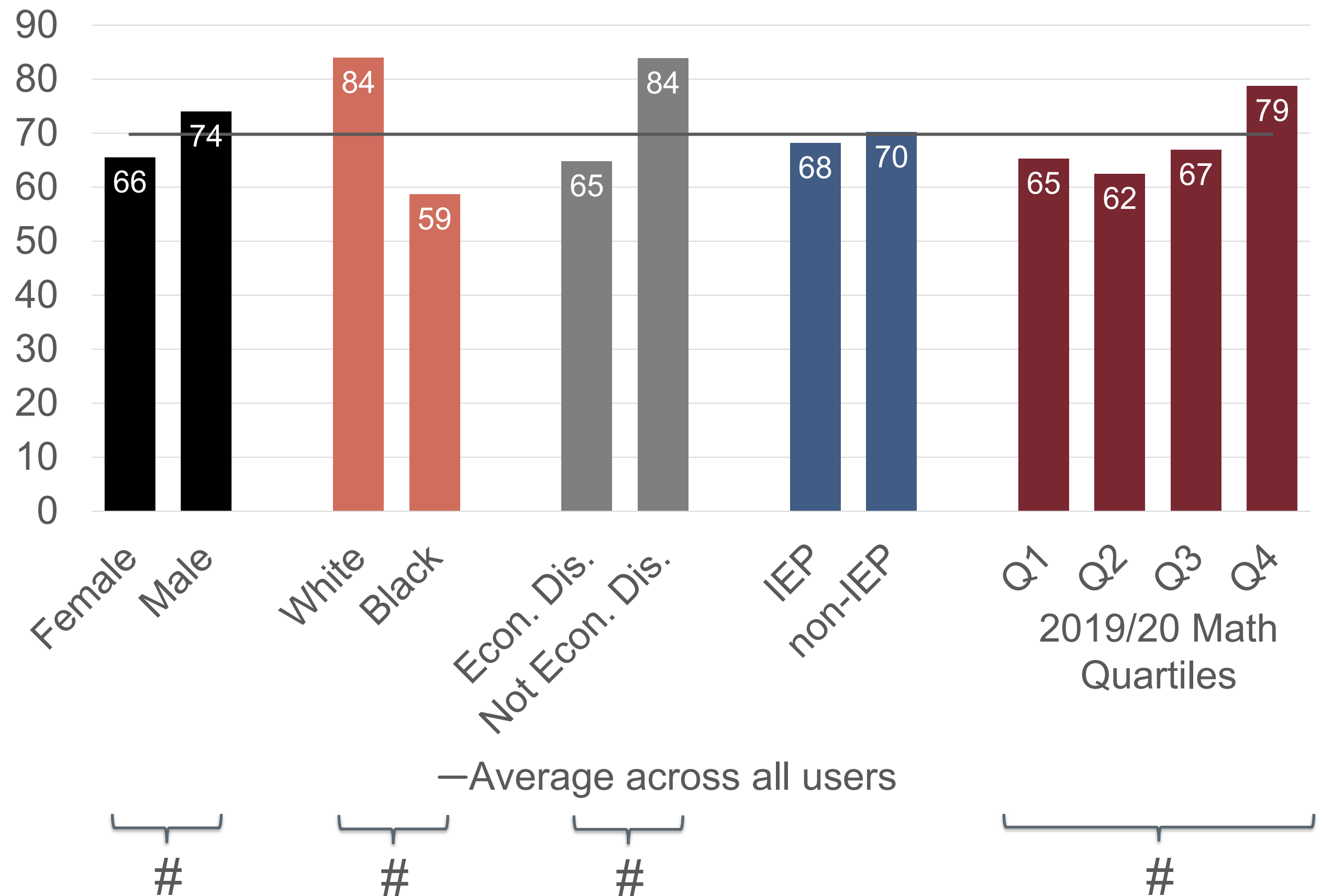


- Exact Path users spent significantly more time on math than reading.
- Students were expected to spend 45 minutes per week.
- The median math user spent 5 minutes per week on math tasks, while the median reading user spent 3 minutes per week on reading tasks.
- The median math user in grades K–5 spent 6 minutes per week, while the median math user in grades 6–12 spent 4 minutes per week.

# Students who are female, Black, or economically disadvantaged who use Exact Path started fewer activities than those who are male, White, and are not economically disadvantaged

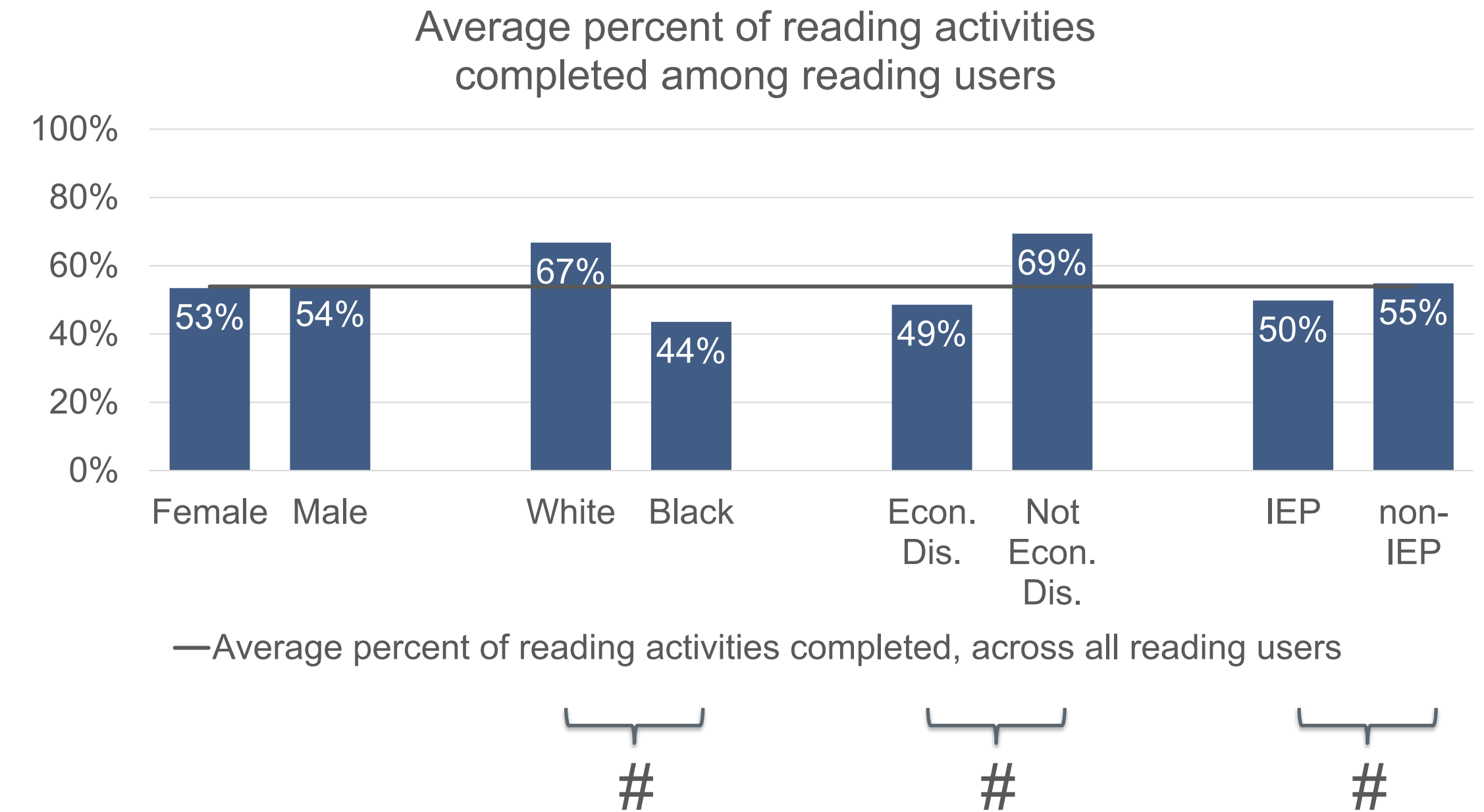
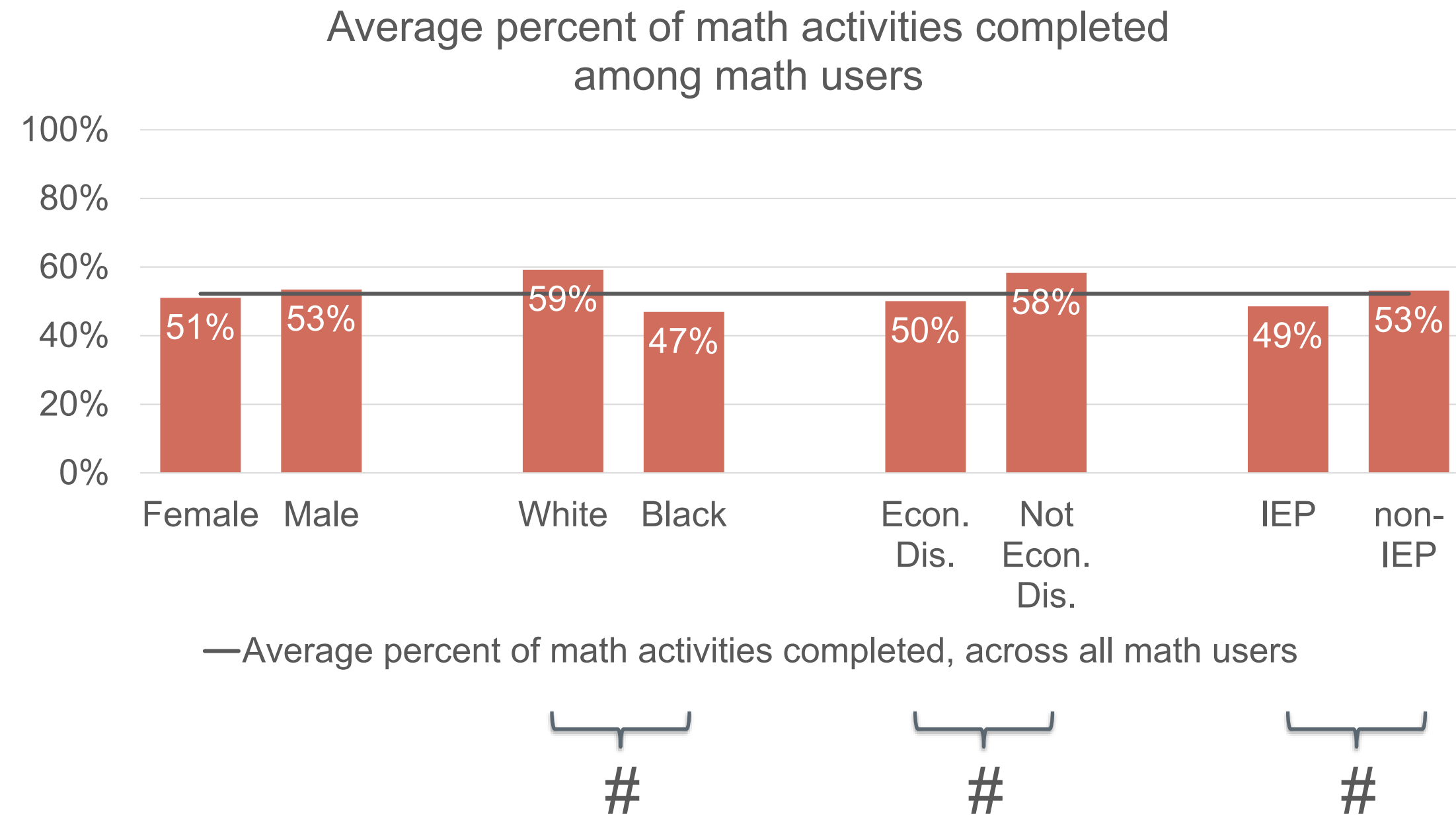
- Differences by IEP status are minimal.
- Students with highest math scores in 2019/20 also start more activities.

Average number of unique activities started among those who started any



Note: Average number of unique activities started covers weeks through 4/19/21, two weeks after resuming in-person learning. (We cannot limit this to only in-person weeks because data in this file are cumulative through 4/19/21.) # denotes a difference of at least five activities.

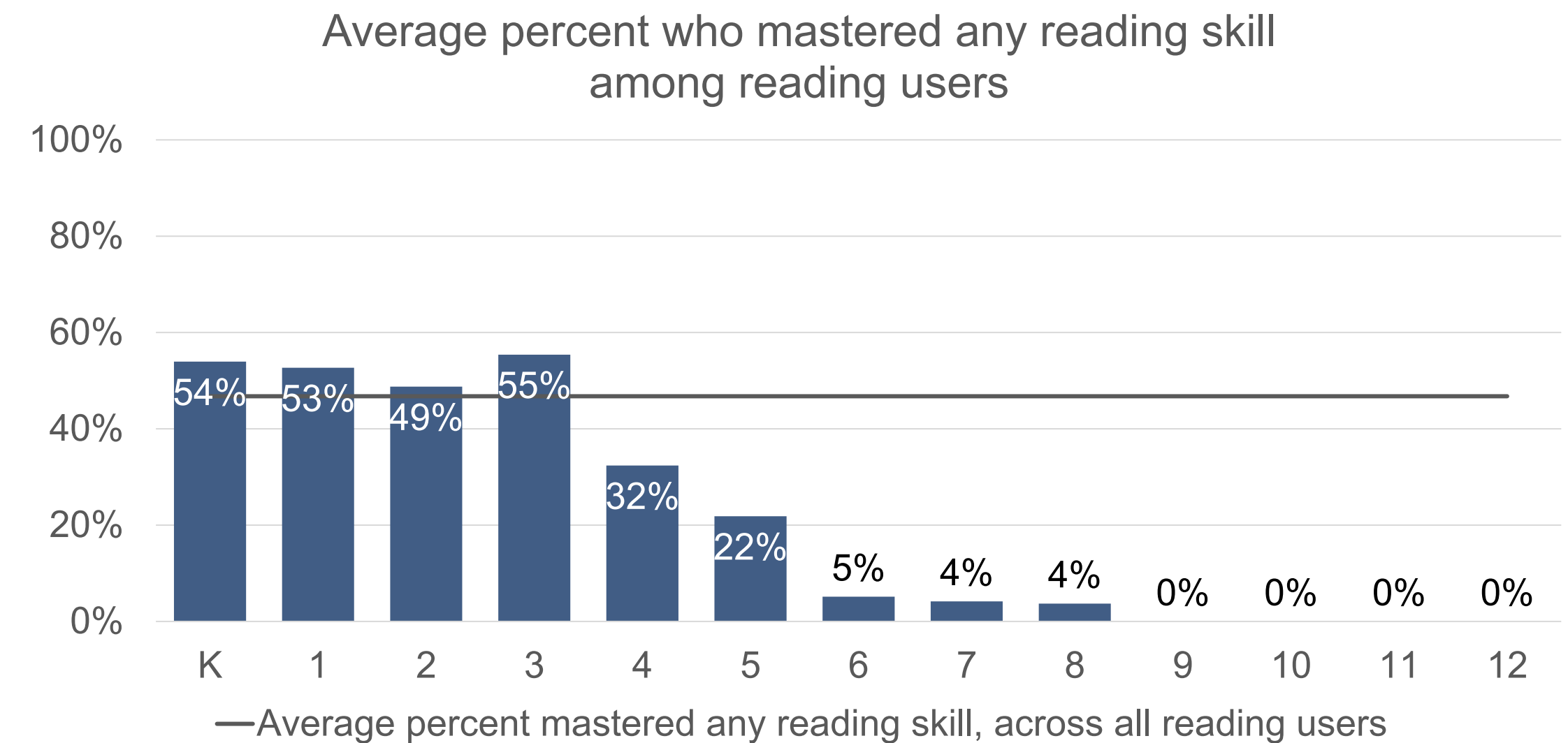
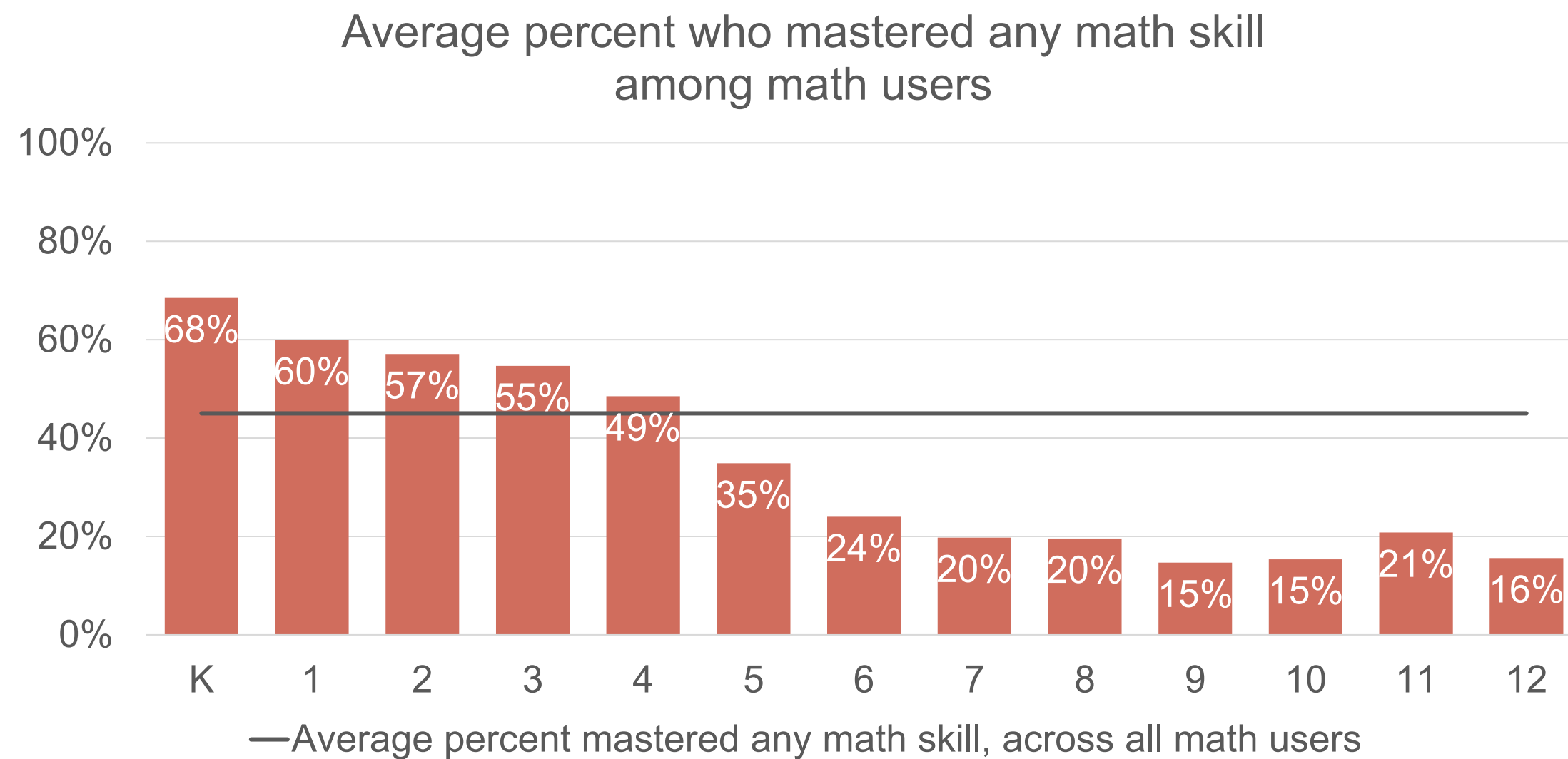
# Several at-risk student groups completed fewer activities than others



- Among students who completed any activity, Black and economically disadvantaged students completed a lower share of activities started.
- This pattern was also consistent for math and reading activities, where we also find differences by IEP status.

Note: Average percent of activities completed covers activity extending to 4/19/21, two weeks after resuming in-person learning. (We cannot limit this to only in-person weeks because data in this file are cumulative through 4/19/21.) # denotes a difference of at least 5 percentage points.

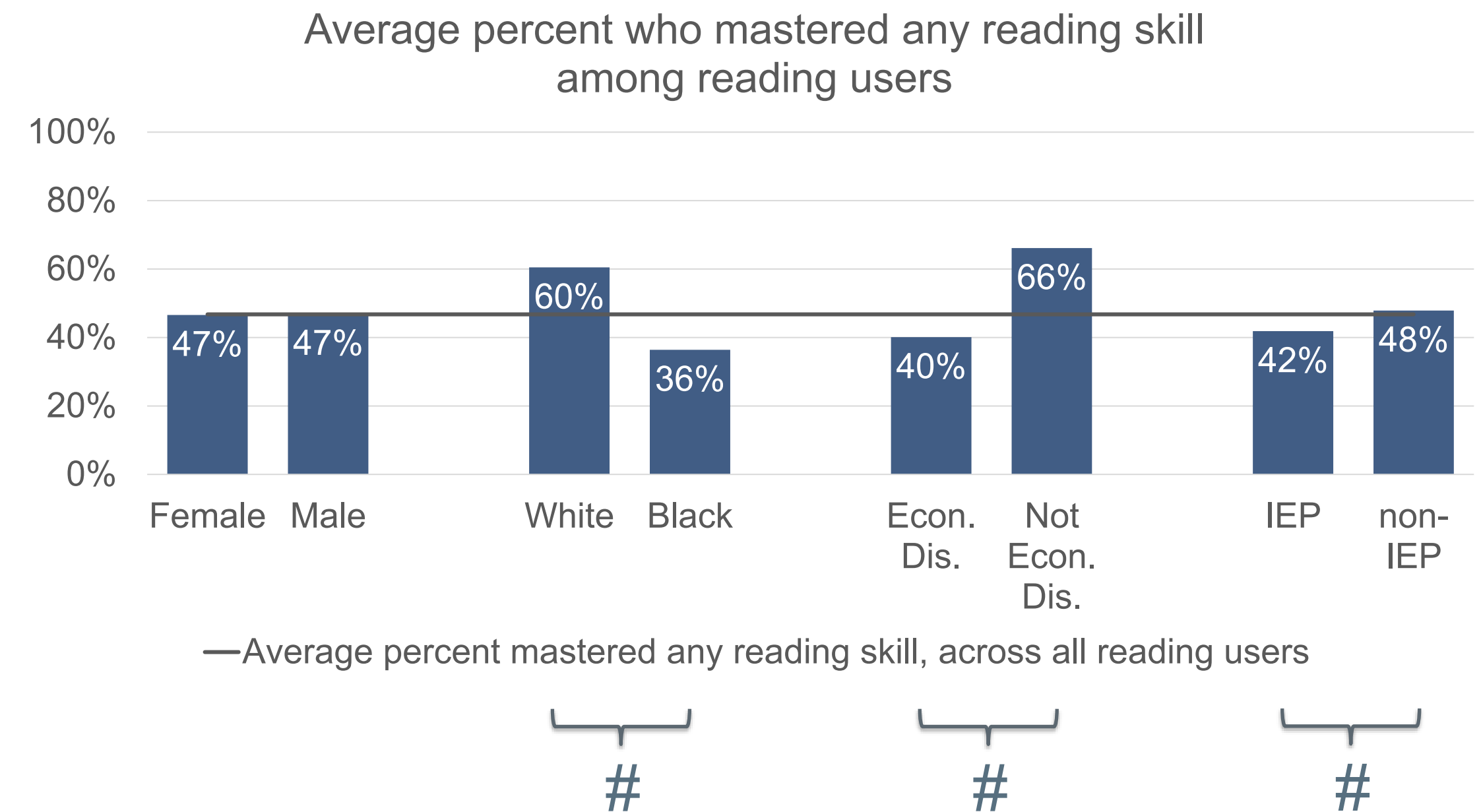
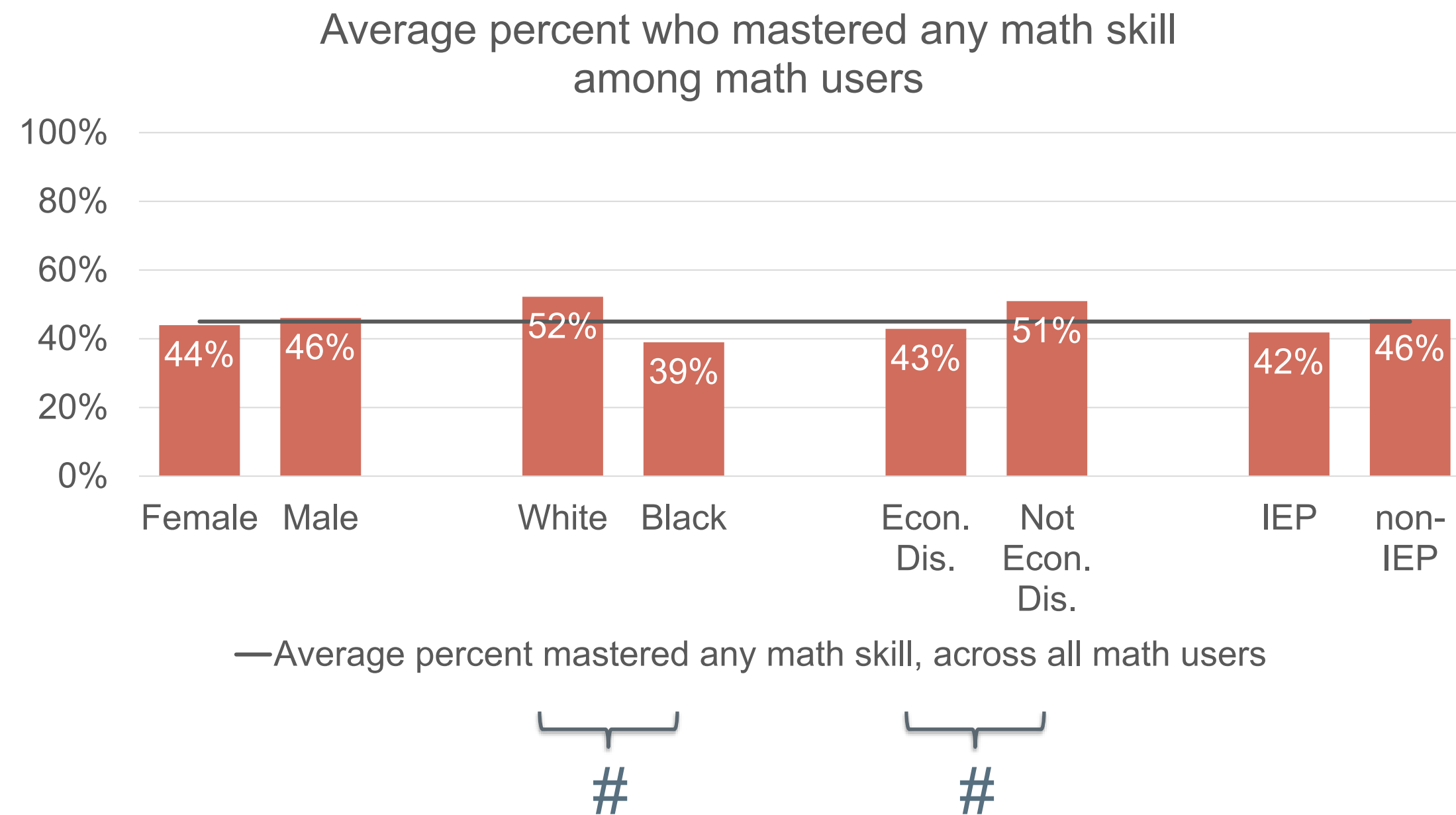
# Only 45% of students who started any math activity and 47% of students who started any reading activity mastered at least one skill



- To master a skill, students must complete the activities for that skill and pass an assessment.
- Among those who started math or reading activities, students in elementary school mastered at least one skill at higher rates than those in other grades.



# Black or economically disadvantaged students who started at least one activity were less likely to master at least one skill



- Among Black students who started a math or reading activity, only about 39% ever mastered a math or reading skill, compared to 52% of their White counterparts.
- Students who have an IEP and who start a reading activity were less likely to ever master a reading skill.
- Differences by gender were minimal.

Note: # denotes a difference of at least 5 percentage points.



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# Findings

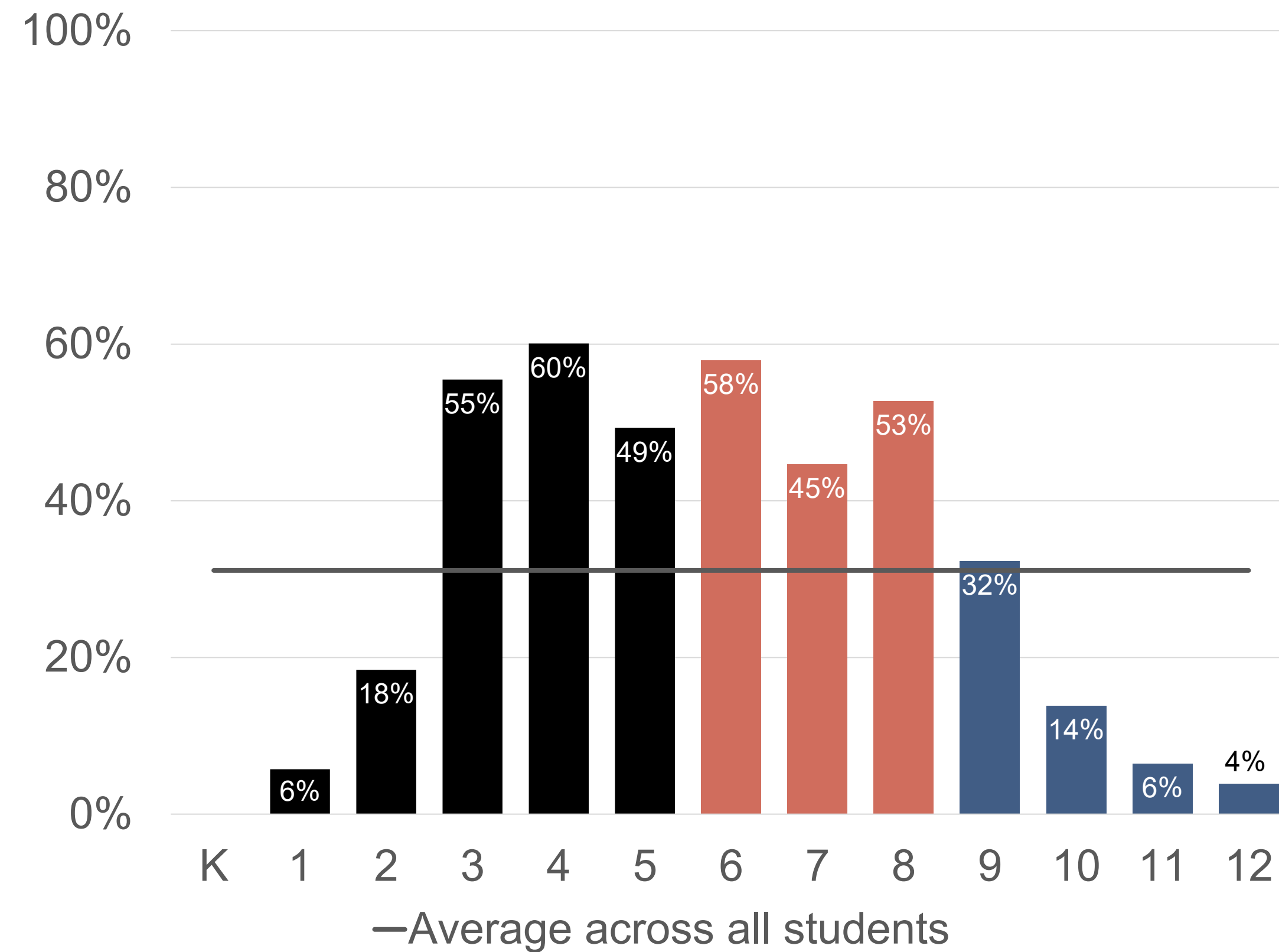
- Access and use of learning management system
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- Use of supplemental programs
  - Edmentum Exact Path
  - ➔ Edmentum Study Island
  - iLit
  - Other supplemental products



# Study Island used primarily in grades 3–9 for math

- **31%** of students answered a practice question in Study Island.
- Students in **grades 3–9** had the highest usage rates.
- Among users, **85%** ever practiced math skills, while **35%** ever practiced science and just **5%** ever practiced reading.

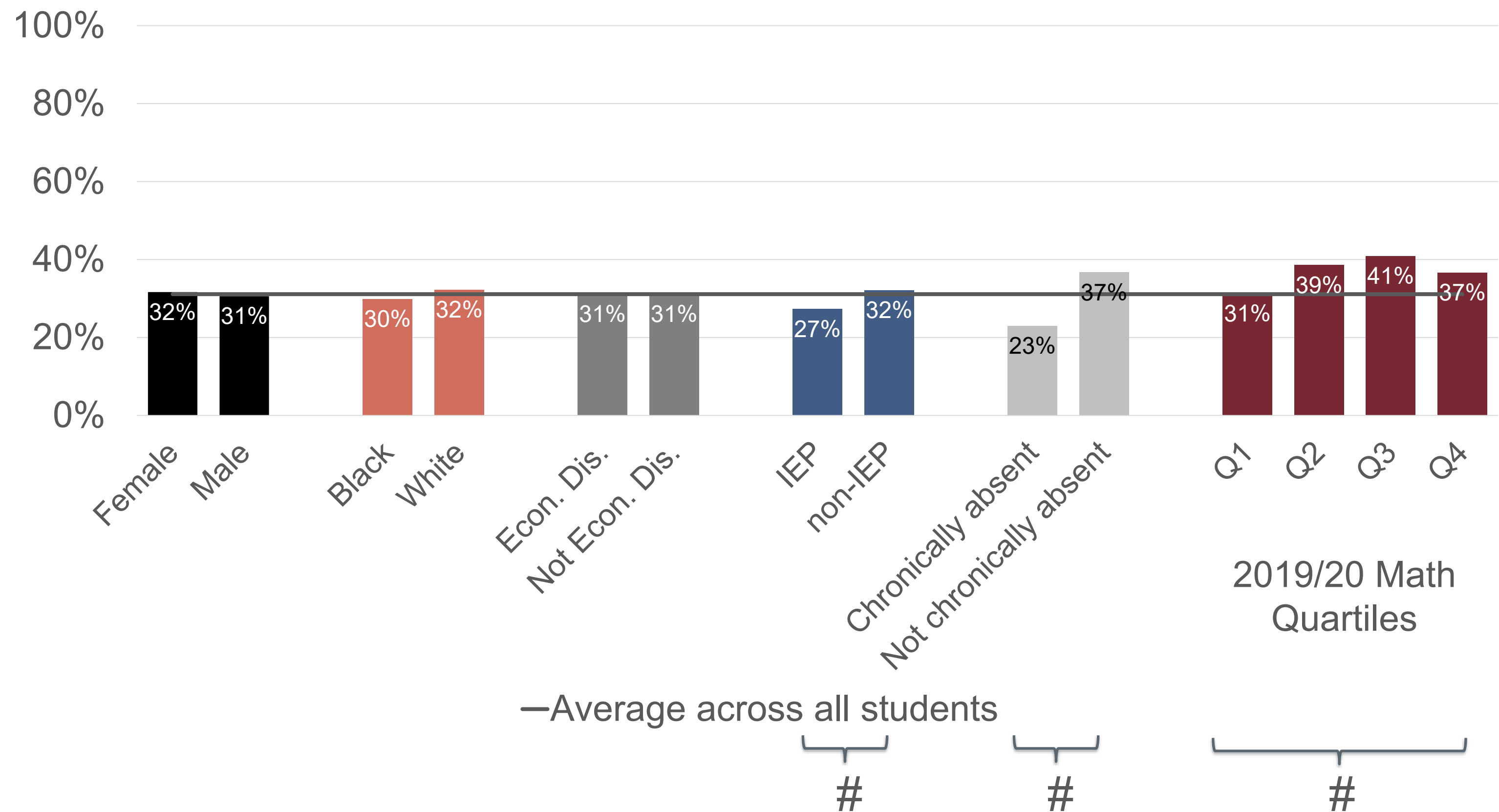
Percent of students who answered any practice question in Study Island



# Study Island uptake was similar across gender, race, and economic disadvantage status, but differences were evident by IEP status, chronic absenteeism, and prior achievement

- Students who have an IEP or were chronically absent in fall 2019 were less likely users.
- Students with lowest math scores in 2019/20 were less likely to use Study Island.

Percent of students who answered any practice question in Study Island



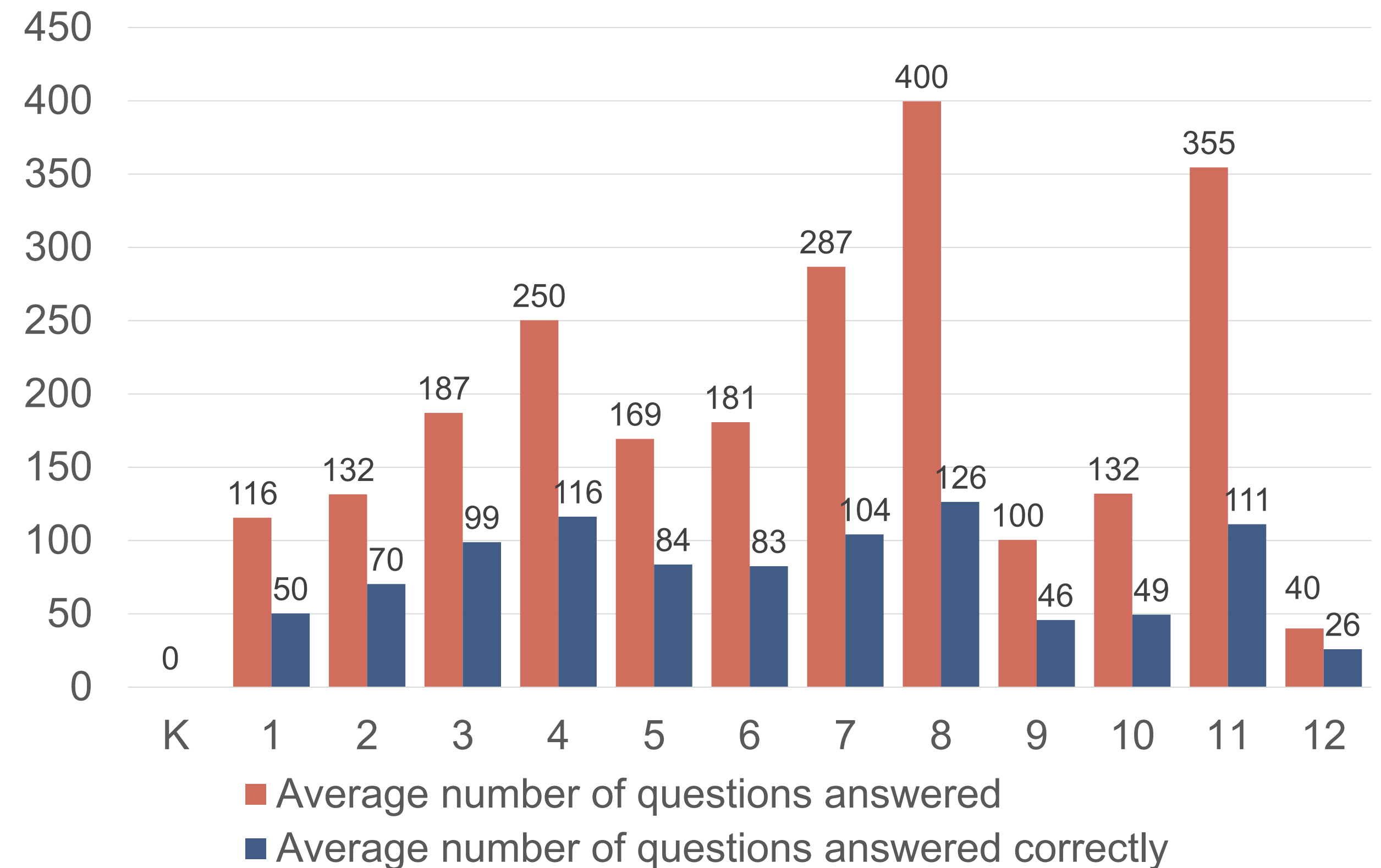
Note: # denotes a difference of at least 5 percentage points.

Chronically absent is having missed more than 10% of instructional days.

# Study Island users answered 223 questions on average, 44% correctly

- The **median** user answered **95 questions, 42% correctly**.
- The median student answered **3 questions per week**, well below the default of 10 questions given at a time.
- **79%** of students who ever used Study Island have received a Blue Ribbon, an indicator of achievement set by the teacher.

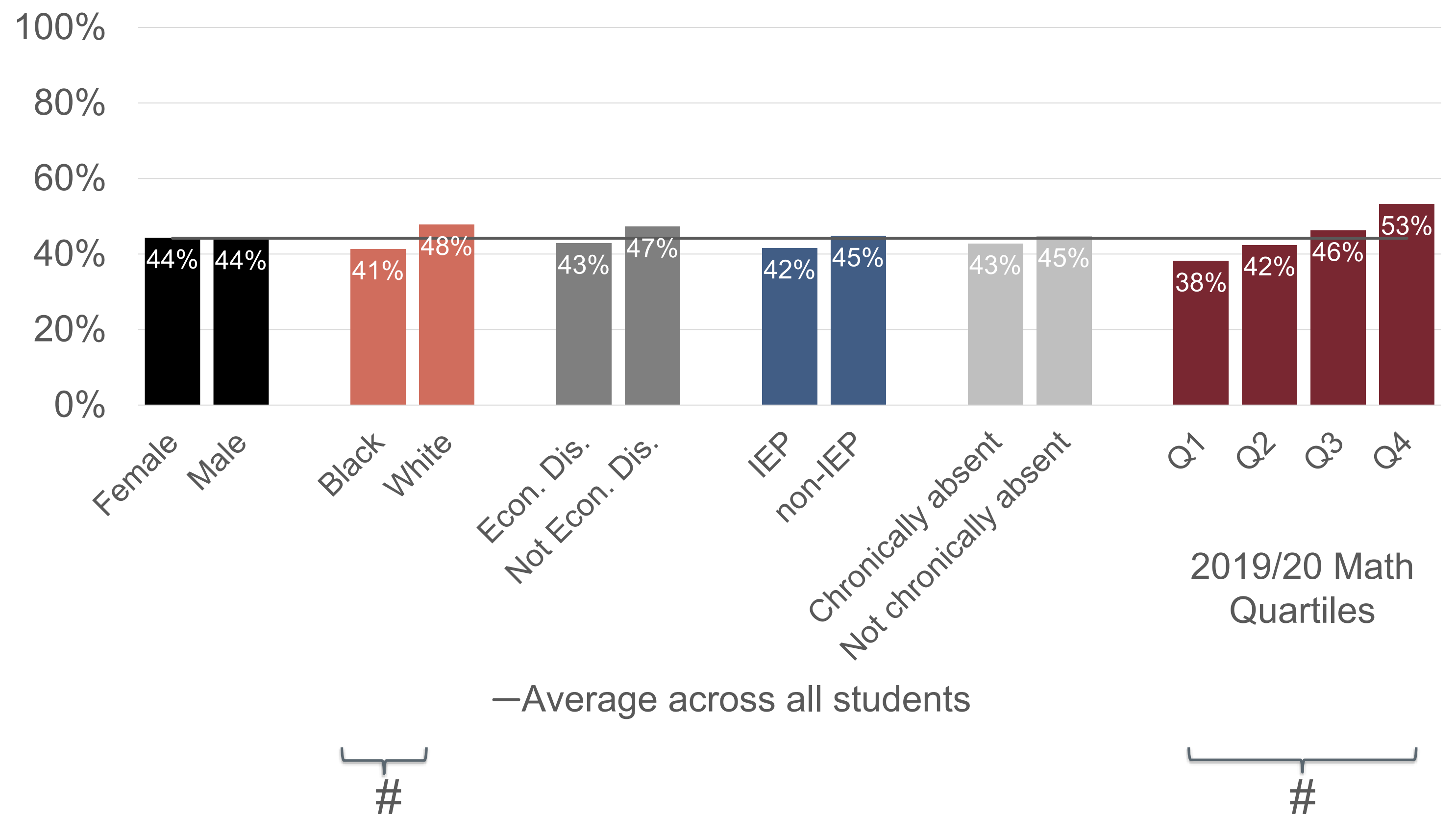
Average number of questions among those who answered any



# Students with higher math scores in 2019/20 answered a higher share of Study Island questions correctly

- Students with higher test scores answered more questions correctly.
- Students who are Black had slightly **lower shares of correct answers.**
- Black students received about **three fewer** Blue Ribbons than White students, among recipients.
- Economically disadvantaged students also received about **three fewer** Blue Ribbons than students who are not, among recipients.

Percent of questions answered correctly among those who answered any



Note: # denotes a difference of at least five percentage points.

Chronically absent is having missed more than 10% of instructional days.



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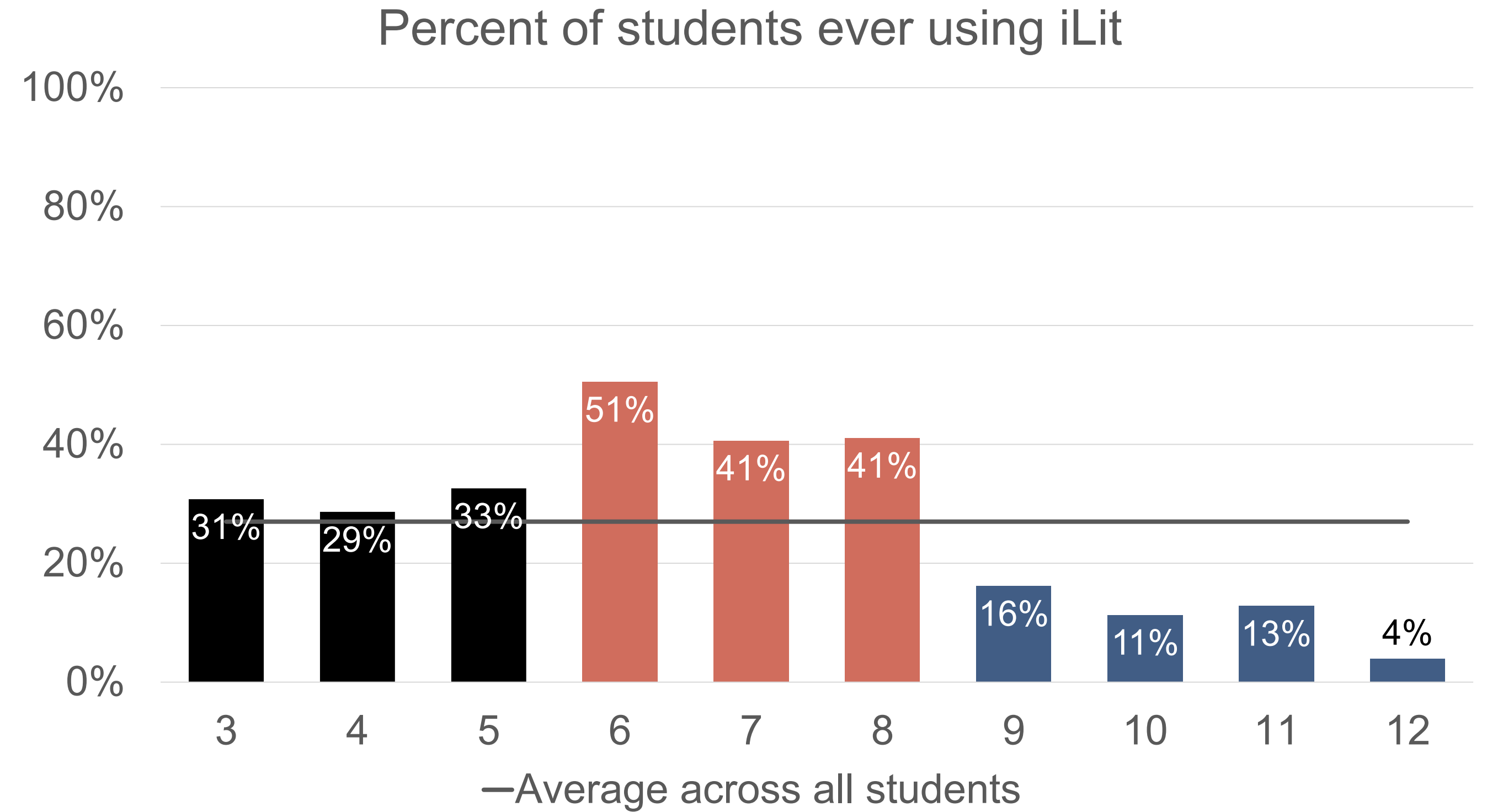
# Findings

- Access and use of learning management system
- Opening and submitting course materials in learning management system
- Use of supplemental programs
  - Edmentum Exact Path
  - Edmentum Study Island
  - ➔ iLit
  - Other supplemental products



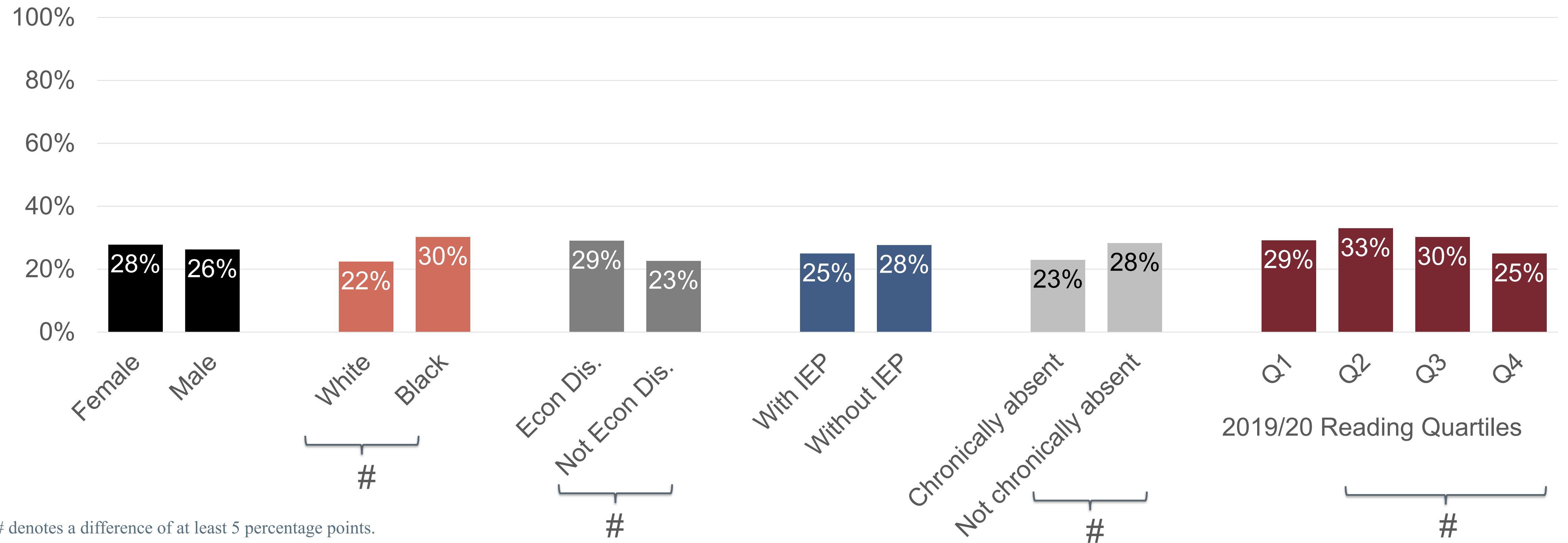
# iLit usage was highest in grades 6–8 and lowest in grades 9–12

- 27% of students in grades 3–12 ever used iLit20

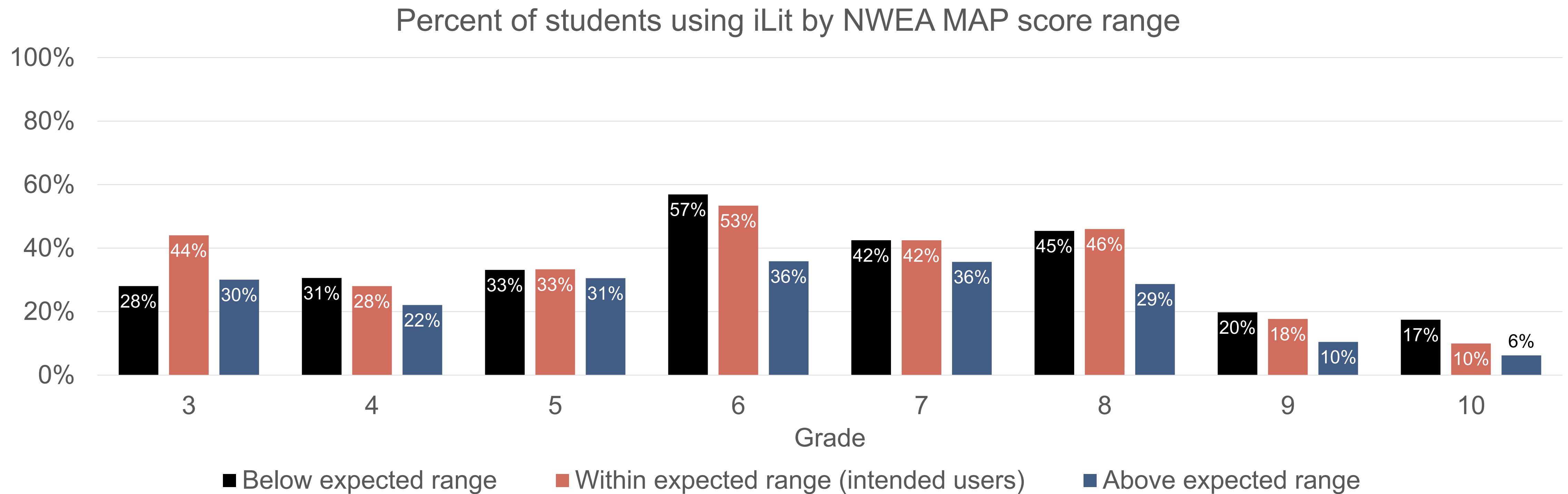


# Some groups were more likely to use iLit: Economically disadvantaged students, Black students, and students in the middle quartiles of reading scores (relative to top quartile)

Percent of students ever using iLit



Students with scores in the targeted test score range for iLit were more likely to use iLit20 than those with higher scores, but those with scores below the target range often used it at a similar rate to those in target range



Among those who ever used iLit20 during the school year, total usage was low

<b>Statistic</b>	<b>Average total year to date (by Week 34)</b>
Total minutes	15.7
Total words read	1,474
Percentage of assignments completed	33.3%



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# Findings

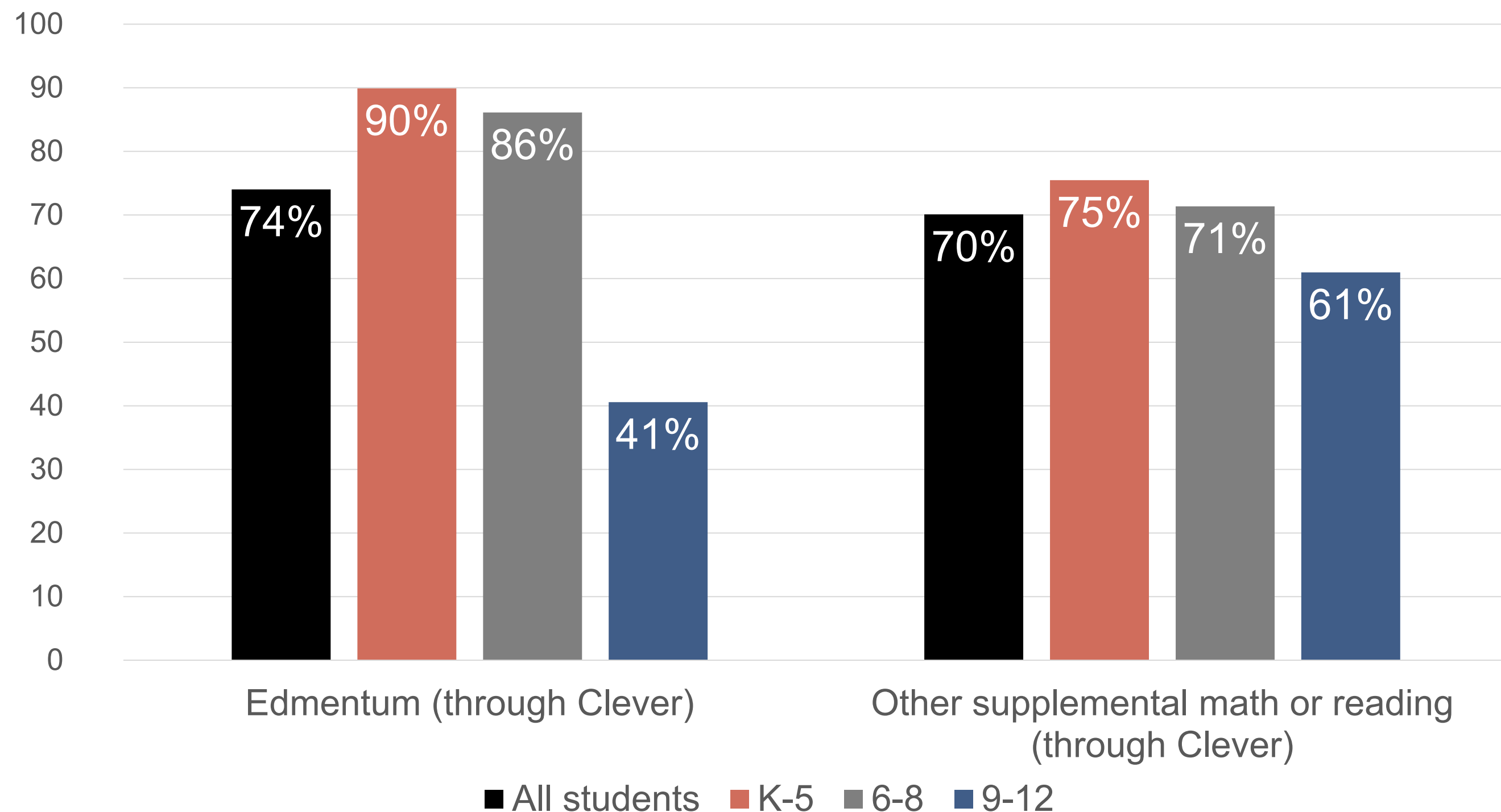
- Access and use of learning management system
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- ➔ Other supplemental products
- 



# Students, on average, accessed supplemental math and reading products other than Edmentum at similar rates to Edmentum, though this varied by grade

- In grades K–5 and 6–8, students were more likely to ever access Edmentum than other supplemental math and reading products.
- In grades 9–12, students accessed other supplemental products more than Edmentum.

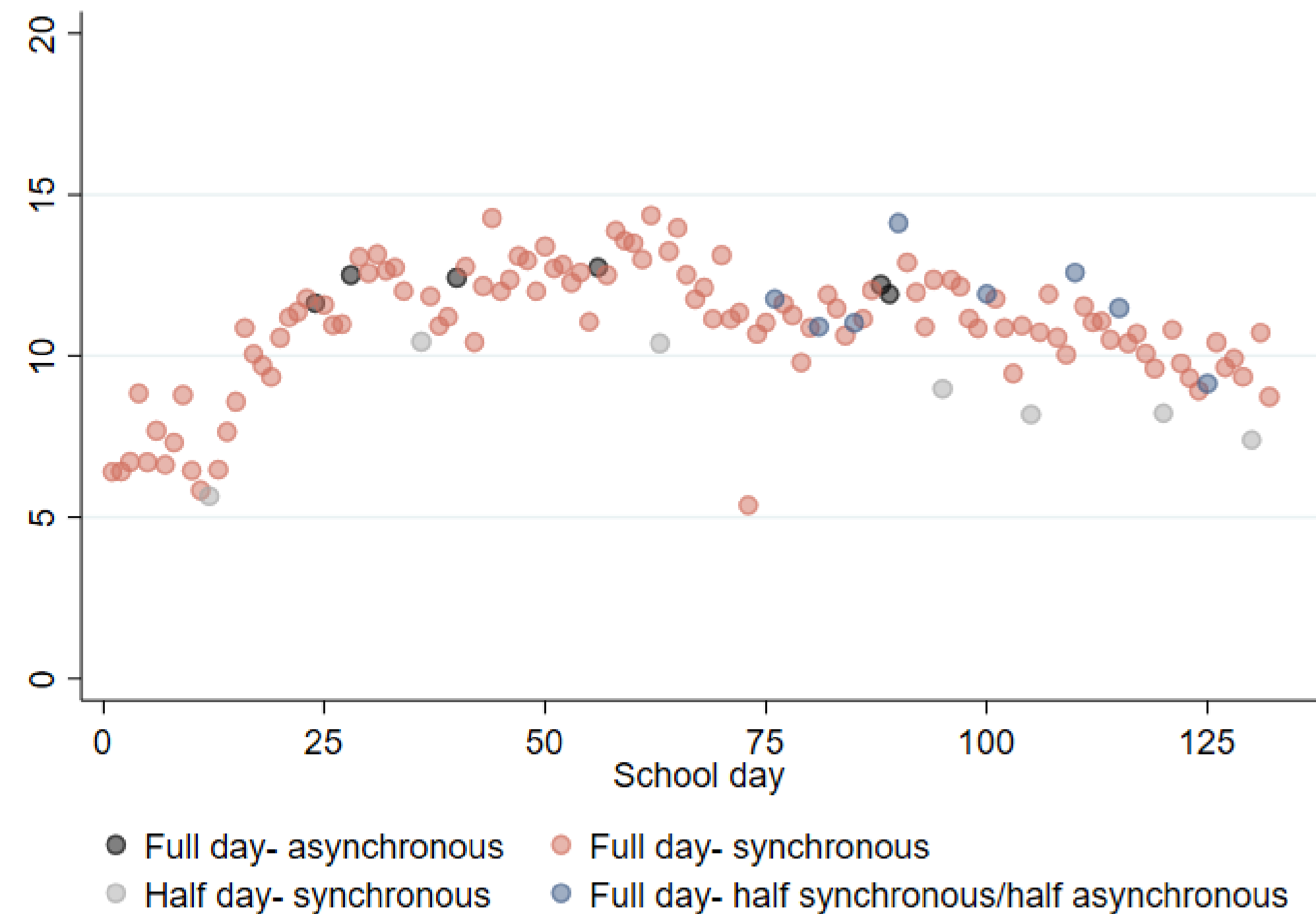
Percent of students who accessed supplemental reading or math products via Clever at least once



# On each school day, 5% to 15% of students logged into Edmentum through Clever

- Usage generally increased during the first 100 days of the school year and then steadily decreased.
- Usage was lower on half synchronous days but was consistent across the other types of virtual school days.

Percentage of students who logged into Edmentum (through Clever), by type of school day\*

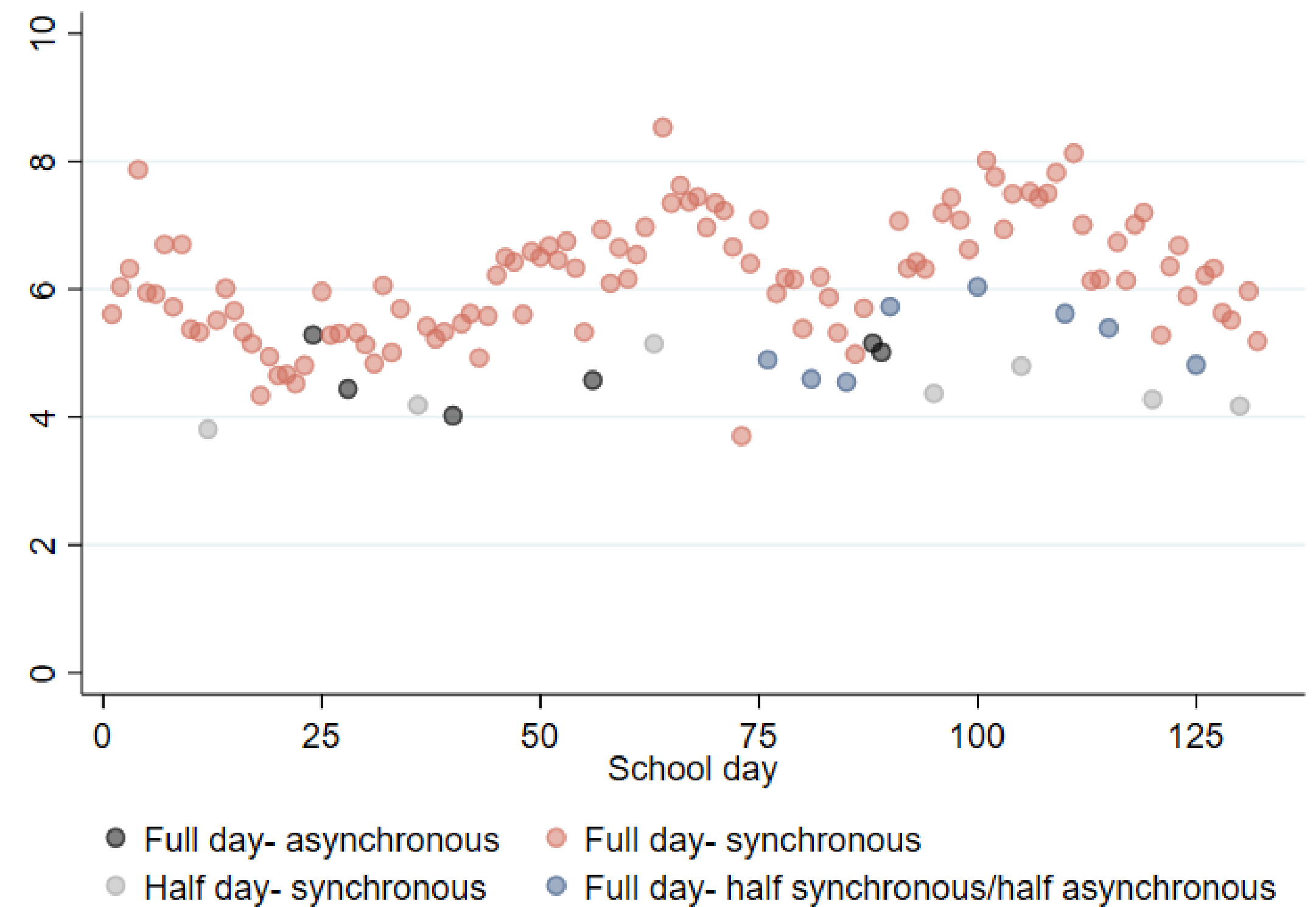


\* One day was removed because no Clever data were collected that day.

# On each day, fewer than 10% of students logged into supplemental programs other than Edmentum (through Clever)

- On any given day, fewer students were logging into other supplemental math and reading products than were logging into Edmentum.
- Usage lower typically on days that were not full synchronous days.
- Usage appears to have distinct peaks and valleys across the school year, perhaps related to district-wide assessment or grading cycles.

Percentage of students who logged into other supplemental math or reading programs (through Clever), by type of



\* One day was removed because no Clever data were collected that day.

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# Research question 2:

## *Limitations and implications*

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# Limitations

- Some groups of students may use these products less **because of their own circumstances** (e.g., parental support, Internet connection) **or motivation** or because of **differences in how their teachers or schools are choosing to use the products.**
- We don't have a **regular year of in-person schooling to compare these trends to.** It is possible that some trends, such as decline in course materials submitted over the course of the year, may happen in regular years as well.
- The association between Schoology usage measures and grades/absences could be due to unmeasured factors and should **not be interpreted as a causal relationship.**

# Implications

- Across products, students were **less likely to log in on full days that have any asynchronous learning and on half synchronous days than on full synchronous days.**
  - Suggests students may be less engaged on asynchronous days and half days.
  - For future remote learning, may need more structure to ensure students are doing schoolwork on asynchronous days or half days (e.g., monitoring not just logins, but also activities and skills mastered on asynchronous days).
- **Decline in daily logins and course materials** opened and submitted over the course of the year suggests students decided to engage less with course materials as the school year went forward or that teachers decided to post fewer materials, assessments, and assignments.
- **Supplemental product use does not appear to be meeting PPS's expected amount of use.** Suggests that schools and teachers may need to provide more explicit expectations and monitoring to support productive use of these products.
- **Teachers play a role** in explaining how many materials students open and submit. A substantial portion of variation (28%-53%) occurs across teachers within the same school.

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# Questions

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# Disclaimer

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





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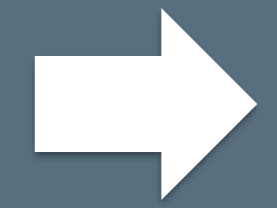
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# Appendix

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# Imputation may still overestimate scores for those who didn't take the test in 2020/21

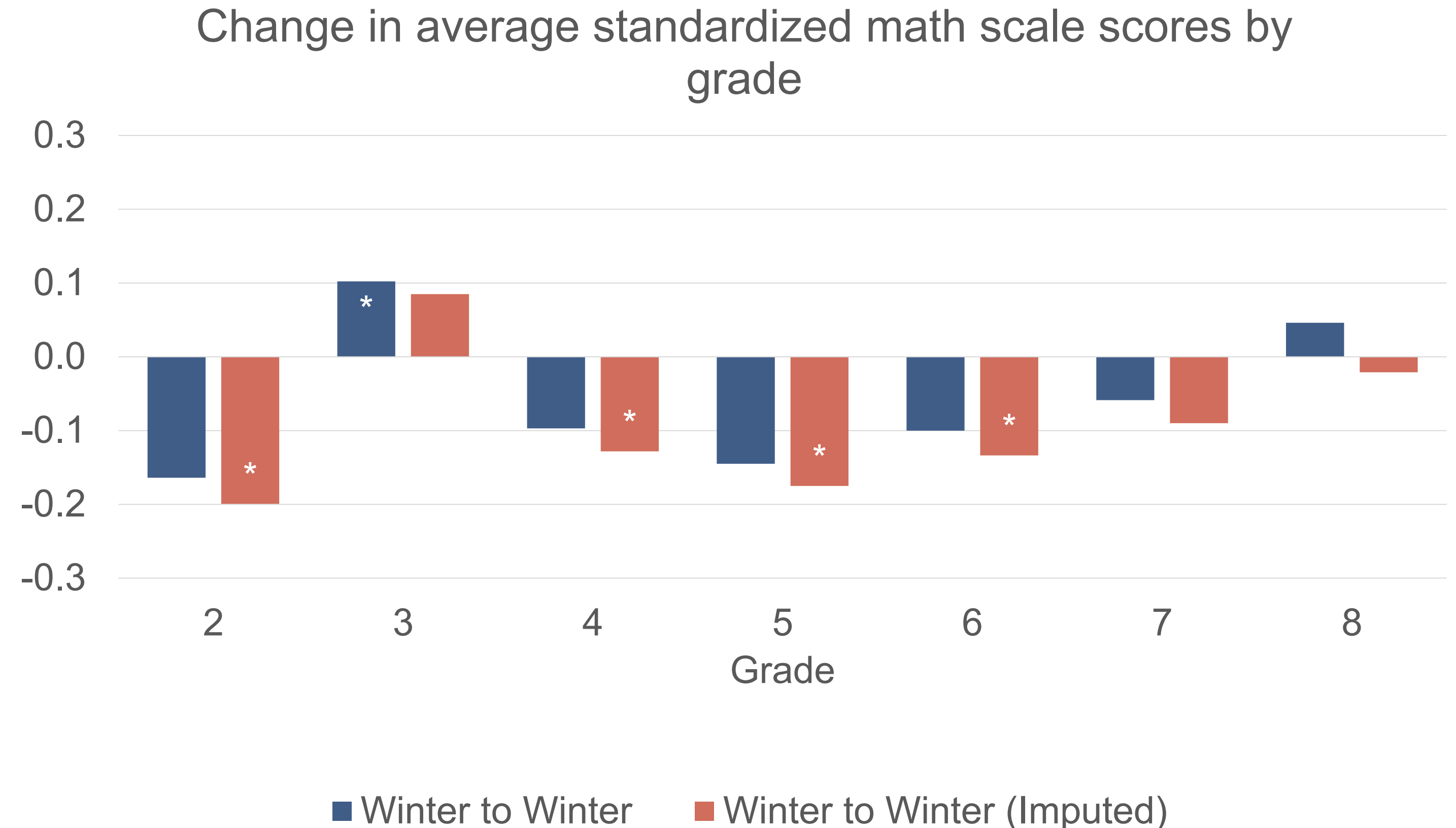
- Among students in grades 2–7 in 2019/20, those who failed more courses were less likely to take the winter 2020 test.
- Students who did not take the test in winter 2020 may have scored lower on average than students who did take the test in winter 2020, even when comparing students who failed the same number of courses and had other similar characteristics.

Number of courses failed in first semester fall 2020	Percentage with a winter 2020 math score	Frequency
0	89%	7,802
1	72%	522
2	64%	213
3	49%	155
4	39%	110
5	30%	63
6	38%	39
7	40%	5
8 or more	29%	9
Total		8,918

Note: Sample includes all students in grades 2-7 in 2019/20.

# Cross-sectional analysis with imputed scores: Comparing successive cohorts in the same grade, there are declines in 2<sup>nd</sup> and 4<sup>th</sup>–6<sup>th</sup> 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 account for those who did not take the test in 2020/21 but may not fully compensate for differences in the students who took the test in 2020/21.

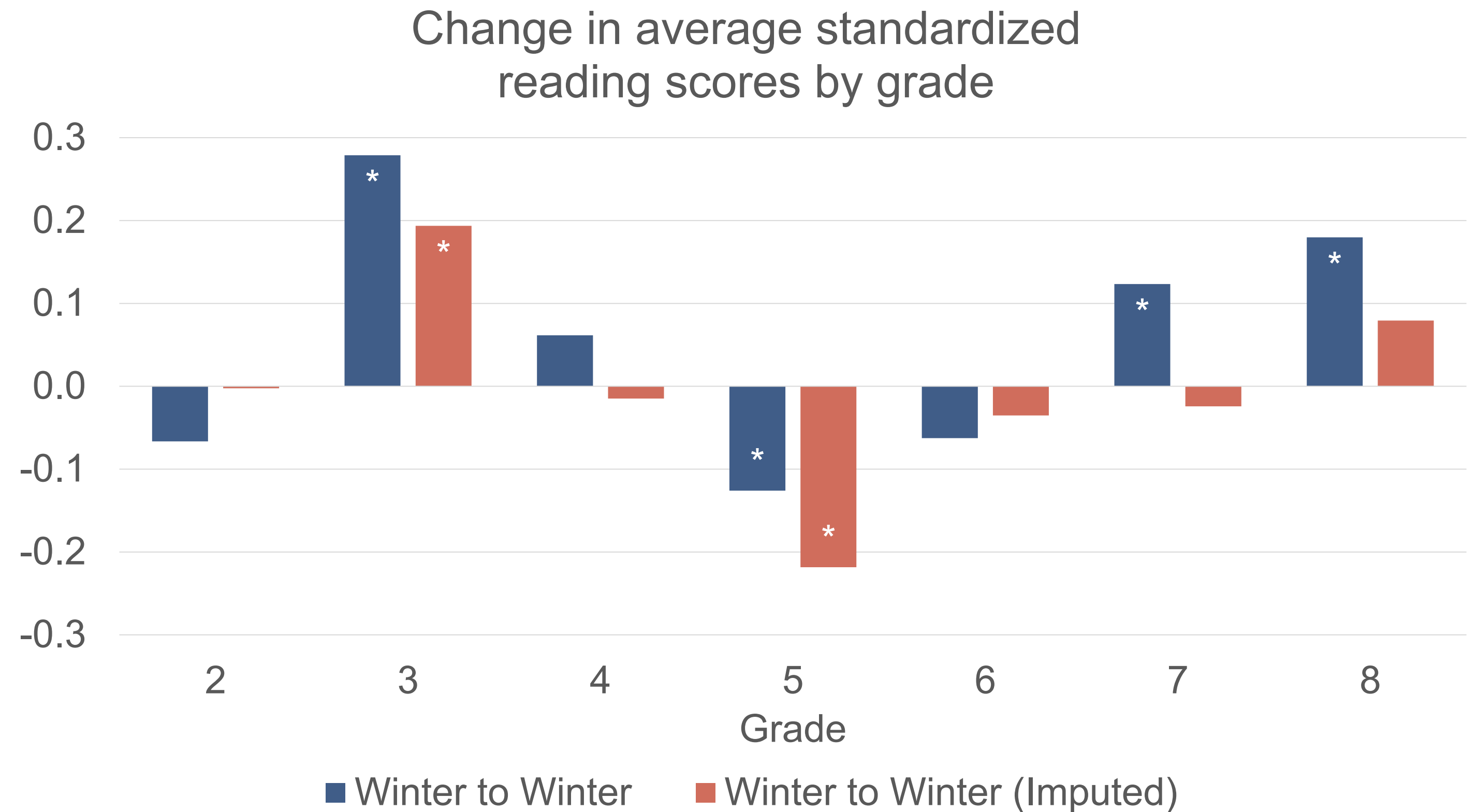


Note: \* indicate the change in standardized student test scores from winter-to-winter exceeds the absolute value of 0.1 standard deviations.



# Cross-sectional analysis with imputed scores: Comparing successive cohorts in the same grade, there are declines in 5<sup>th</sup>–7<sup>th</sup> grades in reading but increases in 3<sup>rd</sup> 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 account for those who did not take the test in 2020/21 but may not fully compensate for differences in the students who took the test in 2020/21.

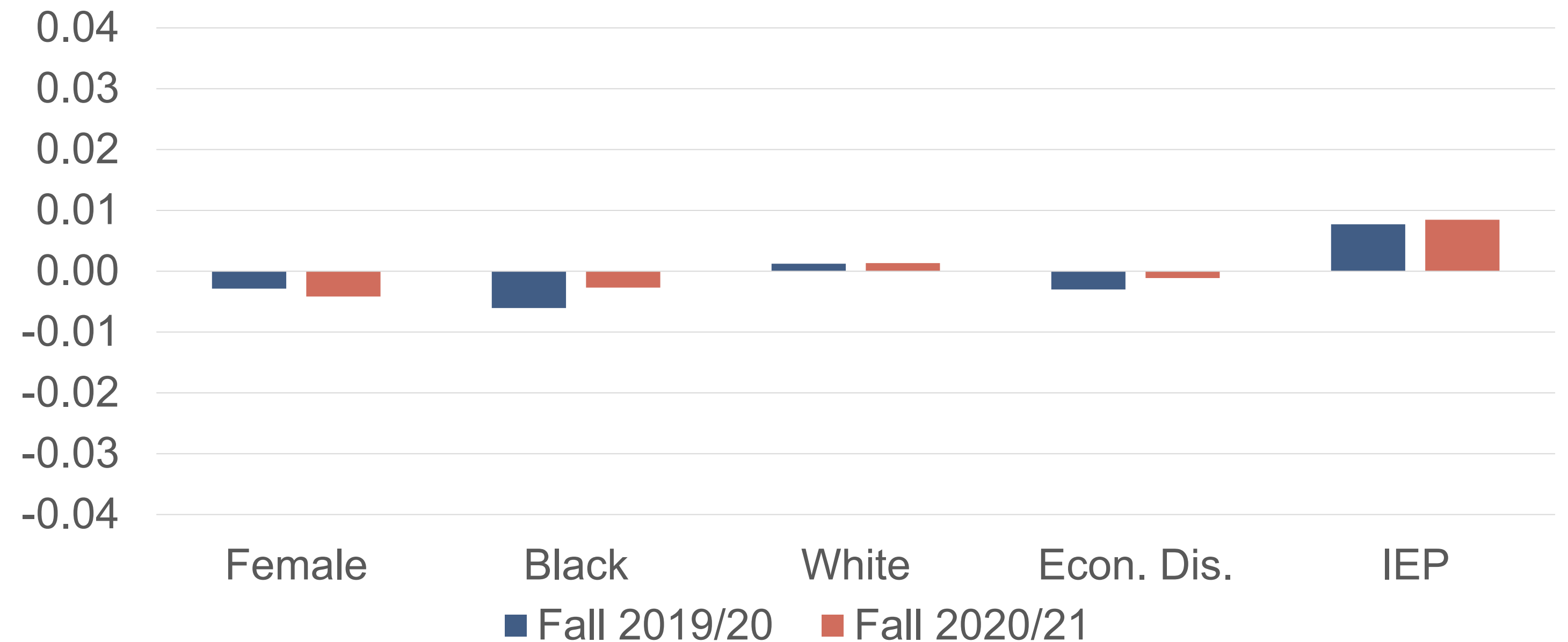


Note: \* indicate the change in standardized student test scores from winter-to-winter exceeds the absolute value of 0.1 standard deviations.

# 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.

Differences in the proportion of students with each characteristic in the sample with first-semester grades versus all enrolled students, grades 1–12



Note: \* 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.

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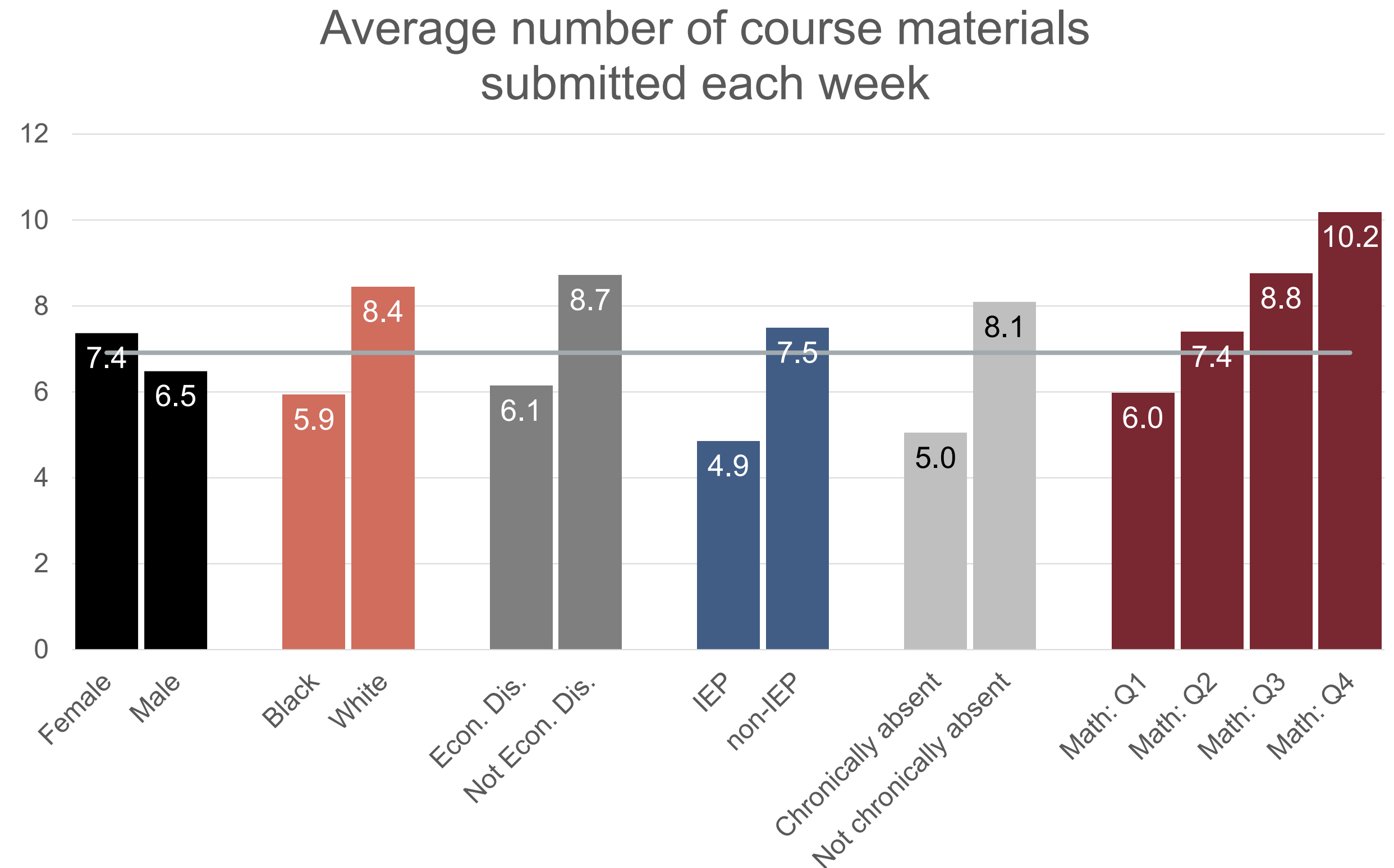
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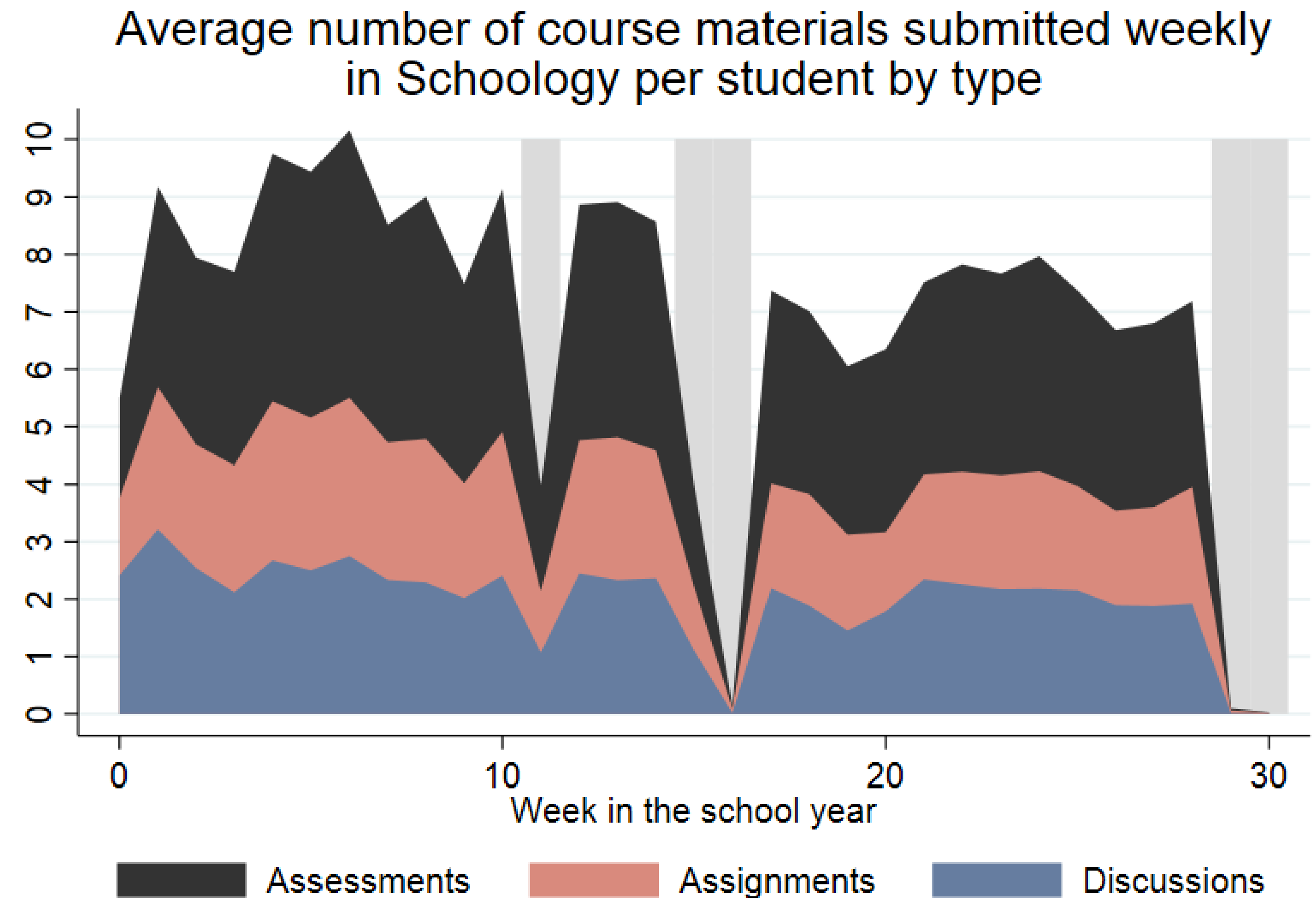
# Students submitted 6.9 items (including assignments, assessments, and discussion posts) each week, on average

- Patterns in work submitted in Schoology very closely follow those of course material opened.
- Students with higher test scores submitted more course material.
- Students who are economically disadvantaged, have an IEP, or were chronically absent in 2019/20 submitted about 2.5 fewer items in a week relative to students without these characteristics.



# Assessments make up the largest share of course material submitted in a week

- Decreases around Weeks 11, 16, and 28 correspond to Thanksgiving, winter, and spring breaks, respectively.



Note: Shading denotes weeks during a school holiday.



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# Appendix

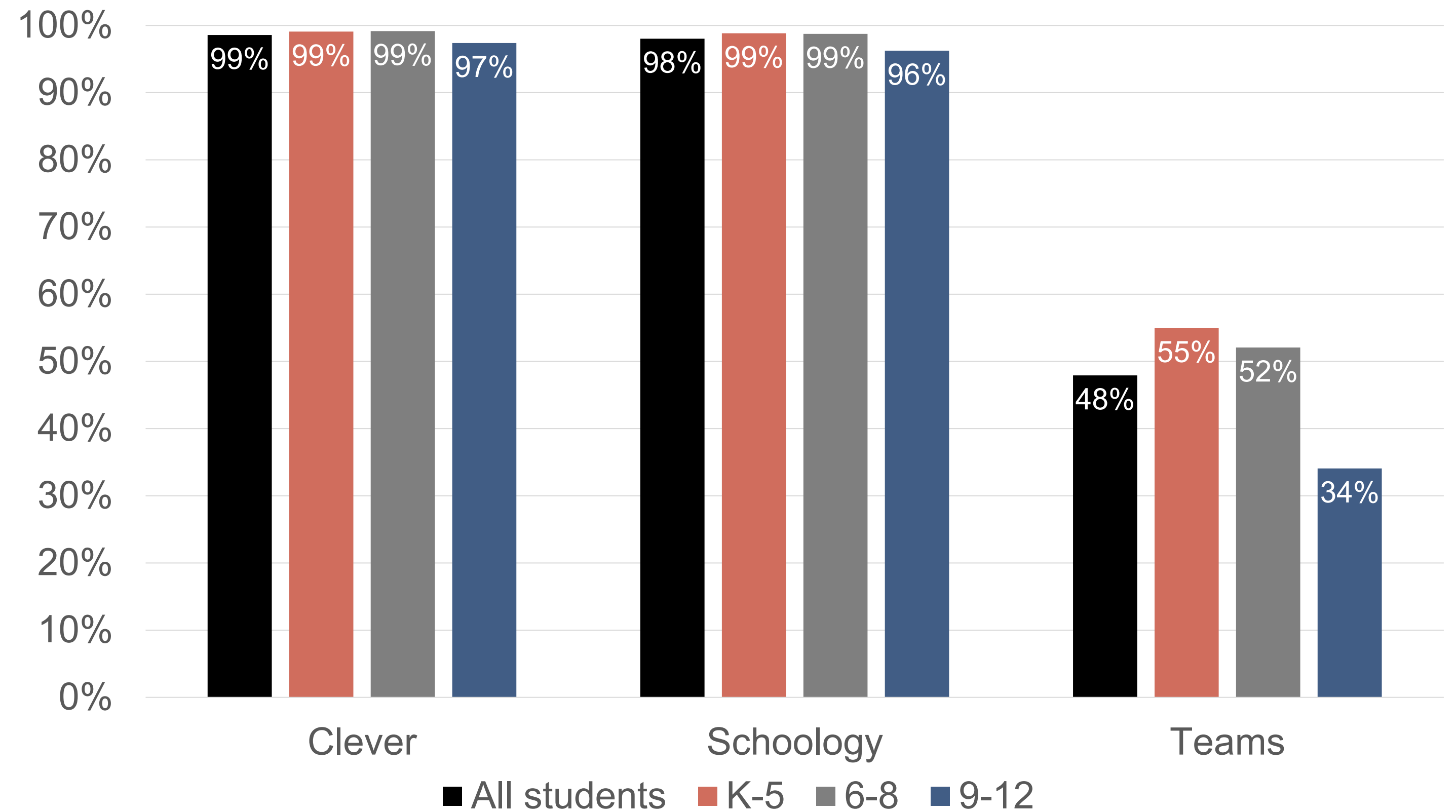
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# Nearly all students used Clever and Schoology; fewer accessed Teams through Clever

- Nearly all students in PPS accessed Clever and Schoology (through Clever).
- Teams use (through Clever) was lower than the other products and was lowest in grades 9–12.

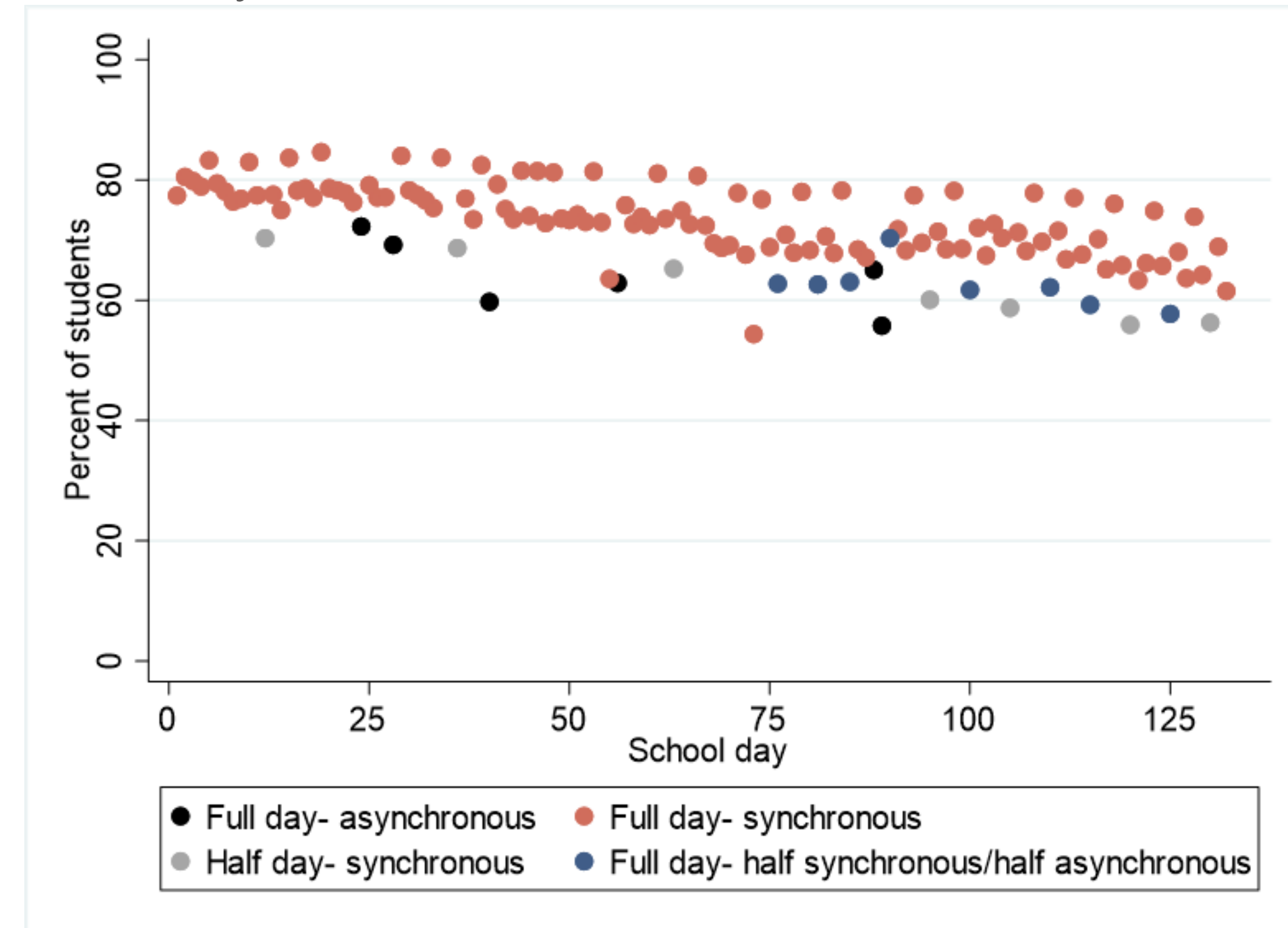
Percentage of students who ever used Clever and each product (through Clever), by grade band



# Like Schoology, Clever usage was higher on full synchronous days and steadily declined across time

- Usage was higher on full synchronous days compared to other types of virtual school days.
- Usage steadily declined from the first to last day of virtual school.

Percentage of students who logged into Clever, by type of school day\*

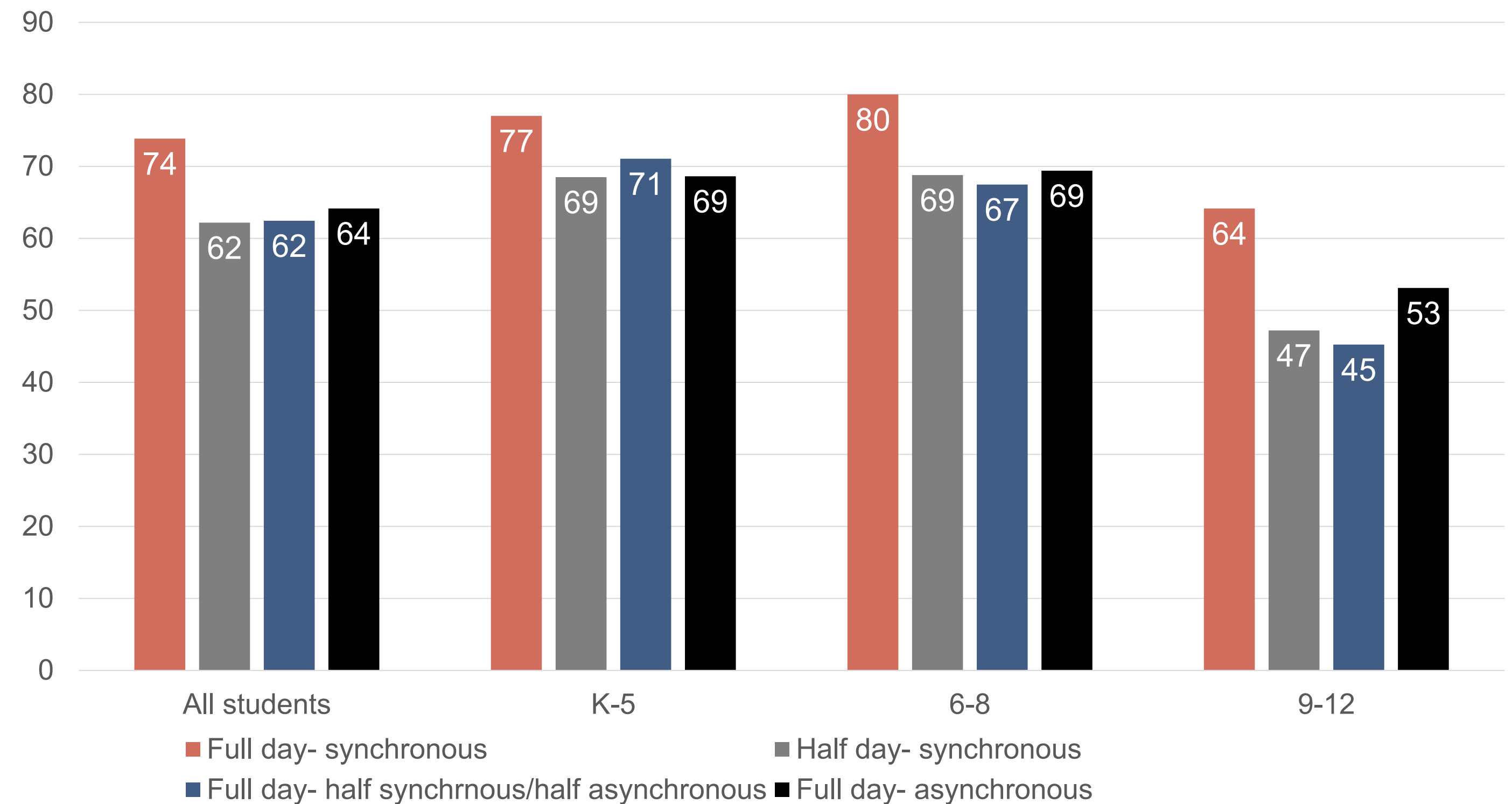


\* One day was removed because no Clever data were collected that day.

# Students in all grade levels used Clever the most on full school days that were synchronous

- Usage was similar across all other types of school days for students in grades K–8.
- Students in grades 9–12 used Clever more on full asynchronous days than on half synchronous days or half synchronous/half asynchronous days.

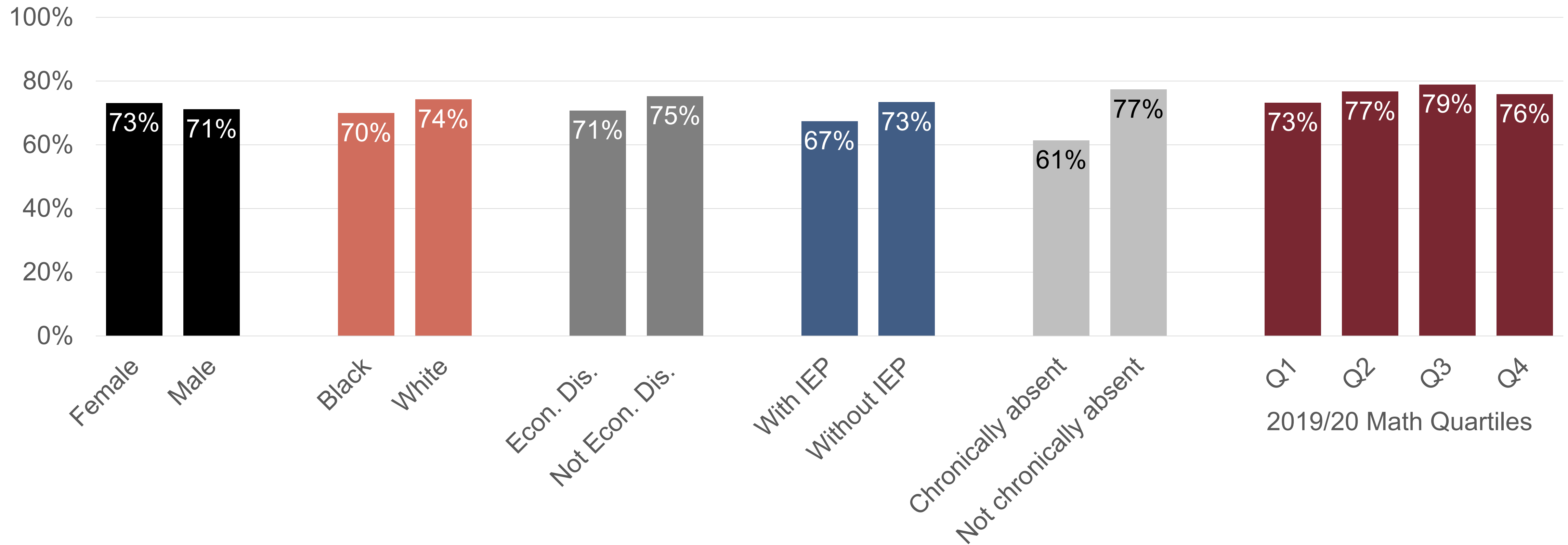
Average percentage of school days that students logged into Clever, by type of school day and grade band\*



\* One day was removed because no Clever data were collected that day.

# Students who were chronically absent in the previous year were less likely than other students to log into Clever

Average percent of school days that students logged into Clever to access any product\*



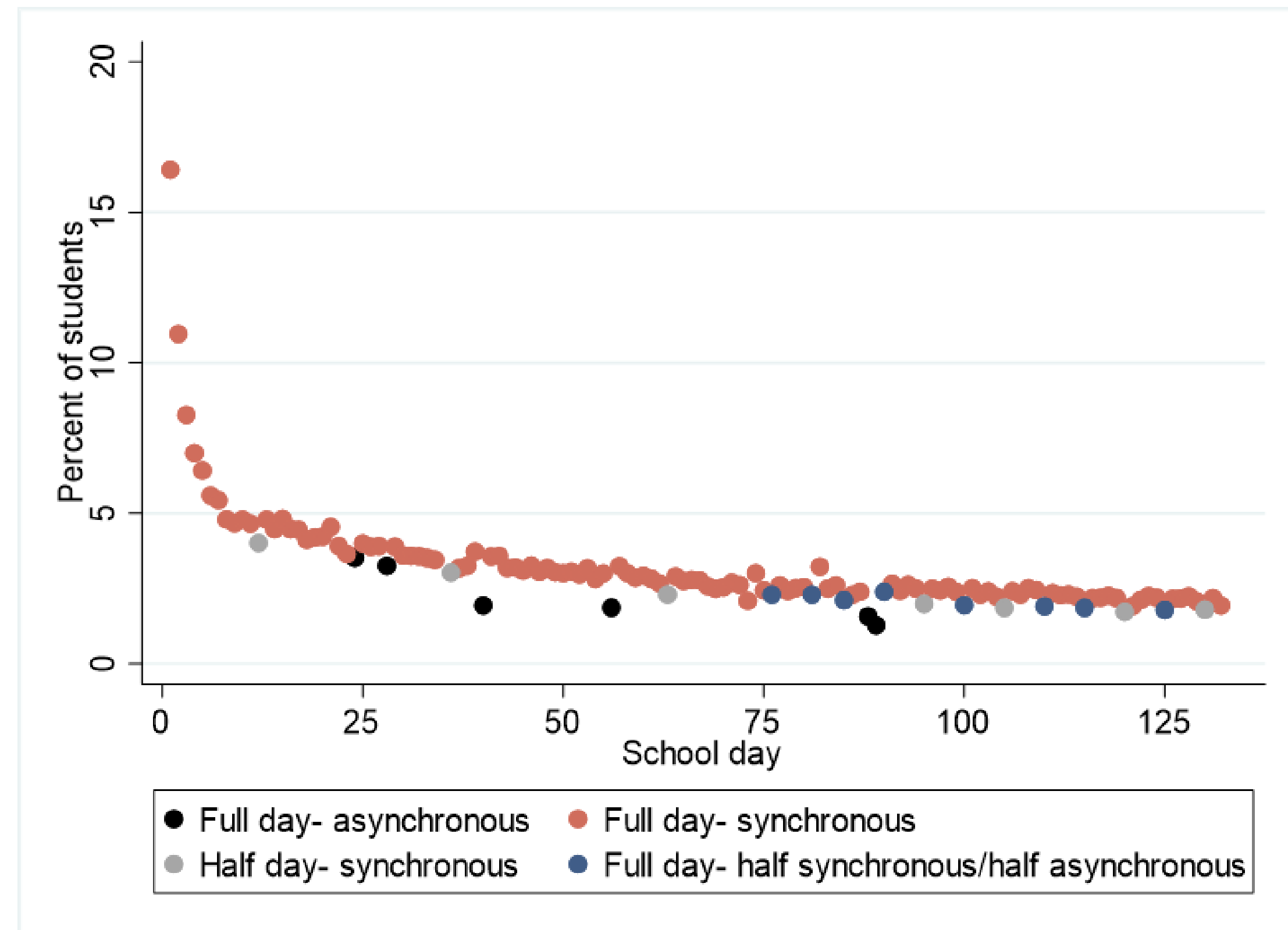
\* One day was removed because no Clever data were collected that day.



# Teams usage (through Clever) sharply fell in the beginning of the fall semester

- On most days, fewer than 5% of students logged into Teams through Clever.
- Students seem to have used alternative ways of accessing Teams (not through Clever).
- As expected, usage was lower on full asynchronous days.

Percentage of students who logged into Teams (through Clever), by type of school day\*



\* One day was removed because no Clever data were collected that day.

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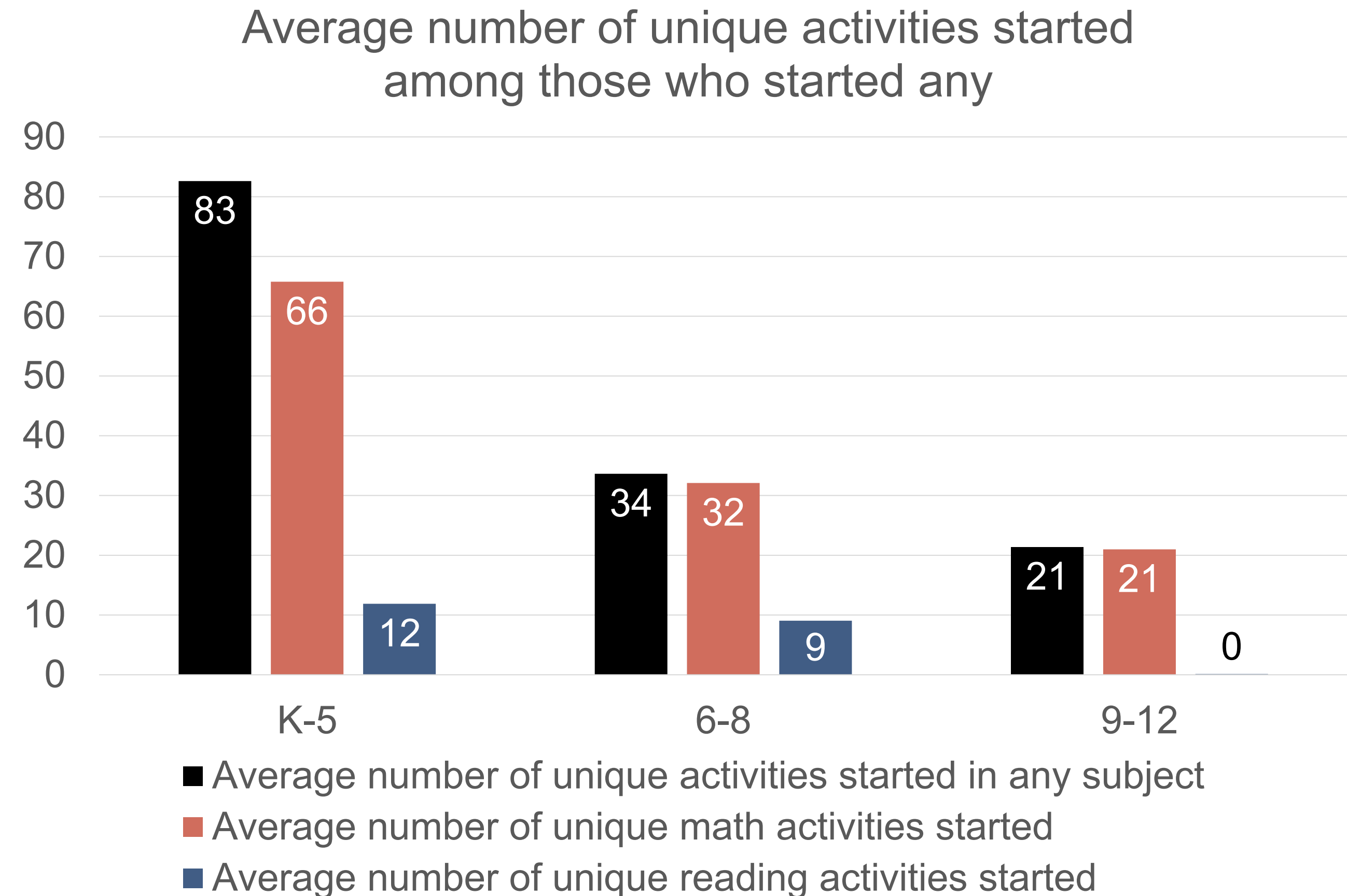
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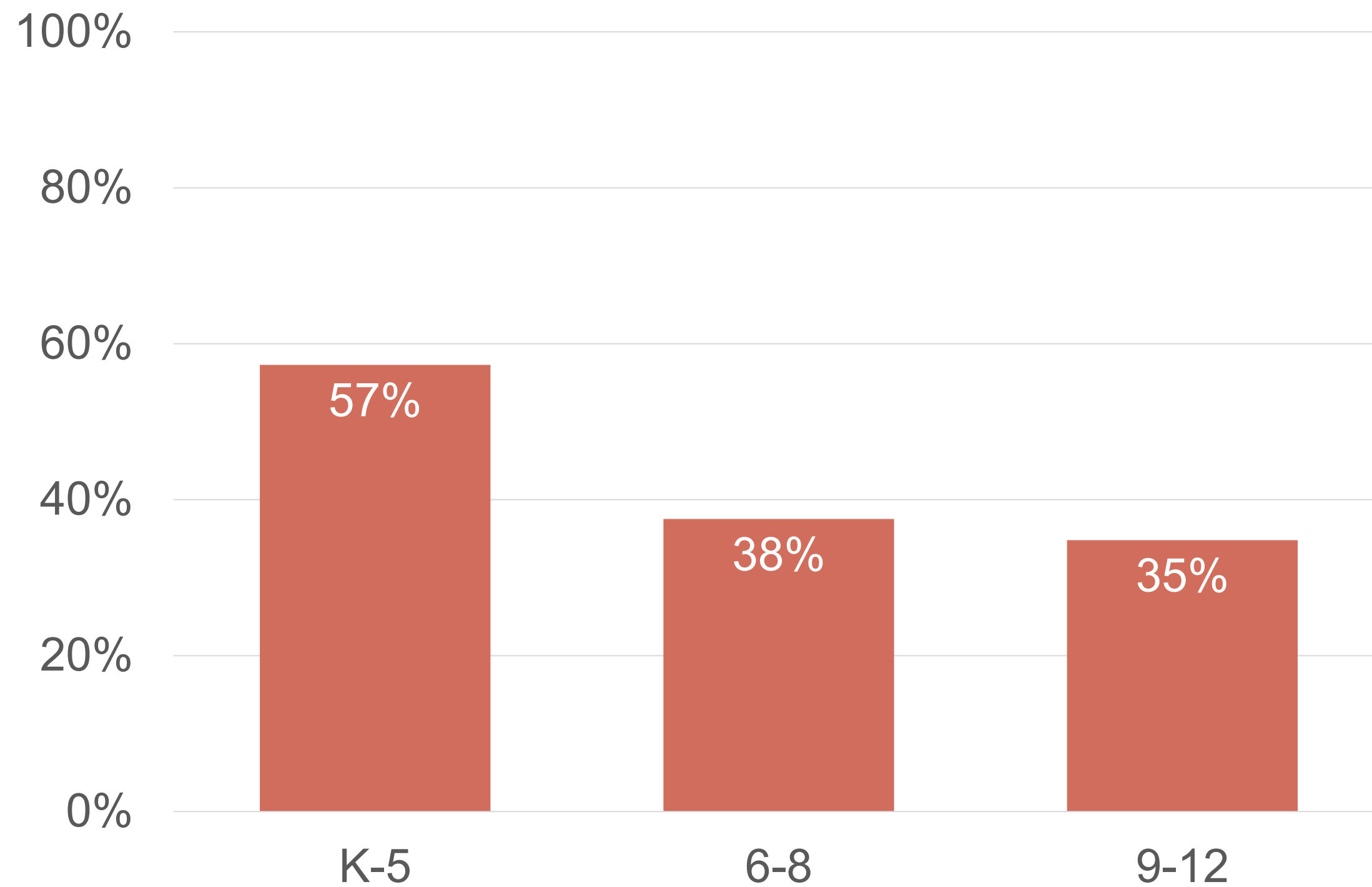
# Among Exact Path users, elementary school students started more activities than other students who started any activities

- Among students who started any activity in Exact Path, elementary school students started more activities than middle and high schoolers.
- Students in all grades started many more math than reading activities.

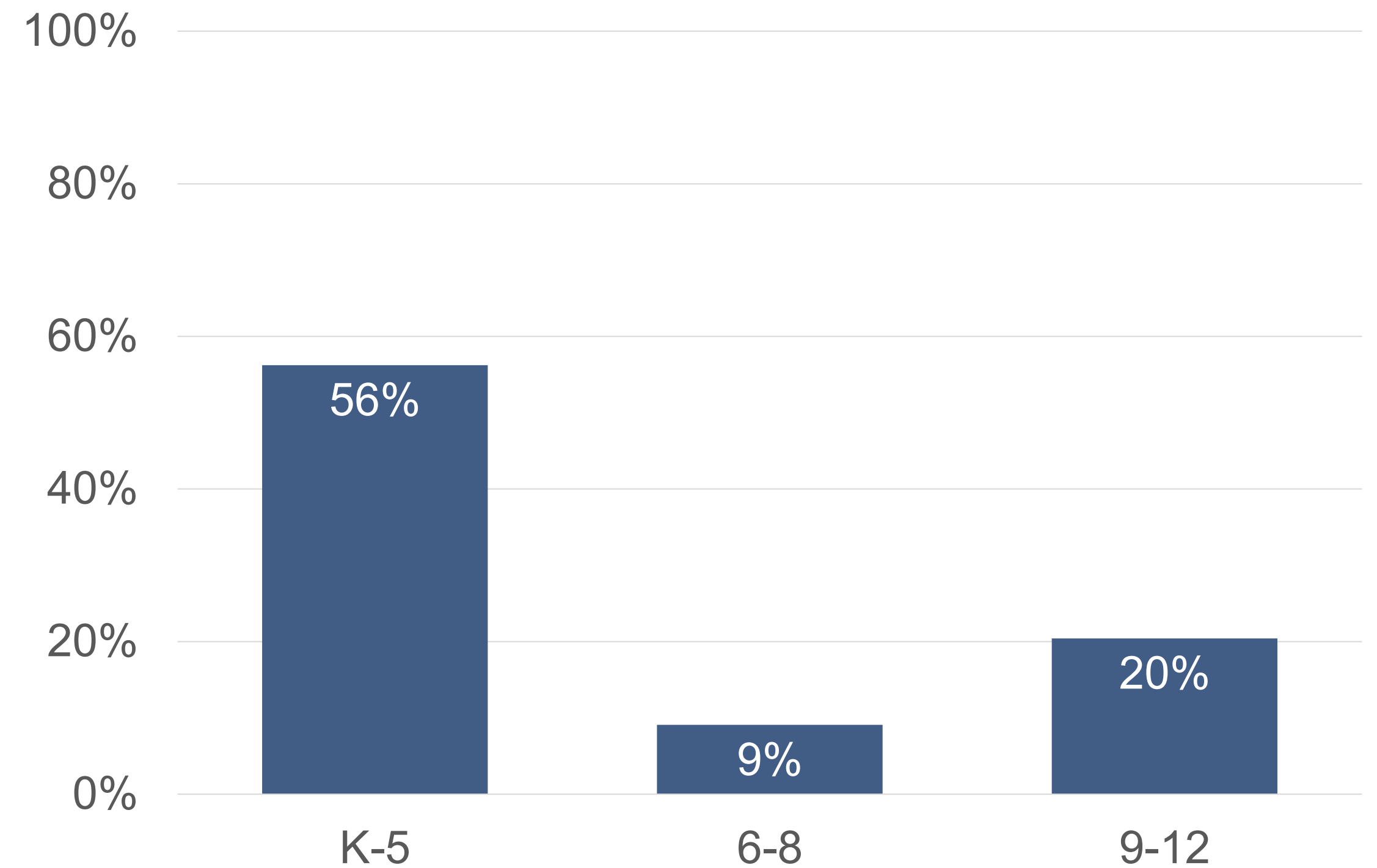


# Elementary school students completed a higher percentage of Exact Path activities that they started than middle and high school students

Average percentage of math activities completed among math users



Average percentage of reading activities completed among reading users



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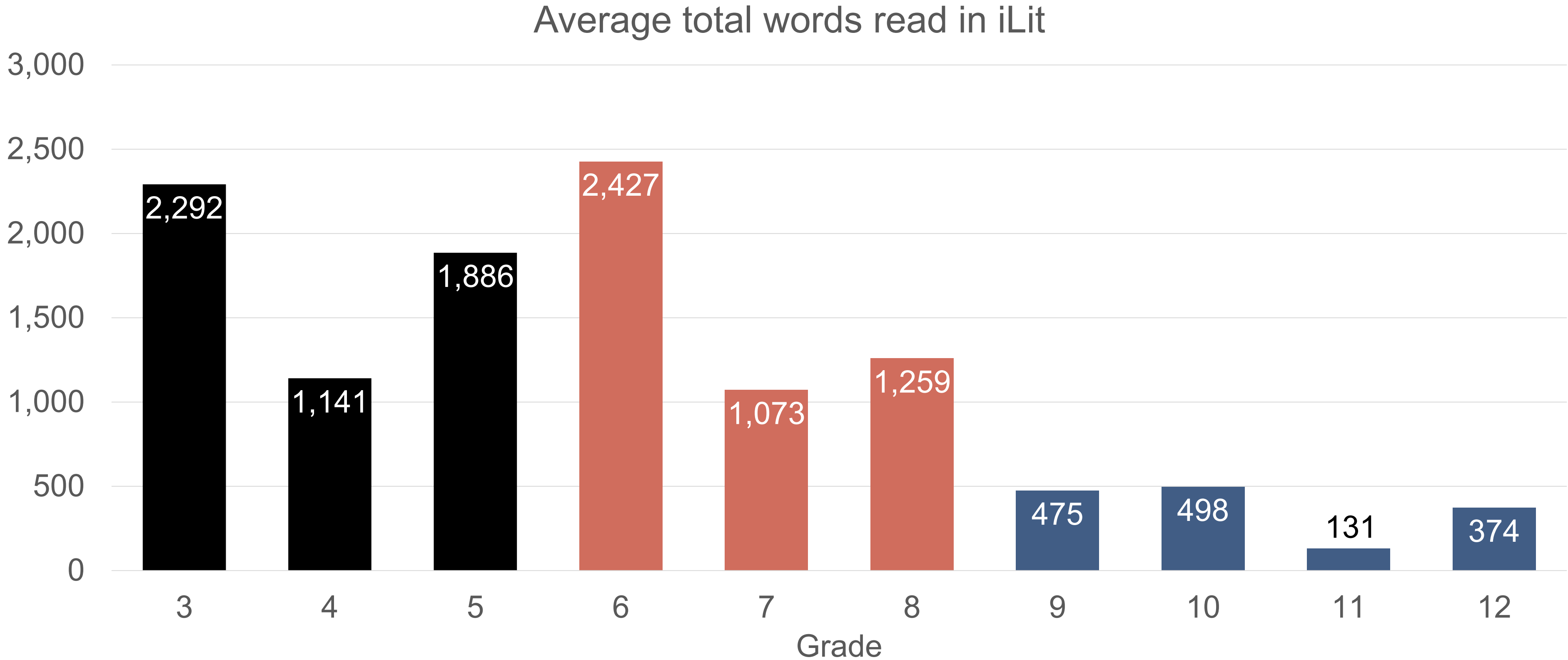
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For students who used iLit during the school year, the total words read was higher in elementary and middle school grades than in high school



Among those who ever used iLit during the school year, total words read in iLit was lower for students who are Black, economically disadvantaged, or chronically absent

