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Virtual Learning Trends During the COVID-19 Pandemic

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Metro Atlanta Policy Lab for Education

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Highlights

- Using data from a metro-Atlanta school district during fall 2020, we study trends in technology usage and virtual learning during the COVID-19 pandemic.
- Students spent less time using virtual learning applications compared to average seat time in face-to-face classrooms before the pandemic: Students logged 14 hours per week on average in fall 2020, versus approximately 33 hours per week of traditional face-to-face instruction prior to the pandemic.
- Usage patterns sometimes differed across student groups. Female students logged more hours using the Microsoft Teams and iReady platforms than male students. Black students logged more time in synchronous meetings than White students.
- Students' weekly achievement growth during pandemic-related virtual learning was lower than pre-pandemic trends predicted.
- More hours spent on virtual learning applications was associated with higher weekly rates of student achievement growth. The associations were particularly strong for applications facilitating student-directed, interactive assignments, including Microsoft Word and iReady.

Introduction

In response to the COVID-19 pandemic, school districts across the United States were forced to close their physical schools and rapidly switch to virtual learning. In this report, we study a district in the metro Atlanta area (“the district”) that began to deliver all content virtually in mid-March 2020, which included teachers delivering lectures and giving assignments online. Subsequently, as the fall 2020 semester progressed, the district offered various hybrid and face-to-face learning options. This report examines trends in technology usage and learning during fall 2020 to elucidate promising strategies and highlight areas for additional attention, which can help improve the effectiveness of virtual learning.

Data

We use administrative data from the district that include student enrollment, achievement, and sociodemographic characteristics. The data also include logs from two virtual learning platforms: Microsoft Teams and iReady.

Microsoft Teams (“Teams”) was used by the district as a learning management program. Students could access a plethora of online tools, programs, and software. We prioritize using data on the most common tools accessed through the Teams platform, including those facilitating synchronous meetings, communication, and Microsoft Word. For each tool or application of interest, we examine the average number of hours logged per week.

iReady is a self-contained learning and assessment tool that can also be used to support blended instruction and teacher-directed interventions. iReady variables of interest include the average number of weekly active hours logged during that same period.

The analyses include data for the fall 2020 semester. Additionally, we limited the analyses to fourth- through eighth-grade students due to low reliability in lower grade test scores. High school grades were excluded due to lower rates of technology usage in higher grades and the use of a different test that could not be nationally normed or linked to the exam used in grades K–8.

Methodology

We estimate reductions in student achievement growth by the extent of virtual learning engagement. For this report, we define the learning impact on student achievement growth in a subject as the difference between each student’s realized winter school year (SY) 2020-21 iReady test score and the winter SY 2020-21 test score we predict they would have achieved if the COVID-19 pandemic and associated school closures had not occurred.

To calculate the predicted scores, we first estimate achievement growth trends for students pre-COVID. We create these prediction models by estimating winter SY 2019-20 test scores based on prior (fall SY 2019-20 and winter SY 2018-19) test scores while accounting for student demographics. We then combine these estimated relationships and each student’s characteristics and (fall SY 2020-21 and winter SY 2019-20) test scores to predict their scores in winter SY 2020-21. The resulting learning impact measures capture the

difference between the actual and expected winter 2021 test scores for approximately five months: from the beginning of the fall SY 2020-21 test administration through the test scores collected during the winter SY 2020-21 administration. The following analysis is conducted at the week level. Thus, we examine average weekly hours logged and the corresponding weekly scale-score growth differential.¹

Research Questions

We address two research questions:

1. How large are disparities in the quantity and type of virtual learning students experience, by race and ethnicity and socioeconomic status?
2. To what extent is student learning during the COVID-19 pandemic associated with those same disparities in virtual learning use and dosage?

To answer these questions, we examine differences in student usage and outcomes within the same school. This is in response to preliminary analyses that showed virtual learning varies more at the school level than based on individual student characteristics.² This approach makes intuitive sense because teachers within the same school face similar opportunities and constraints related to school-level resources, support, and leadership.

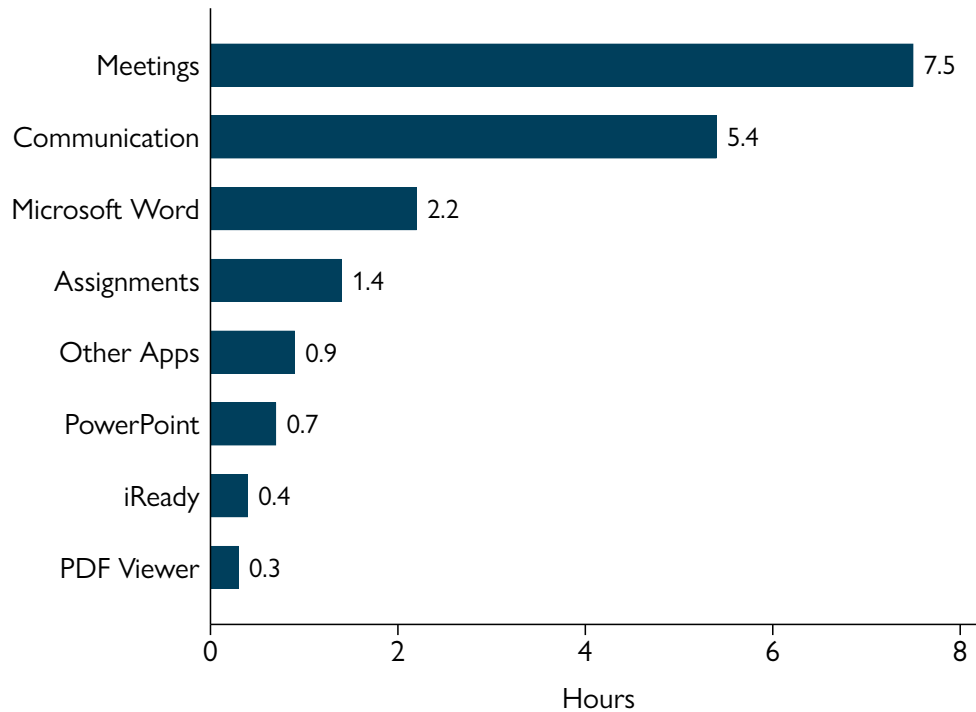
All findings presented in this report have a correlational rather than causal interpretation, as we cannot control for potentially confounding student factors when no data exist and data cannot be collected. By examining differences within the same school, however, we can control for many of the unmeasured structural differences in schools and the neighborhoods they serve.

Finding 1: Application Engagement Patterns

Students spent less time using virtual learning applications compared to average seat time before the pandemic.
Usage patterns sometimes differed across student groups.

During the study period (August through December 2020), Teams was used almost universally among fourth- through eighth-grade students in the

Figure 1. Average Hours Per Week by Application



district. Additionally, 91% of students completed at least one iReady lesson. During a typical week in the fall 2020 semester, the average student logged approximately 14 hours per week virtually. In comparison, the district's bell schedule indicates that during traditional face-to-face instruction, students would spend slightly over 33 hours per week (or 6 hours and 40 minutes per day) in school.

Figure 1 shows average hours per week by software application. Of the 14 virtual hours per week logged by students during the study period, students spent around 7 hours per week in screen-to-screen, synchronous meetings, 5 hours per week in communication programs, and 2 hours per week in Microsoft Word.

Figure 2 shows that Black students logged more time in synchronous meetings than White students. For other applications and online tools, students belonging to marginalized groups (e.g., Hispanic students, Black students, students eligible for free or reduced-price meals (FRPM), students with disabilities) logged a comparable number or significantly fewer hours per week across applications (as shown in Figure 2 through Figure 5).

Figure 2. Fourth through Eighth Grade Hours Per Week in Math, by Application and by Race and Ethnicity

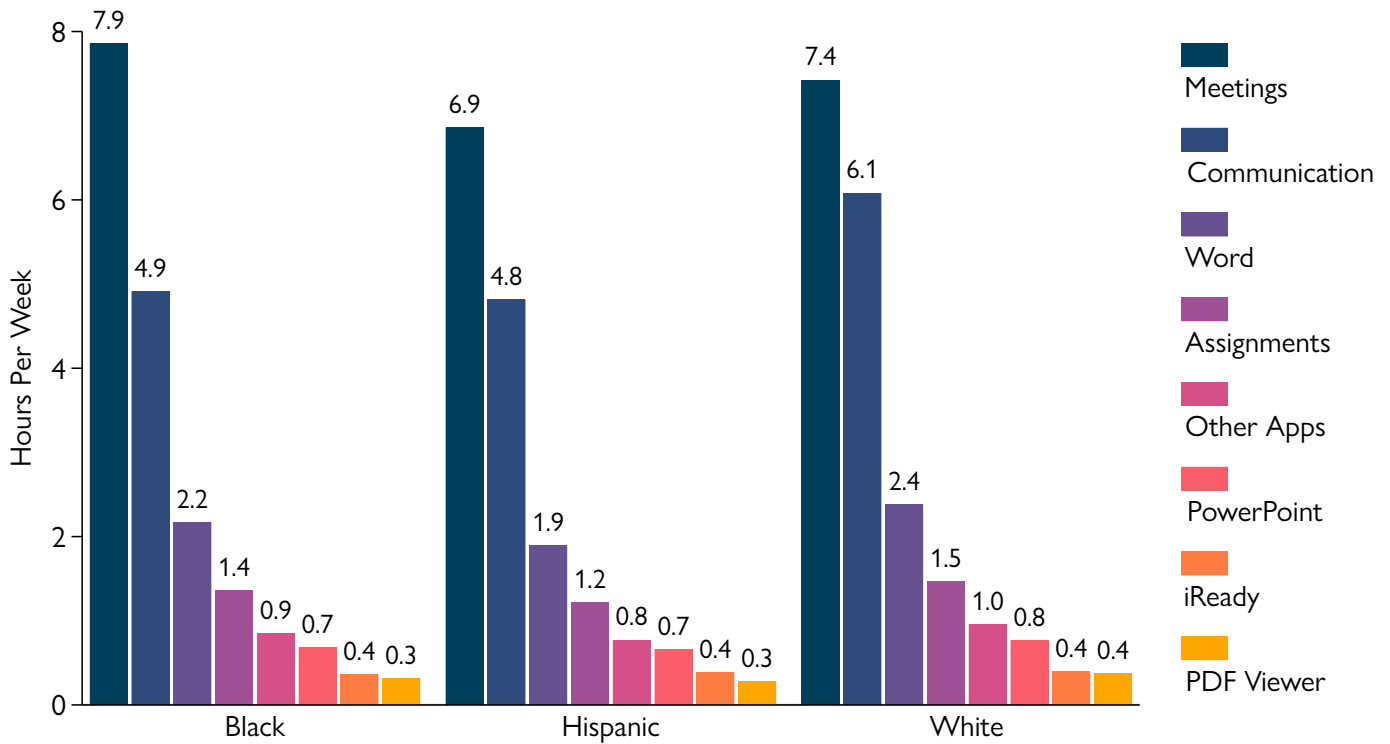


Figure 3. Fourth through Eighth Grade Hours Per Week in Math, by Application and by Gender

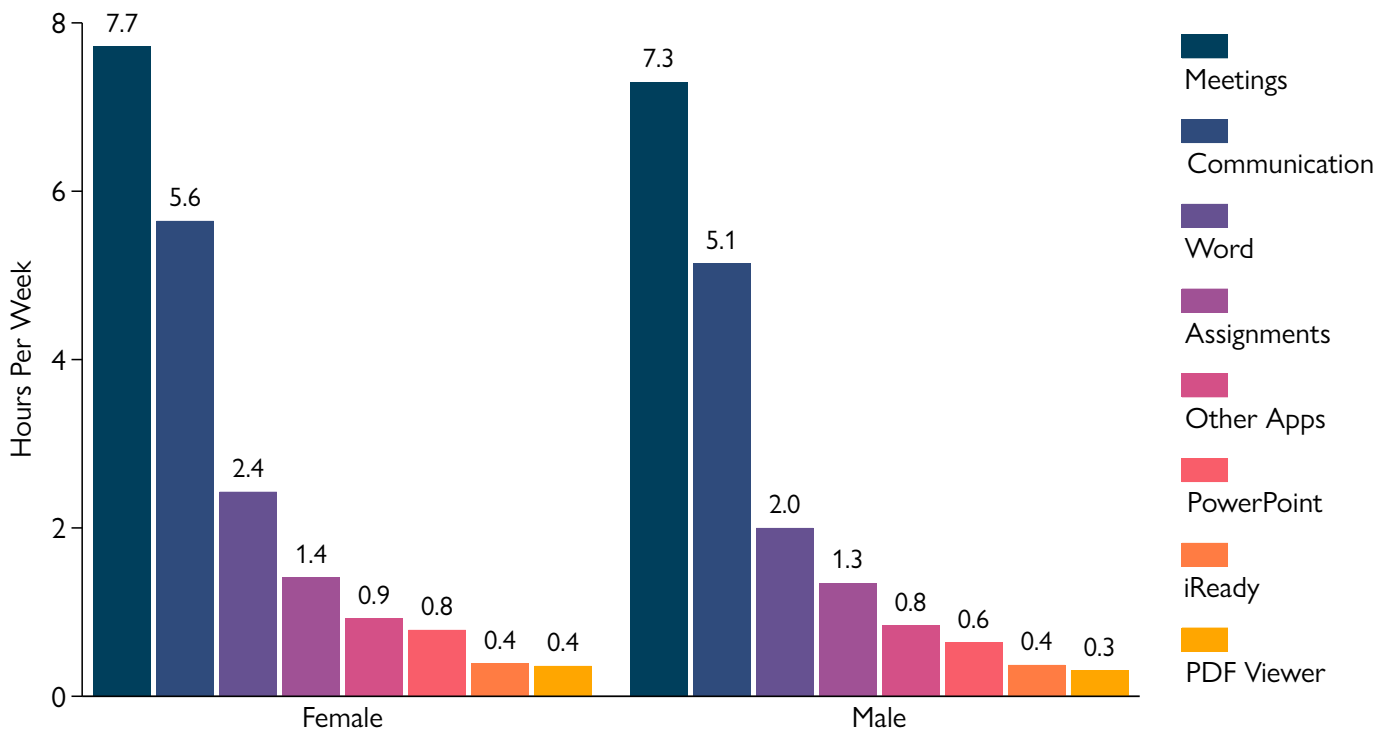


Figure 4. Fourth through Eighth Grade Hours Per Week in Math, by Application and by FRPM Status

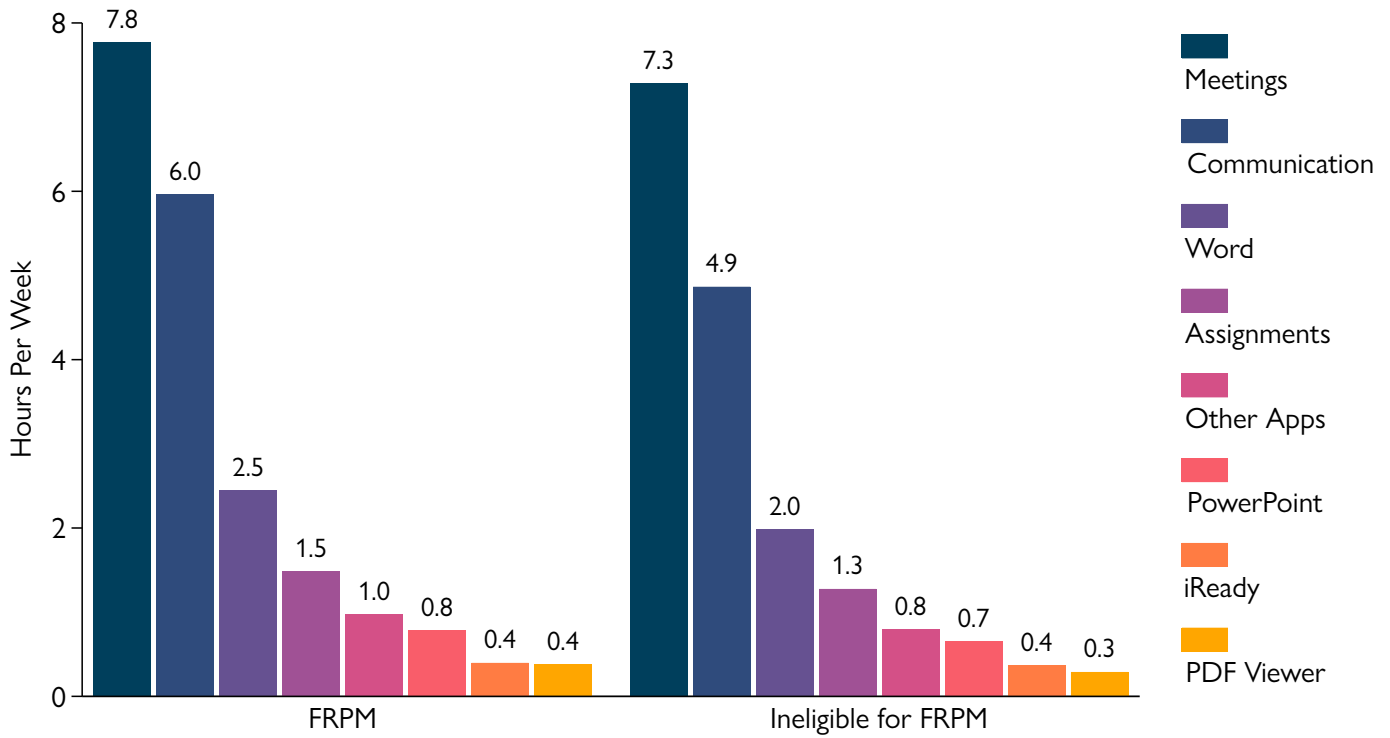


Figure 5. Fourth through Eighth Grade Hours Per Week in Math, by Application and by Disability Status

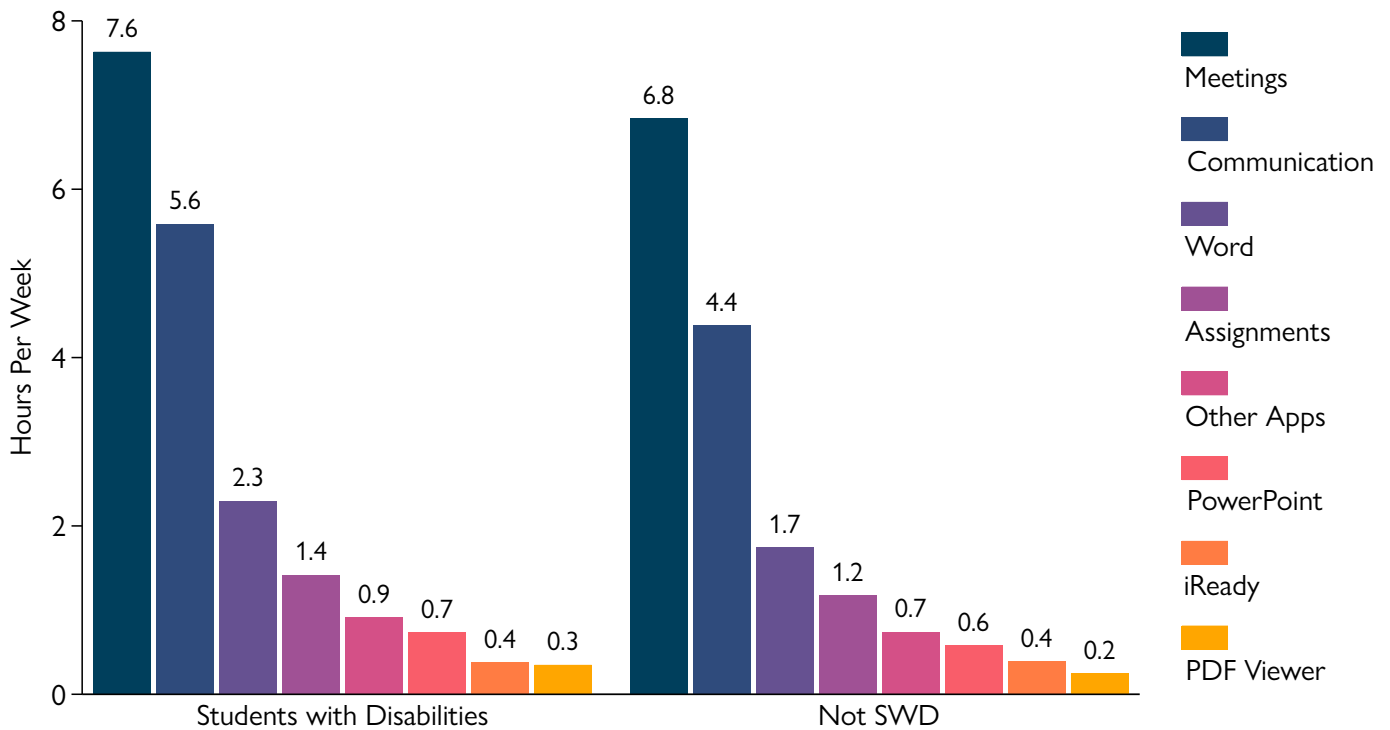
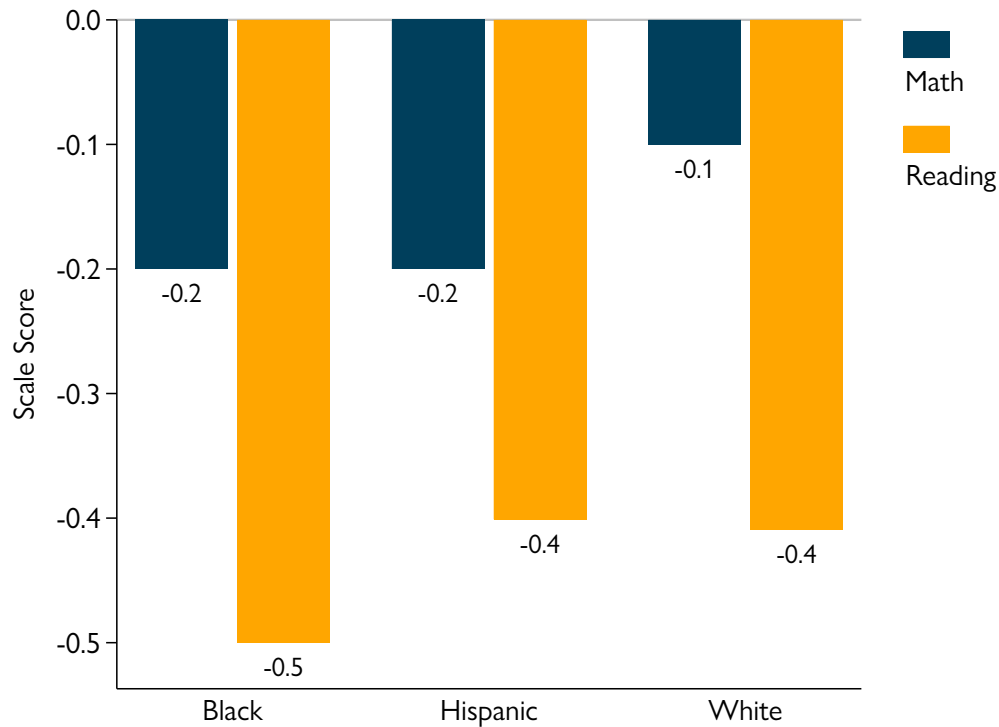


Figure 6. Fourth through Eighth Grade Learning Outcomes by Race and Ethnicity: Estimated Weekly Within-School Differential in Student Achievement Growth during the Fall 2020 Semester by Student Characteristics

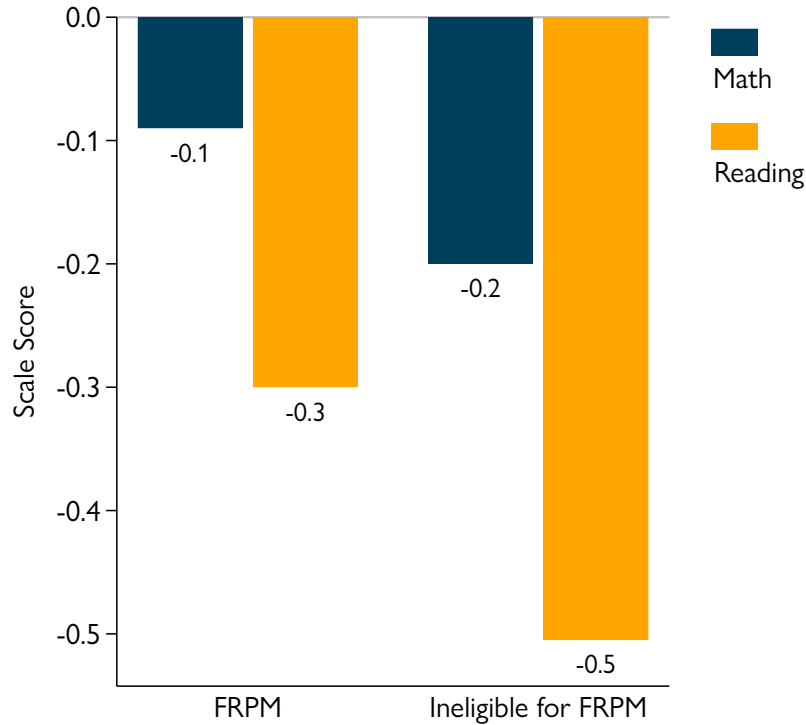


Finding 2: Student Achievement Growth During the Pandemic

Students' weekly achievement growth under virtual learning during the pandemic was lower than pre-pandemic trends predicted.

Students scored approximately three scale score points lower in math and seven scale score points lower in reading than pre-COVID trends predicted, after accounting for students' prior test score histories, characteristics, and grade level. Figures 6 and 7 translate scale score points into the equivalent change in scale score growth. Math scale score growth was about 0.1 to 0.2 scale score points lower than expected each week, while reading was approximately 0.4 to 0.5 scale score points lower each week than expected. Prior to COVID-19, students in grades 4-8 were expected to score around 0.6 scale score points higher each week.³ Based on this rough approximation,

Figure 7. Fourth through Eighth Grade Learning Outcomes by FRPM Status: Estimated Weekly Within-School Differential in Student Achievement Growth during the Fall 2020 Semester by Student Characteristics



the lower math growth corresponded to 17% to 33% of typical achievement growth, while the lower reading growth corresponded to 67% to 83% percent of typical growth.

The estimated reduction in student achievement growth was larger for students belonging to marginalized groups, particularly for students eligible for FRPM (Figure 7). When focusing on student groups by race and ethnicity (Figure 6), only student achievement growth in math for Black students and Hispanic students was statistically significant.

Table 1. Associations Between Fourth Through Eighth Grade Virtual Learning Usage and Weekly Differential in Student Achievement Growth

	Math	Reading
Meetings (hours/week)	0.005 (0.003)	0.010 (0.005)
Communication (hours/week)	0.000 (0.002)	0.003 (0.002)
Word (hours/week)	0.035** (0.010)	0.058*** (0.015)
Assignments (hours/week)	-0.000 (0.017)	-0.006 (0.027)
Other apps (hours/week)	-0.007 (0.016)	-0.029 (0.018)
PowerPoint (hours/week)	0.028 (0.014)	0.063*** (0.017)
iReady (hours/week)	0.431*** (0.040)	0.616*** (0.079)
PDF viewer (hours/week)	0.124* (0.050)	0.334*** (0.078)
Image app (hours/week)	0.196*** (0.051)	0.351*** (0.091)
Media app (hours/week)	0.423* (0.172)	0.148 (0.249)
Excel (hours/week)	0.224 (0.143)	0.176 (0.228)
Grade & school FE	Y	Y
Student characteristics	Y	Y
N	21,027	21,149
R-squared	0.032	0.030

Finding 3: Virtual Engagement and Learning Outcomes

More hours spent using virtual learning applications was associated with higher weekly rates of student achievement growth.

Using a regression model, we also examined associations between students' virtual engagement and learning outcomes. We based predictions of learning outcomes on students' pre-COVID achievement test scores, grade level, and sociodemographic characteristics. The model compared students to others enrolled in the same school and grade after accounting for variation in student test-score histories and observable characteristics.

Table 1 reports estimates from the regression model. Apart from several non-significant negative associations, greater use of virtual learning applications was associated with higher rates of student achievement growth. Each additional hour per week that students spent on the iReady platform was associated with scoring approximately 0.4 scale score points higher in math and 0.6 points higher in reading than predicted. Across the 18-week semester, these gains translated into approximately 7 and 11 more scale score points in math and reading, respectively. These correlations should not be interpreted as causal estimates; more motivated students and those with stronger parental supports may have scored more highly in math and reading and also may have tended to log in more, for example.

The use of Microsoft Word, image apps, and PDF viewers were also significantly associated with positive gains in both subjects. These programs are often used to facilitate student-directed, interactive assignments. By contrast, time spent in the meeting application could represent varied forms of learning (e.g., administrative tasks, lecture, discussion) with equally varied likely associations with learning.

Results by the proportion of remote (versus hybrid or face-to-face) days of school attended are shown in Appendix Table 2. Similar patterns persisted by application, particularly the strong positive association between student achievement growth in the use of both iReady and Word. Notably, when limiting the sample to students who attended entirely online during the fall 2020 semester, we identified a significant, positive association between student achievement growth and hours per week logged in meetings.

Conclusions

We find that students logged fewer instructional hours virtually than they spent in classrooms during a traditional, face-to-face school day in fall 2020. Consequently, the pandemic “learning gap” might be more accurately portrayed as an “opportunity gap” due to less access to educational experiences.

Within the same school and grade, female students logged more hours across Teams and iReady than male students. This discrepancy likely reflects greater behavioral engagement among female students. Black students logged more time in synchronous meetings than their peers. Conversely, Hispanic students, low-income students, and students with disabilities logged less time in Teams and iReady programs. These differences across student subgroups may reflect differential access to the virtual instructional environment.

Variation in technology usage during the pandemic is likely associated with differences in family characteristics and resources, including (but not limited to) the ability of guardians to provide or pay for supervision and academic support during the school day. Furthermore, our analysis was unable to fully control for the degree of engagement due to students' motivation or self-regulation. There may also have been variation in activities assigned by teachers within the same school.

We intend to conduct several additional analyses that may allow us to produce more plausibly causal estimates of the effect of virtual learning. For instance, we will control for parental preferences and resources by accounting for parental responses to a survey of instructional mode preferences. We will also examine variation in engagement and achievement growth across students within the same classroom. This approach will allow us to hold constant unobserved factors that could affect both engagement and test scores, such as teacher quality and peer influences. Additionally, we will examine student-level changes in engagement throughout the semester, which are associated with switching to or from fully remote learning.

Endnotes

1. Teams and student achievement growth data were reported at the semester level. To estimate the average number of hours logged per week, we divided the total number of hours logged by the number of weeks in the semester. To estimate the average weekly scale-score growth differential, we divided the total differential in scale score growth (between the predicted and actual scores) by the number of weeks in the semester.
2. For the preliminary analyses, we estimated regression models that included school fixed effects. The use of school fixed effects means that we compared a student to other students at the same school, not to all other students in the district. Reported standard errors allowed for clustering at the school level.
3. Average scale score growth prior to the pandemic was calculated based on the assumption of a 20-point scale score increase over a semester. Additional specifics in variability in expected increases by grade and subject is available at freeman.wjUSD.org/documents/Learning%20Resources/I-Ready/ExpectedScaleScoreGrowthChartsforI-Ready2015-16.pdf

About the Authors

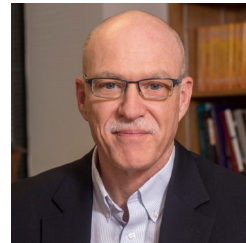
Jennifer Darling-Aduana

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Tim R. Sass

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Henry T. Woodyard

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The Georgia Policy Labs is an interdisciplinary research center that drives policy and programmatic decisions that lift children, students, and families—especially those experiencing vulnerabilities. We produce evidence and actionable insights to realize the safety, capability, and economic security of every child, young adult, and family in Georgia by leveraging the power of data. We work alongside our school district and state agency partners to magnify their research capabilities and focus on their greatest areas of need. Our work reveals how policies and programs can be modified so that every child, student, and family can thrive.

Housed in the Andrew Young School of Policy Studies at Georgia State University, we have three components: the Metro Atlanta Policy Lab for Education (metro-Atlanta K-12 public education), the Child & Family Policy Lab (supporting children, families, and students through a cross-agency approach), and the Career & Technical Education Policy Exchange (a multi-state consortium exploring high-school based career and technical education).

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