Revisiting the Digital Divide: Digital Learning during the Pandemic

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Executive Summary

When the COVID-19 pandemic closed schools in March 2020, most students and teachers switched from in school to remote learning—a change that some communities were better equipped to handle than others (Curriculum Associates, 2020). While research from spring 2020 highlighted the divide in usage of digital instruction between students in schools in zip codes with different income levels, researchers quickly shifted their attention to the effects of the pandemic on student performances (Curriculum Associates, 2021; Kuhfeld, Tarasawa, Johnson, Ruzek, & Lewis, 2020). However, due to differential responses to the pandemic, many students continued remote learning well into the 2020–2021 school year, and these students were more likely to come from historically marginalized demographic groups (Harris & Oliver, 2021; Rome & Cançado, 2021).

In this study, we examined usage of the *i-Ready Personalized Instruction* digital learning platform prior to and during the pandemic. We found that weekly usage rates were disrupted beginning in March 2020 and did not recover to baseline levels during the 2019–2020 school year. Even during the 2020–2021 school year, the overall weekly usage rates were consistently below those of the baseline 2018–2019 school year. We looked at usage rates during the 2020–2021 school year separately by where students reported testing on the *i-Ready Diagnostic* (in school or remote) and found that usage was rank-ordered based on the amount of in-school testing. Students who tested in school for most of the year had higher usage rates and spent more time working on *i-Ready* lessons than did students who tested out of school for most of the year.

Testing location was the most important driver of *i-Ready Personalized Instruction* usage during the pandemic. Students in schools of all income levels and locales, and students of all racial/ethnic groups showed a significant difference in both weekly usage rates and total Time-on-Task, between in-school and out-of-school testers during the 2020–2021 school year. Usage differences between in-school and out-of-school testers were largest for students in schools in lower-income zip codes and urban areas and for Hispanic students. The differences between in-school and out-of-school testers appeared to interact with the fact that students from historically marginalized demographic groups were also less likely to be testing in school (Rome & Cançado, 2021). As a result, there were sizeable differences in the effects of the pandemic on students in cities, relative to suburbs, and students of color, relative to White students.

This study sheds light on the access and usage of one prominent digital instruction platform from before the pandemic and through the 2020–2021 school year. The results provide insight into how the pandemic, combined with pre-existing inequities, disproportionately impacted the usage of one digital instruction platform for students from historically marginalized populations: Black and Hispanic students and student in schools in low-income zip codes.

Introduction

In March 2020, the COVID-19 pandemic closed the doors of schools across the United States. Students and teachers were suddenly forced into a remote learning environment that highlighted a digital divide among families in different socioeconomic groups. Timely research from household and teacher surveys (Ong, 2020; Stelitano, Doan, Woo, Diliberti, Kaufman, & Henry, 2020; Gao & Hayes, 2021) and usage of digital learning platforms (Curriculum Associates, 2020) pointed to persistent differences in internet access between low-income and high-income families and between students of color and White students. It is these differences—differences in students' access and engagement with online instruction during the pandemic—that we focus on and refer to as the "digital divide" during the remainder of this report.

During the 2020–2021 school year, attention shifted to the impact of COVID-19 on student achievement (Curriculum Associates, 2021; Kuhfeld et al., 2020). However, the digital divide persisted, with survey data showing that nearly 40% of low-income students in Grades K–12 lacked reliable internet at home (Gao & Hayes, 2021). What's more, research on school calendars and students' self-reported interim testing locations has shown that the same groups of students who were most impacted by the digital divide in spring 2020—namely students of color and students in low-income, urban areas—were also the most likely to be away from their school building during the 2020–2021 school year (Harris & Oliver, 2021; Rome & Cançado, 2021). While the existing research highlights a potential divide in digital learning access during the 2020–2021 school year, there is a notable lack of comprehensive research examining the extent to which this potential divide was manifested in digital learning data.

This study uses data from Curriculum Associates' *i-Ready Personalized Instruction* (referred to hereafter as *i-Ready*) digital learning platform to examine the effect of the pandemic on students' access and engagement with online instruction during the pandemic. Specifically, we looked at *i-Ready* usage across the last three full academic years, starting with the 2018–2019 school year as a baseline, to understand what weekly login rates and total hours of *i-Ready* usage looked like prior to COVID-19 and how usage changed during the pandemic. Finally, we used students' self-reported *i-Ready Diagnostic* testing locations during the 2020–2021 school year to parse out differences in usage among students who spent various amounts of the school year in school or remote.

The data analyzed for this report comes from a common sample of 8,558 schools that used *i-Ready* in each of the last three academic years. In each year, more than 3.5 million students used *i-Ready* in these schools. The analyses presented here give a comprehensive view of the effect of COVID-19 on online instruction access and usage and how these effects differed based on demographic characteristics and students' in-school or remote testing patterns during the 2020–2021 school year.

Methodology

Research Questions

This study aims to answer the following research questions:

1. How did *i-Ready* usage during the last two school years compare to usage during the 2018–2019 school year?
   a. How did weekly usage trends change during the pandemic?
   b. How did students' total Time-on-Task differ between the three school years?
2. How did *i-Ready* usage differ between in-school testers and remote testers during the 2020–2021 school year?
   a. How did weekly usage trends differ between students with differing patterns of testing locations throughout the year?
   b. How did students' total Time-on-Task differ between students with differing patterns of testing locations throughout the year?
3. How did *i-Ready* usage differ between students in schools in various income and locale groups?
   a. How did weekly usage trends differ based on school-level median income and locale groups?
   b. How did students' total Time-on-Task differ based on school-level median income and locale groups?
   c. How did students' total Time-on-Task differ based on the cross-section of school-level median income and locale groups and testing location pattern during the 2020–2021 school year?
4. How did *i-Ready* usage differ between students of different racial/ethnic groups?
   a. How did weekly usage trends differ based on student race/ethnicity?
   b. How did students' total Time-on-Task differ based on student race/ethnicity?
   c. How did students' total Time-on-Task differ based on the cross-section of student race/ethnicity and testing location pattern during the 2020–2021 school year?

Data

This study uses data from Curriculum Associates' *i-Ready Personalized Instruction*, a digital learning platform for students in Grades K–8. In *i-Ready*, lessons are sequenced to support students' growth, with scores on the *i-Ready Diagnostic* assessment driving each student's personalized lesson queue. Teachers may also assign specific lessons as desired. Curriculum Associates' guidance and research suggests that students should use *i-Ready* for 30–49 minutes per week in both Reading and Mathematics (Curriculum Associates, 2021a).

In addition to the *i-Ready* digital learning data, students' self-reported testing location in the *i-Ready Diagnostic* assessment was used as an imperfect proxy for learning location throughout the 2020–2021 school year. *i-Ready Diagnostic* is an online adaptive assessment taken up to three times per academic year. Finally, publicly available data from the National Center for Education Statistics (NCES) Common Core of Data (CCD) and median annual income by zip code data from the US Census (2019) were used for the school-level demographic analyses.

Sample Description

The sample used for this study comes from the population of students who used *i-Ready* between August 2018 and June 2021. To ensure a fair comparison across academic years, we limited the sample to only school, subject (i.e., Reading or Mathematics), and grade combinations with at least 25 *i-Ready* users in each of the three academic years. Additionally, we filtered out school, subject, and grade combinations that showed inconsistencies in their implementation during the study period (i.e., a large decrease or increase in the number of users during any of the three academic years). We also removed schools that we were unable to link with the NCES CCD data. Table 1 shows the number of unique schools and students included in the analyses for each academic year. Table A1 in Appendix A summarizes the demographics of the included schools.

Table 1: Number of Unique Schools and Students by Subject and Grade

Grade	Reading				Mathematics			
	N Schools	N Students			N Schools	N Students		
		2018–2019	2019–2020	2020–2021		2018–2019	2019–2020	2020–2021
K	3,503	310,127	302,656	262,846	4,072	356,459	349,169	299,631
1	4,062	364,241	355,769	322,376	4,682	414,841	407,086	366,232
2	4,406	396,613	386,086	354,487	4,960	440,615	429,376	391,309
3	4,610	425,897	416,056	373,377	5,171	466,956	455,895	409,791
4	4,558	422,379	407,610	379,890	5,123	468,403	451,045	417,990
5	4,357	424,214	405,691	366,944	4,924	472,521	452,947	409,363
6	2,195	288,087	284,694	249,001	2,452	330,046	329,696	294,777
7	1,548	237,051	233,495	206,895	1,775	279,185	281,223	253,362
8	1,448	211,057	215,085	190,890	1,619	231,876	234,568	215,115

The sample included more than 190,000 students from more than 1,400 schools in every subject and grade. Students could appear in the samples for both Reading and Mathematics. The number of students within a subject and grade was generally comparable between the 2018–2019 and 2019–2020 school years. However, in the 2020–2021 school year, there was a noticeable drop-off in the number of students who used *i-Ready*, despite using a common set of schools across the three years. This trend, which we believe to be related to the pandemic, is further explored in Appendix B. The implications of this effect are that there are likely students who did not use *i-Ready* during the 2020–2021 school year who would have, were it not for the pandemic. As such, estimates of average time spent in *i-Ready* during the 2020–2021 school year may be inflated, as there are likely students missing from the dataset who should have been included with a Time-on-Task of 0.

Results

Research Question #1: Year-over-Year *i-Ready* Usage

Year-over-Year Weekly Usage

To answer Research Question 1a, we calculated weekly usage rates by grade for all three school years. Weeks were defined as Monday through Sunday, starting with the week after August 1 and going through the week of June 15, per the *i-Ready Diagnostic* testing windows.[1] Weekly usage rates were calculated by dividing the number of unique students who used *i-Ready* during the given week by the total enrollment, according to NCES, of the schools included in the sample for the given grade. In other words, the usage rates can be thought of as the percentage of all students in the included schools who used *i-Ready* in each week. Usage rates varied somewhat by grade, but the trends across school years were consistent between grades. As such, we've chosen to focus on Grade 3 as the exemplar grade. Figure 1 shows the usage rate, by school year, for Grade 3 students.

Figure 1: Weekly *i-Ready* Usage Rates in Grade 3 by School Year
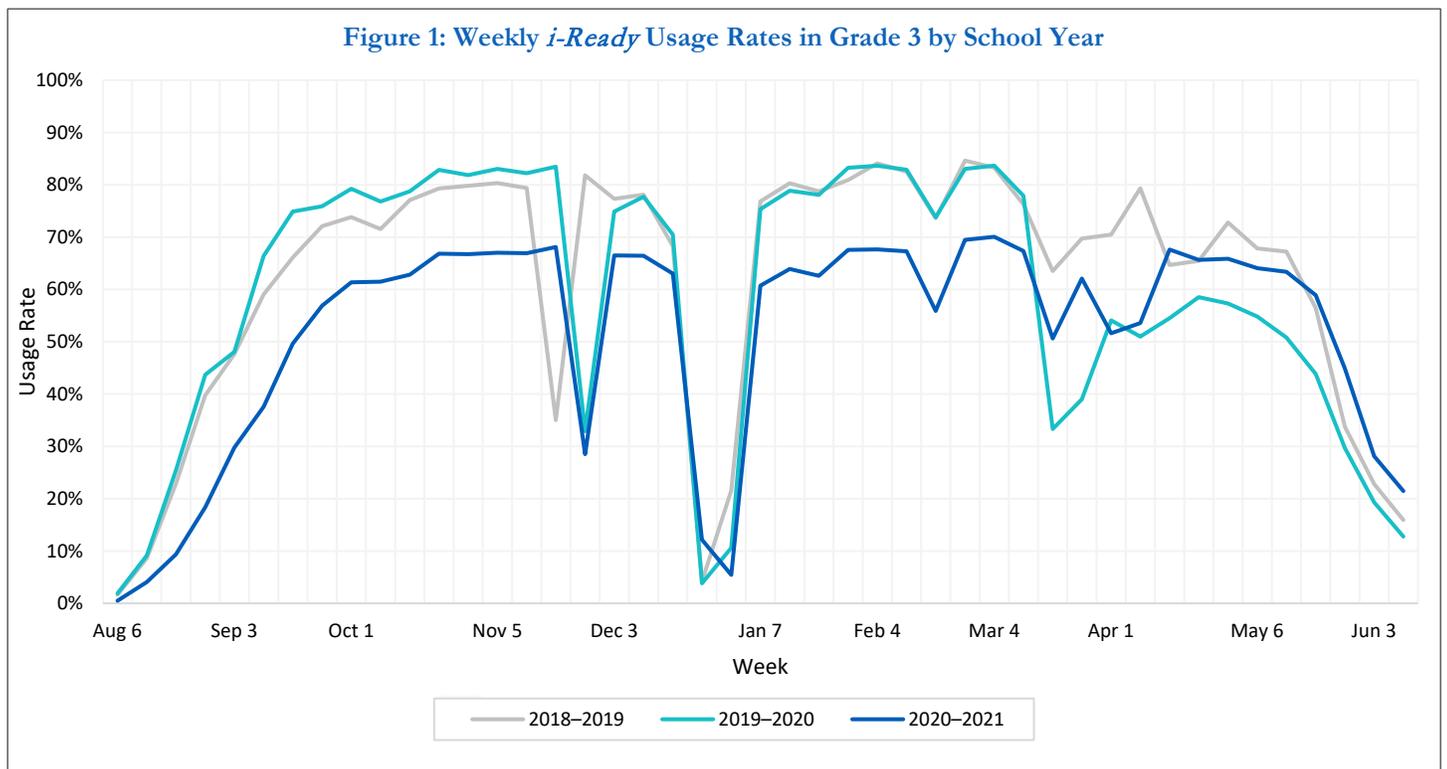
During the baseline year, 2018–2019, there was an increase in the *i-Ready* usage rate every week from the beginning of August to the beginning of October, as schools began to open. Starting in October, usage stayed above 70%, except for the weeks of Thanksgiving and winter break, until mid-March, when the combination of state summative testing and spring breaks caused the usage rates to fluctuate before declining steadily starting in mid-May, as schools began to close.

During the 2019–2020 school year, usage rates began slightly higher than the baseline year until Thanksgiving, which fell one week later than in 2018. After Thanksgiving, the 2019–2020 usage rates mirrored that of the baseline year, until the week of March 16, 2020, when COVID-19 forced schools nationwide to close. In the first week of the pandemic, the usage rate dropped to 33%, just

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[1]The three *i-Ready* testing windows are defined as follows:

Fall: August 1 to November 15

Winter: November 16 to March 1

Spring: March 2 to June 15

more than half of what it was in the baseline year. While usage rates recovered between mid-March and mid-April, they never again reached the rates of the baseline year. Additionally, the decline in usage as schools began closing for the year started earlier than during the baseline year, with 2019–2020 usage rates dropping every week starting in mid-April. It is clear from this year-to-year comparison that the pandemic caused a disruption in students' weekly access of digital instructional tools.

During the 2020–2021 school year, the weekly usage rate was much slower to warm up at the start of the school year, presumably because many schools delayed their start dates or began the year in remote learning. But the rates stayed low throughout the year. While usage rates stayed above 70% throughout most of the baseline year, in 2020–2021, there was just one week—the first week of March—where the weekly usage rate reached 70%. However, unlike the previous year, the academic year ended relatively strong, with 2020–2021 usage rates surpassing those of the baseline year during each of the last four weeks. Across the entire 2020–2021 academic year, the weekly *i-Ready* usage rates seemed to fall between what we see in a normal year and what we saw during spring 2020, when the pandemic first forced schools to close.

Year-over-Year Aggregate Usage

To answer Research Question 1b, we aggregated Time-on-Task in *i-Ready* for each student within each school year. We then conducted an Analysis of Variance (ANOVA) within each subject and grade combination, where the outcome was the total number of hours spent using *i-Ready* and the grouping variable was the school year. Additionally, we conducted pairwise comparisons between each academic year to test the statistical significance of the differences in total hours of *i-Ready* usage between each pair of school years. All ANOVAs and nearly all pairwise comparisons between academic years were statistically significant, with α adjusted according to the number of significance tests and comparisons. The only non-significant pairwise comparisons were between 2018–2019 and 2019–2020 in Grade 8 Reading and Grades 7 and 8 Mathematics and between 2018–2019 and 2020–2021 in Grade 4 mathematics. The partial-η^2 values from the models were all very small, with the largest being .014 in Grade K Mathematics. Examining individual mean differences, Cohen's *d* ranged from less than .01 to .285. Complete ANOVA and effect size results can be found in Appendix Tables A2 and A3. Figure 2 shows the average number of hours of *i-Ready* usage by subject, grade, and school year.

Figure 2: Average Hours of *i-Ready* Usage by School Year
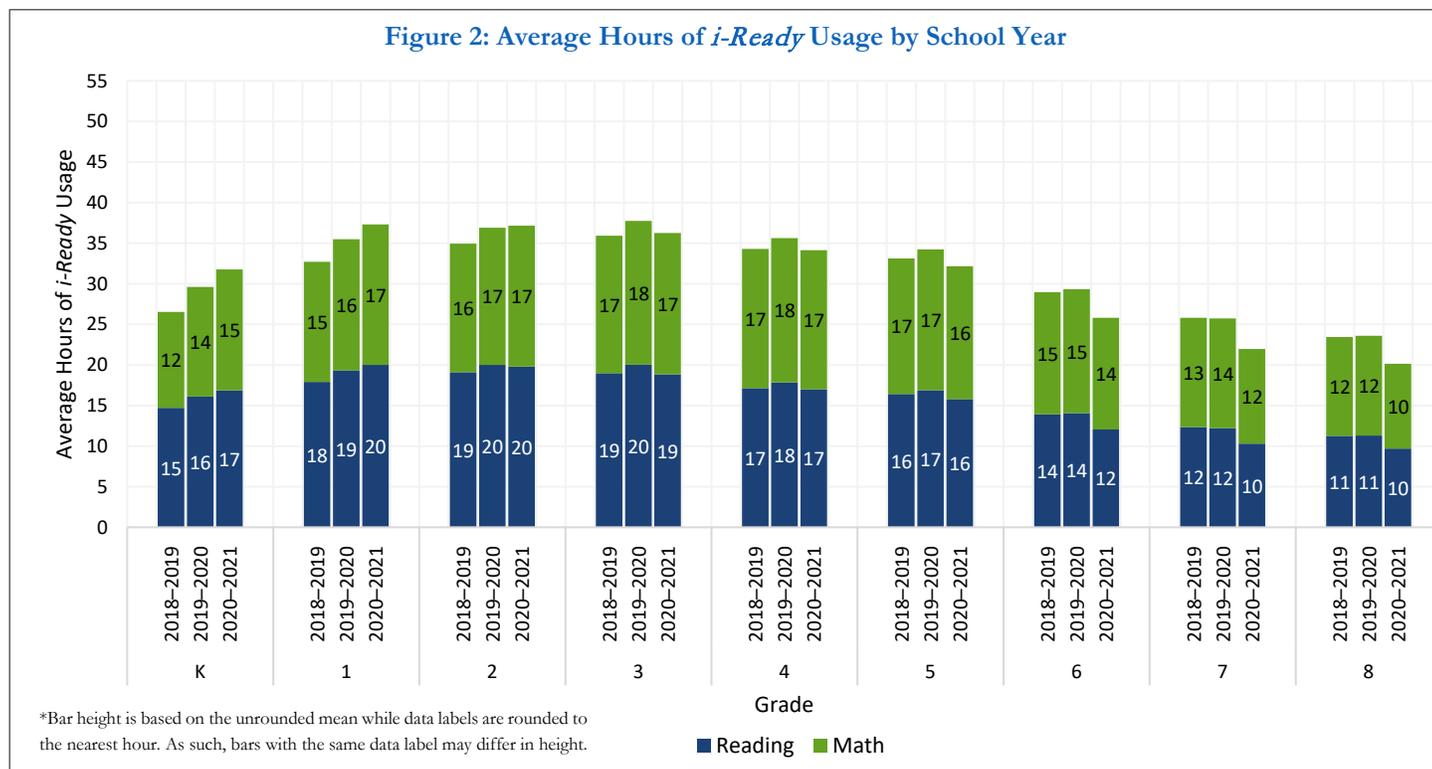
The year-over-year changes in hours of *i-Ready* usage were similar across Reading and Mathematics but differed noticeably by grade level. In Grades K–1, the number of hours increased each year from 2018–2019 to 2020–2021. In Grade 2, the number of hours

increased in 2019–2020 before leveling off in 2020–2021. In Grades 3–5, there was an increase in 2019–2020 followed by a return to baseline levels in 2020–2021. Finally, the middle school grades saw little to no increase in hours of *i-Ready* usage in 2019–2020 and a noticeable drop during the 2020–2021 school year. The mean differences were generally small, with the largest difference in hours between two adjacent years being just two hours.

Research Question #2: *i-Ready* Usage by Testing Location

Weekly Usage by Testing Location

Addressing Research Question 2 required focusing on only the 2020–2021 school year and separating out usage by students' self-reported *i-Ready Diagnostic* testing location. After examining the frequencies of testing location patterns across the three testing windows, we found four distinct testing location patterns that accounted for most students and represented what we know, anecdotally, about the 2020–2021 school year. These patterns, along with their frequencies, are shown in Appendix Table A4. For the analyses by testing location, we decided to focus on students with these four testing location patterns, referred to hereafter as In-In-In, Out-In-In, Out-Out-In, and Out-Out-Out.

To address Research Question 2a, we again calculated weekly *i-Ready* usage rates, this time by testing location during the 2020–2021 school year only. Because testing location is a student-level variable, we could not use the NCES enrollment figures in the denominator of the usage rates. Instead, the usage rates in this analysis were calculated by dividing the number of unique students who used *i-Ready* during the given week in the given testing location group by the total number of students in that testing location group who used *i-Ready* at all during the 2020–2021 school year. Therefore, the usage rates in this analysis can be interpreted as the percentage of all *i-Ready* users in each testing location group who used *i-Ready* during a given week. Because the calculation differs slightly from that used in the year-over-year analyses, the usage rates from Figure 3 should not be directly compared to those from Figure 1. Figure 3 shows the weekly usage rates by testing location during the 2020–2021 school year for Grade 3. While usage rates varied by grade, the trends across testing location groups were similar, so we are again focusing on Grade 3 as the exemplar.

Figure 3: Weekly *i-Ready* Usage Rates in Grade 3 by Testing Location
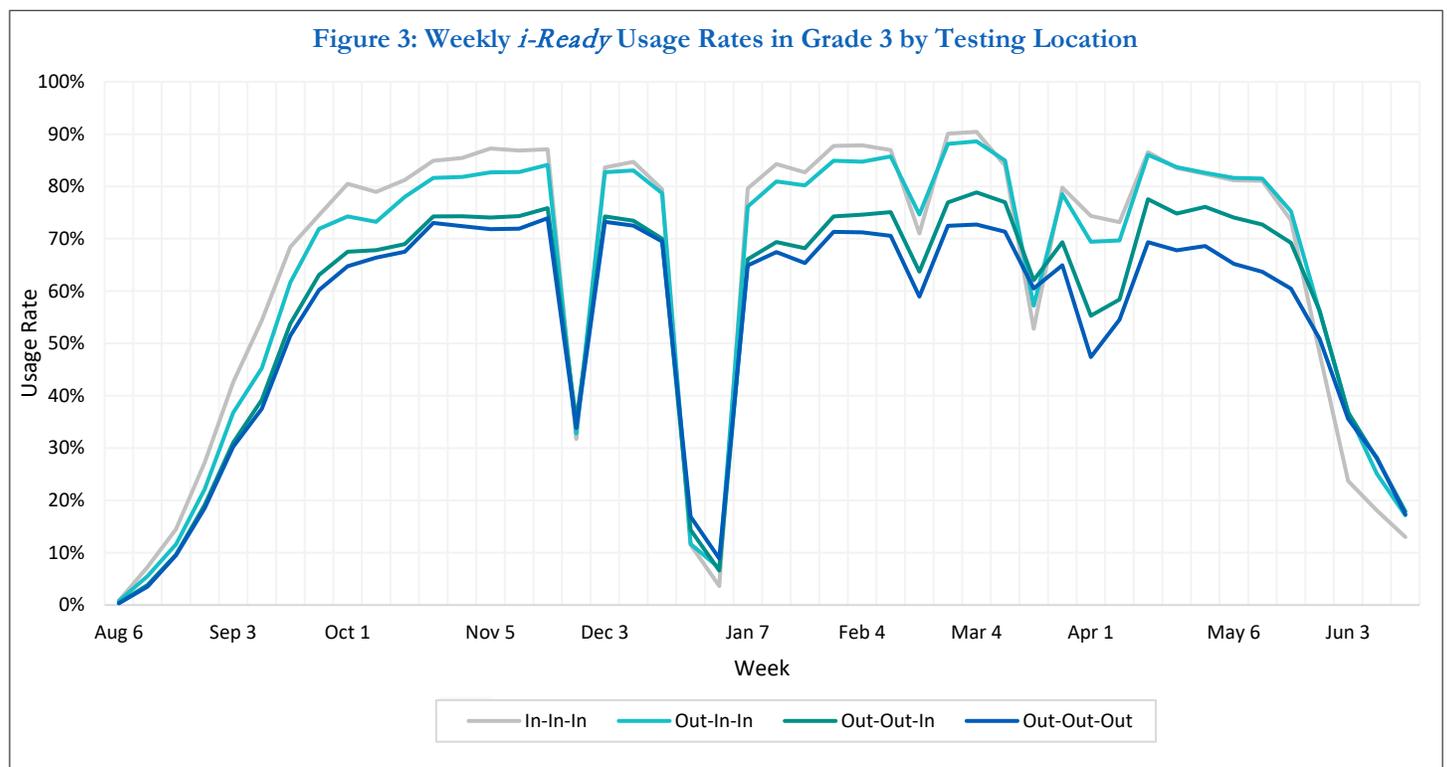
Across nearly the entire 2020–2021 school year, there was a rank-order of *i-Ready* usage rates such that students who tested in school for more testing windows showed higher usage rates than those with more testing windows out of school. Students who tested out of school in the fall before moving to in-school testing showed lower usage rates than those who tested in school all

year until mid-February, when the two groups started to show similar usage rates. The largest difference in usage rates was between the Out-In-In and Out-Out-In groups—in other words, those who tested in school for most of the year and those who tested out of school for most of the year. Other than the anomalous weeks where schools had Thanksgiving, winter, or spring breaks, the mostly in-school students had usage rates that were consistently between five and 10 percentage points higher than the mostly out-of-school students. Comparing the two groups that tested mostly out of school, usage rates were close in the early part of the school year, but the differences between the Out-Out-In and Out-Out-Out group widened after winter break, reaching a difference of more than five percentage points, in favor of the Out-Out-In students, by March.

Taken together with the findings from Research Question 1a, the results here indicate that the lower usage rates seen during the 2020–2021 academic year, relative to previous years, were likely due to low usage rates among students who were testing (and, presumably, learning) remotely. This implies a continuation of the digital divide into the 2020–2021 academic year: Students who spent the 2020–2021 academic year away from the school building accessed the *i-Ready* digital learning platform less than did students who spent the year in school.

Aggregate Usage by Testing Location

To answer Research Question 2b, we aggregated Time-on-Task in *i-Ready* across the 2020–2021 school year for each student. We conducted a similar ANOVA to that of Research Question 2a, but with testing location as the grouping variable. Within each subject and grade, we conducted one planned contrast, comparing students who tested mostly in school to those who tested mostly out of school. The overall ANOVA and planned contrast were statistically significant in every subject and grade. As with the year-over-year ANOVAs, the partial-η^2 values were small, with the largest being .021 in Grade 5 Mathematics. The complete ANOVA results can be found in Appendix Table A5. Appendix Table A6 shows the group means and the effect size (Cohen's *d*) of the difference between students who tested mostly in school and those who tested mostly out of school. Figure 4 shows the average number of hours of *i-Ready* usage by subject, grade, and testing location.

Figure 4: Average Hours of *i-Ready* Usage by Testing Location
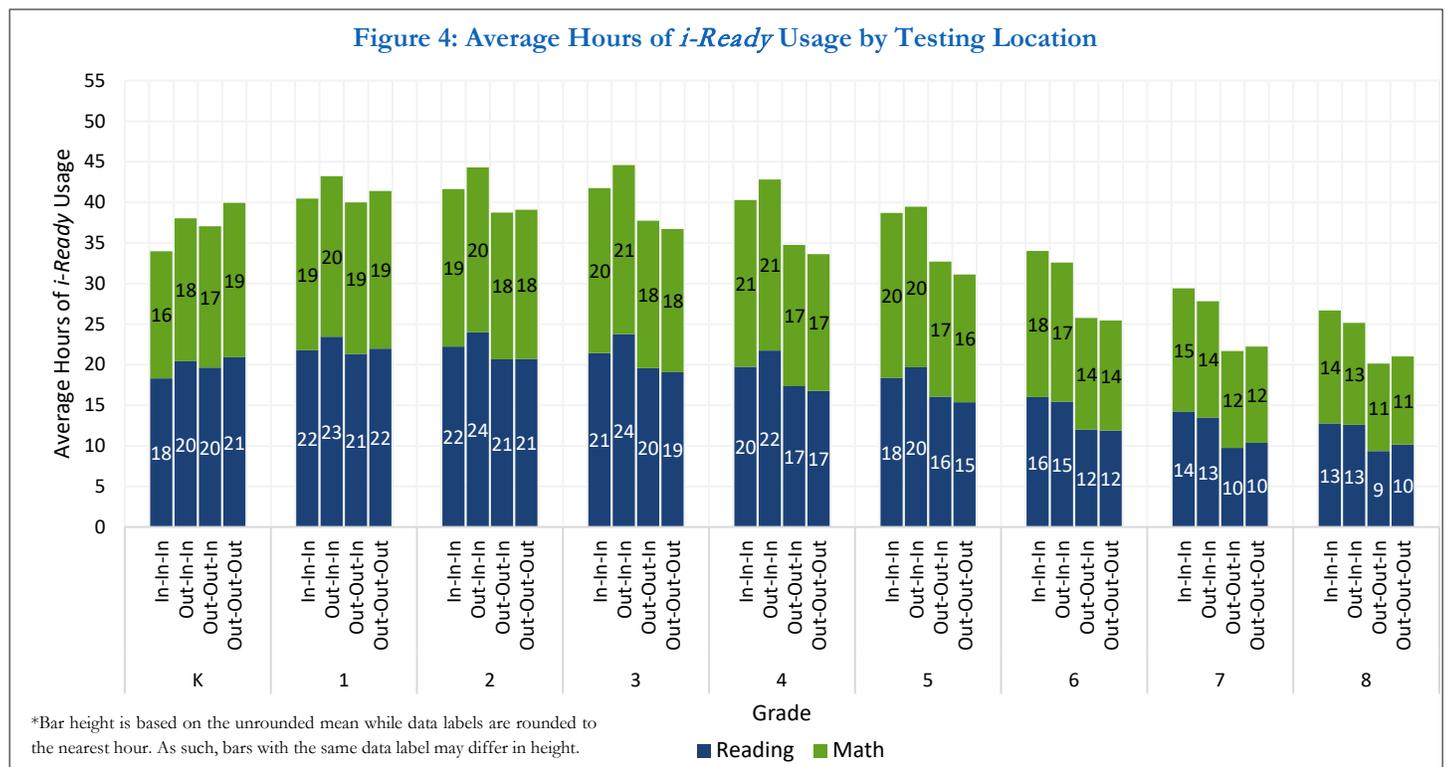
As with the year-over-year analysis, different trends emerged across grades. In Grades K–1, differences in hours of *i-Ready* usage across testing location groups were minimal, and there was not a clear difference between students who tested mostly in school and those who tested mostly out of school. Starting in Grade 2, we see a noticeable difference between students who tested mostly in school and those who tested mostly out of school, with the in-school students averaging between one and a half and four hours

more of *i-Ready* usage per subject than their out-of-school peers. These differences translate to effect sizes ranging from .106 in Grade 2 Mathematics to .307 in Grade 7 Reading. When we compare these results with the average time spent by academic year (Figure 2), we see that students in Grades K–5 generally spent more time in *i-Ready* during the 2020–2021 school year, compared to the baseline year, regardless of testing location. In other words, all testing location groups showed an increase in hours of *i-Ready* usage during the 2020–2021 school year, but the increase was greatest for students who spent most of the year testing in school. For students in Grades 6–8, those who tested mostly in school averaged more time in *i-Ready* than did students in the baseline year, while those who tested mostly out of school averaged less time in *i-Ready*, compared to the baseline year.

It is also worth noting the variability in average hours of *i-Ready* usage. Across all of Grades K–5, without exception, the standard deviations of hours of *i-Ready* usage were higher in 2020–2021 compared to the previous two years. Within the 2020–2021 school year, standard deviations were rank-ordered such that higher variability occurred among students who spent more testing windows out of school. In other words, for students who tested mostly out of school, the average time spent in *i-Ready* was lower, but there was also more variability in usage time, compared to students who were mostly in school.

Research Question #3: *i-Ready* Usage by School-Level Demographics

Weekly Usage by School Median Income and Locale

To answer Research Question 3a, we calculated weekly usage rates by counting the number of unique students who used *i-Ready* in each week by the median annual household income of the school's zip code (i.e., < $50,000; $50,000–$74,999; ≥ $75,000) and by school locale (i.e., city, suburb, town/rural) and dividing by the total enrollment, according to NCES, of the schools in each income or locale group. Figures 5 and 6 show the weekly usage rate by median income and locale groups, respectively, for Grade 3. As with the other usage rate analyses, the effects looked similar across grades, so Grade 3 is shown as the exemplar.

Figure 5: Weekly *i-Ready* Usage Rates in Grade 3 by School Median Income
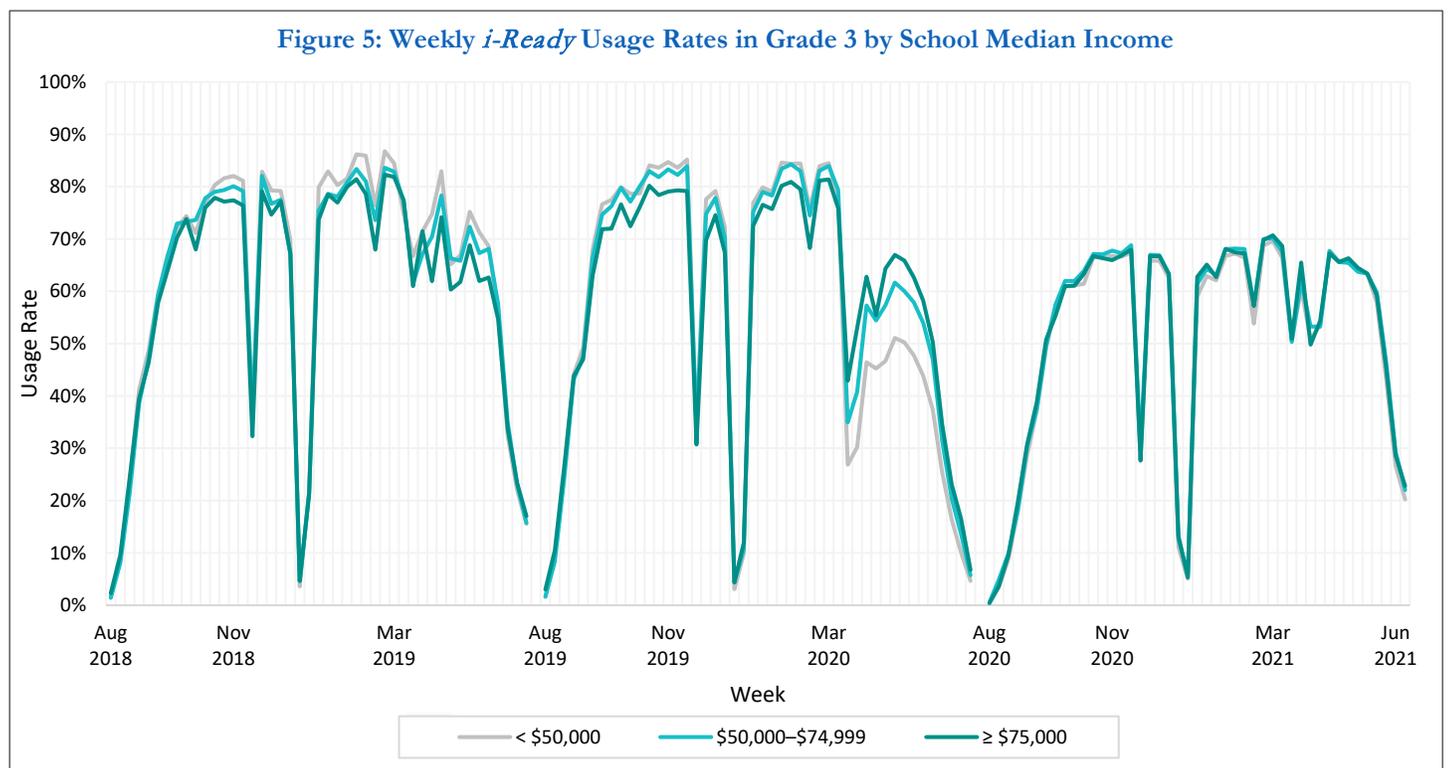
During the baseline year, usage tended to be rank-order by median income, with higher usage rates among students in schools in lower-income communities. The differences were small. Generally, less than five percentage points separated the lowest and highest usage groups in each week. This trend continued during the first part of the 2019–2020 school year, until March 2020, when the pandemic closed schools. The end of the 2019–2020 school year saw large discrepancies in weekly usage rates among income groups, with students in schools in higher-income communities showing usage rates 10 to 20 points higher than those in schools

in lower-income communities. During the 2020–2021 school year, usage rates were very comparable between income groups across the whole year. When compared to the baseline year, this could be seen as a continuation of the digital divide. Usage rates for students in schools in higher-income communities were closer to their baseline values, compared to those in schools in lower-income communities. If we focus on the weeks between October and April, removing Thanksgiving and winter breaks, the average weekly usage rates for students in schools in low-income zip codes were 77% and 63% in 2018–2019 and 2020–2021, respectively. For students in schools in high-income zip codes, the corresponding rates were 73% and 64%. In other words, the average usage rate dropped by 14 percentage points in low-income zip codes, but only 9 percentage points in high-income zip codes.

Figure 6: Weekly *i-Ready* Usage Rates in Grade 3 by School Locale
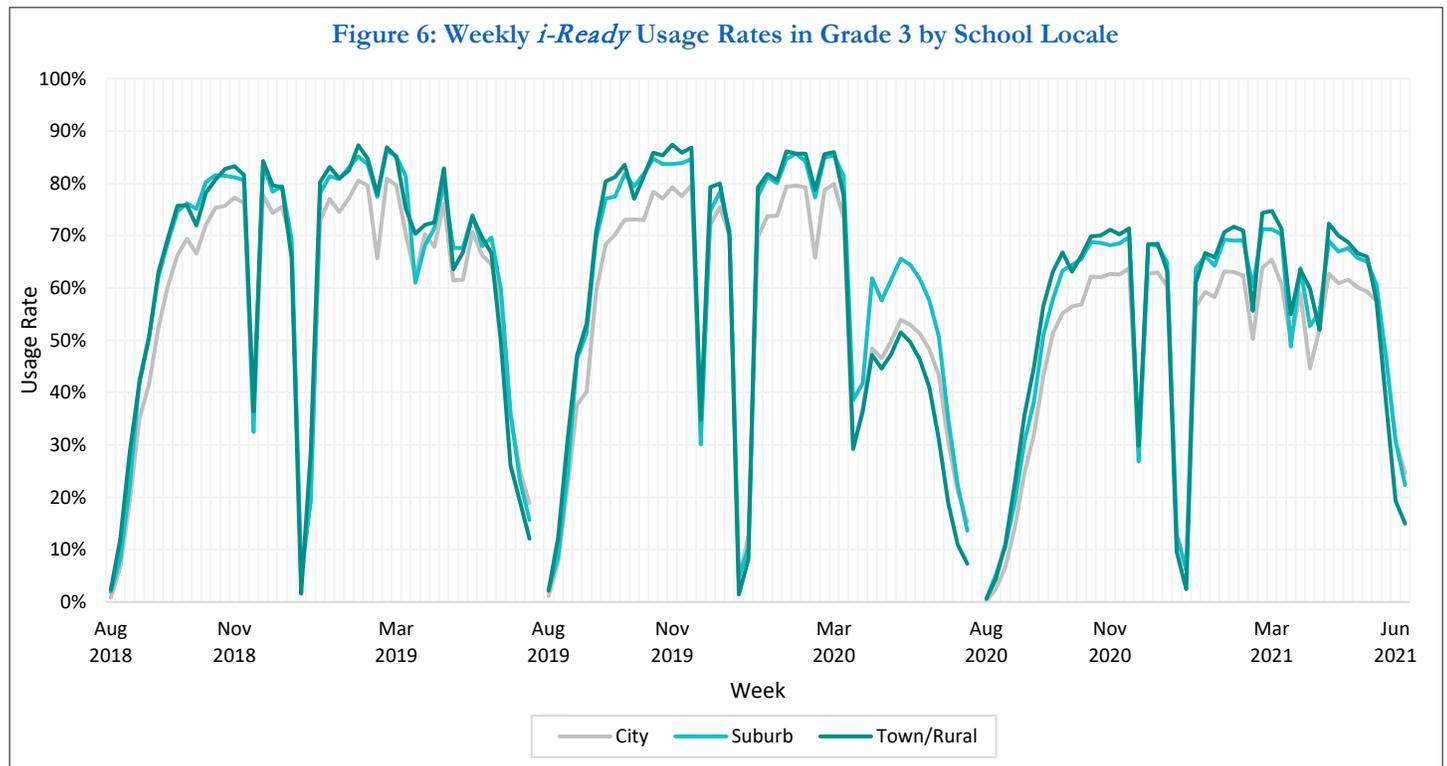
During the baseline year, students in suburbs, towns, and rural areas showed higher usage rates than those in cities, with an average difference of about five percentage points. This trend continued into the first part of the 2019–2020 school year until March 2020, when the pandemic closed schools. During the first week of school closures, usage rates dropped from more than 70% to less than 40% in all locales. Within three weeks, usage rates in suburbs had recovered to more than 60%, while usage rates in cities and towns and rural areas never again reached 55% during the 2019–2020 school year. During the 2020–2021 school year, however, differences in the usage rates across locales looked comparable to those of the baseline year. The differences between cities and suburbs and towns and rural areas were slightly wider during some weeks in 2020–2021, but the interaction between locale and academic year was very small.

Aggregate Usage by School Median Income and Locale

To answer Research Question 3b, we conducted two sets of ANOVAs. In the first set of ANOVAs, the independent variables were school year, median income group, and an interaction between the two. In the next set, the independent variables were school year, locale, and an interaction. The outcome variable in all ANOVAs was hours of *i-Ready* usage across the school year. The overall ANOVA, both main effects, and the interaction were statistically significant in every subject and grade for both median income and locale. As with the previous ANOVAs, the partial-η^2 values were extremely small; most below .01. The complete ANOVA results, as well as means and effect sizes, can be found in Appendix Tables A7 through A10. Figures 7 and 8 show the average number of hours of *i-Ready* usage by median income group and locale, respectively. The trends were similar within grade bands (i.e., K–2, 3–5, 6–8), therefore, the middle grade in each grade band is shown as the exemplar.

Figure 7: Average Hours of *i-Ready* Usage by School Year and Median Income

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.

Grade

■ Reading ■ Math
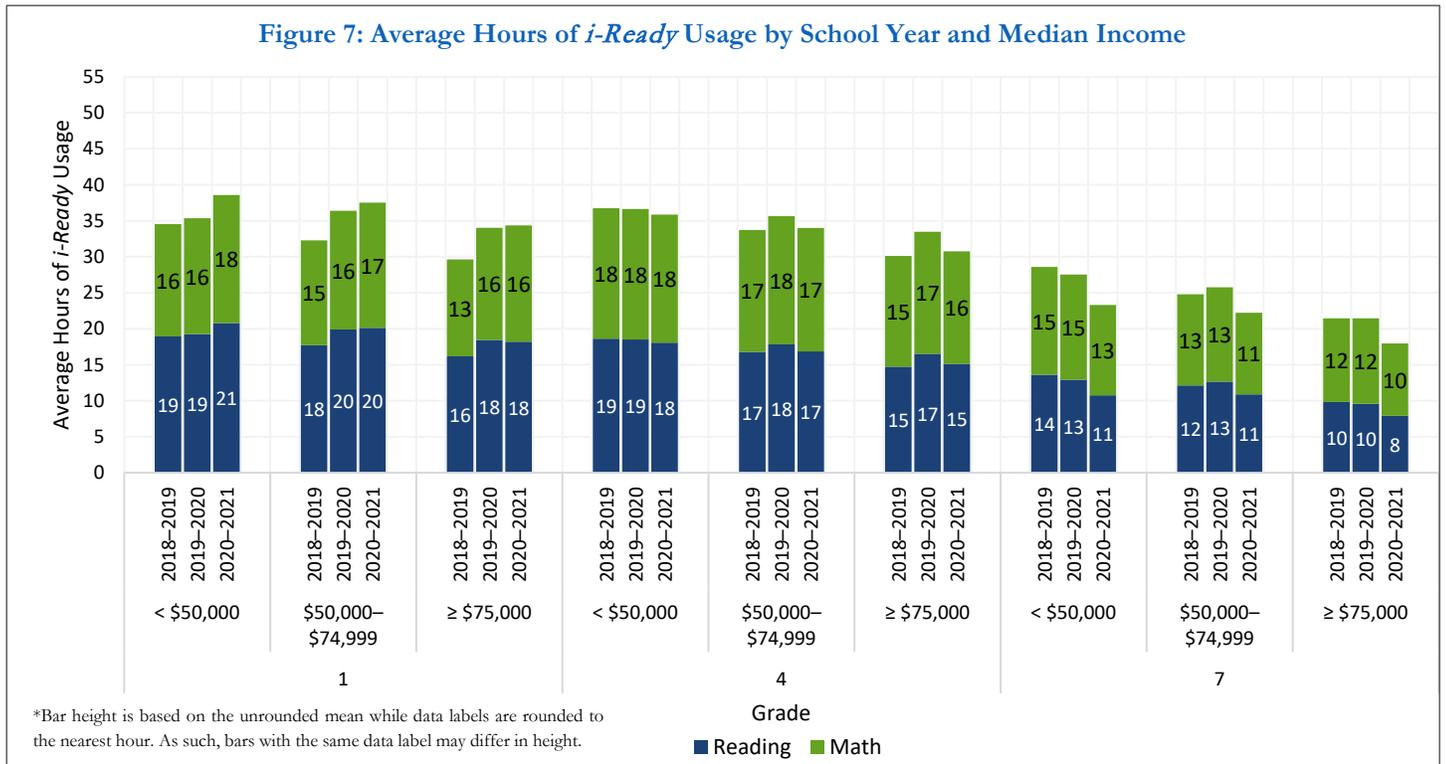
In Grades K–2, the average time spent in *i-Ready* increased by about two hours per subject between 2018–2019 and 2019–2020 for students in schools in zip codes where the median annual income was at least $50,000. These differences translate to effect sizes less than .1. Between the 2019–2020 and the 2020–2021 school years, the average number of hours increased for students in schools in zip codes where the median annual income was less than $75,000. In the highest-income schools, however, the number of hours stayed roughly the same in 2020–2021, compared to 2019–2020.

In Grades 3–5, the average time spent in *i-Ready* for students in schools in low-income areas stayed roughly the same between the first two years before decreasing slightly in 2020–2021. For students in schools in zip codes where the median annual income was at least $50,000, time spent in *i-Ready* increased by about one hour per subject in 2019–2020 before returning to baseline levels in 2020–2021.

In middle school, students in schools in low-income zip codes showed a slight decrease in time spent in *i-Ready* between 2018–2019 and 2019–2020 followed by a decrease of up to two hours per subject between 2019–2020 and 2020–2021. For students in schools in zip codes where the median income was at least $50,000, time spent in *i-Ready* increased from 2018–2019 to 2019–2020 before dropping to one to two hours below the baseline levels per subject.

Comparing the individual group means, Cohen's *d* was always small or negligible. In Grades K–2, the largest effect sizes were comparing the means from 2018–2019 to those of 2020–2021, ranging from .094 to .313. Effect sizes were similar when comparing 2018–2019 to 2019–2020 for the two highest income groups. In Grades 3–5, most of the effect sizes were less than .1. In middle school, the largest effect sizes were in comparing each of the first two school years to the 2020–2021 school year, ranging from .066 to .217. Even the largest differences are considered to have small effect sizes (Cohen, 1988).

Figure 8: Average Hours of *i-Ready* Usage by Academic Year and Locale

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.

■ Reading ■ Math
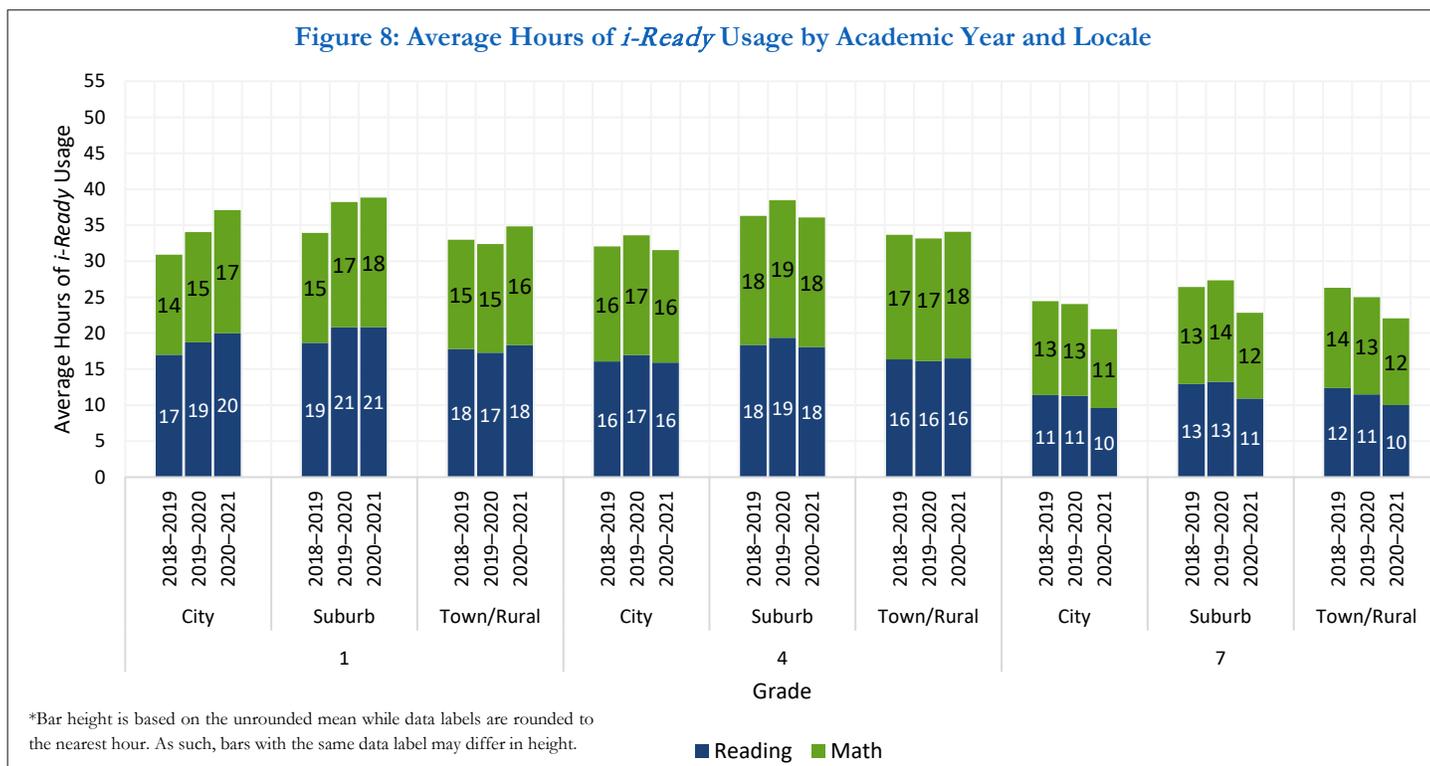
In Grades K–2, hours spent in *i-Ready* tended to increase each year in cities and suburbs. For students in cities, the increase was similar each year, while students in suburbs saw a large increase between 2018–2019 and 2019–2020 and a much smaller increase in 2020–2021. For students in towns and rural areas, time spent in *i-Ready* generally decreased from 2018–2019 to 2019–2020 before increasing to at least baseline levels in 2020–2021.

In Grades 3–5, among students in cities and suburbs, hours spent in *i-Ready* increased by about one hour per subject between 2018–2019 and 2019–2020 before returning to baseline levels in 2020–2021. Among students in towns, the average number of hours spent in *i-Ready* stayed roughly the same across the three years.

Finally, in middle school, average time spent in *i-Ready* among students in cities stayed roughly the same from 2018–2019 to 2019–2020 before decreasing by about one hour per subject in 2020–2021. In towns and rural areas, time spent in *i-Ready* dropped slightly in each school year in both subjects. However, in suburbs, time spent in *i-Ready* increased between 2018–2019 and 2019–2020 before dropping below baseline levels, by one to two hours, in 2020–2021.

The effect sizes were generally similar to those in the analysis by median income group. The largest effect sizes were between the 2018–2019 school year and the other two school years in Grades K–2 and between the 2020–2021 school year and the first two school years in middle school. However, all effect sizes are considered small, per Cohen's (1988) guidelines.

Aggregate Usage by School Demographics and Testing Location

For Research Question 3c, we examined the interaction of school median income and locale groups with student testing location during the 2020–2021 school year. We ran another series of ANOVAs with hours of *i-Ready* usage as the outcome and school median income or locale group, testing location group, and an interaction as independent variables. Once again, the overall ANOVA, main effects, and interactions were statistically significant across all subjects and grades, with one exception: the main effect of locale in Grade 8 Mathematics. The partial-η^2 values were still practically very small, with the largest being .02. The partial-η^2 values were largest for the testing location variable. The complete ANOVA results, means, and effect sizes are shown in Tables A11 through A14 and the averages from Grades 1, 4, and 7 are shown in Figures 9 and 10 for the median income and locale groups, respectively.

Figure 9: Average Hours of *i-Ready* Usage by Testing Location and Median Income

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.
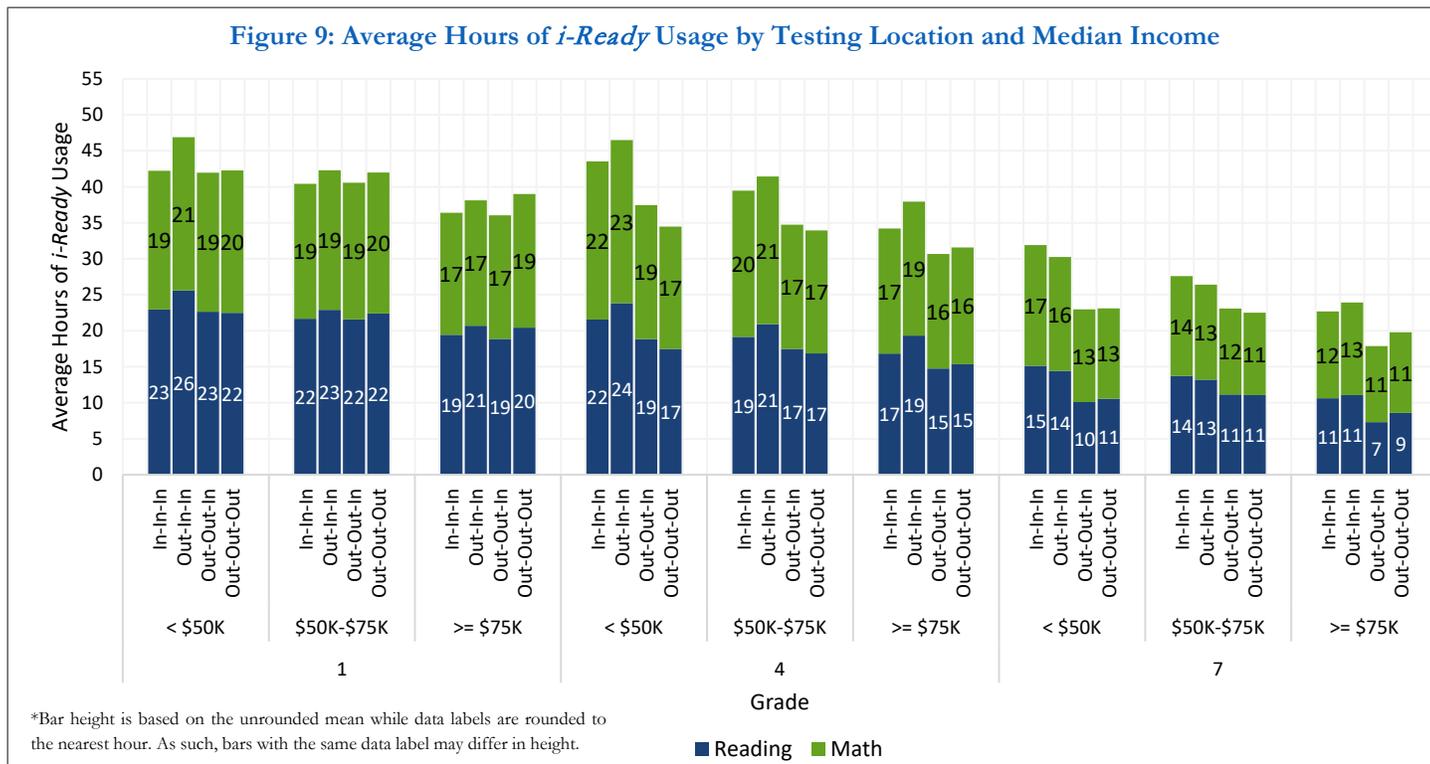
In Grades K and 1, the results were mixed. There were no consistent trends either within or between income groups. In Grades 2–8, however, there was a clear effect of testing location within each income group. Specifically, students who tested in school for most of the year, on average, spent more time in *i-Ready* for all subjects, grades, and income groups. There were also trends between income groups. For students in schools in zip codes where the median annual income was less than $50,000, the difference between students who tested mostly in school and those who tested mostly out of school ranged from two to five hours per subject, with an average of nearly three hours. For students in schools in the higher income groups, the differences were much smaller, ranging from less than an hour to three hours, with an average of less than two hours per subjects. In terms of effect sizes, the difference between mostly in school and mostly out of school testers was always largest for the lowest income group in Grades 2–8. For the lowest income group, Cohen's *d* ranged from .131 in Grade 2 mathematics to .388 in Grade 6 reading: all small effect sizes. For the two highest income groups, differences ranged from .017 to .258. These results provide more evidence for the continued existence of the digital divide. When we separate out 2020–2021 *i-Ready* usage by testing location, we see larger differences between in- and out-of-school testers for students in schools in lower-income communities, compared to those in higher-income communities. It is worth noting, however, that students in lower-income schools did average more time spent on *i-Ready*, relative to their peers in higher-income schools.

Figure 10: Average Hours of *i-Ready* Usage by Testing Location and Locale

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.

■ Reading ■ Math
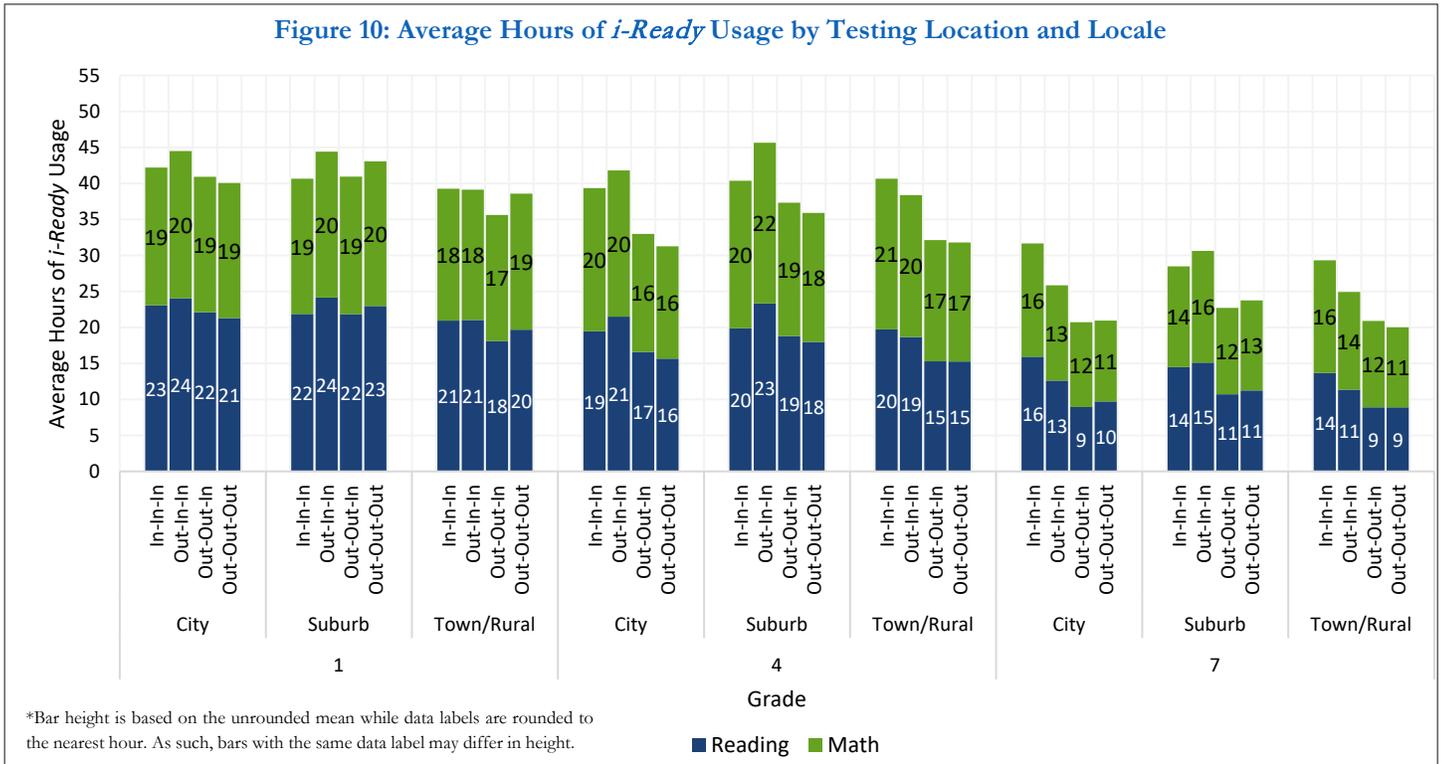
As with the analyses by median income group and testing location, the effects in Grades K and 1 by locale were small and inconsistent. In Grades 2–8, however, we once again saw differences between students who tested mostly in school and those who tested mostly out of school across all locales. These differences were largest for schools in cities, ranging from three to five hours per subject, with an average difference of three hours per subject, and smallest for schools in suburbs, ranging from one to three and a half hours, with an average of two hours per subjects. In cities, these differences translated to effect sizes between .203 and .407. These are the largest effect sizes we've seen, although they're still considered small (Cohen, 1988). For towns and rural areas, the difference between in-school testers and out-of-school testers fell in between that of cities and suburbs, ranging from one to four and a half hours, with an average of two and a half hours per subject. These differences continue with the trend of larger differences between in- and out-of-school testers for students from historically marginalized populations (i.e., those attending schools in urban areas).

Research Question #4: *i-Ready* Usage by Student-Level Demographics

Weekly Usage by Student Race/Ethnicity

To answer Research Question 4, we had to use a subset of students where student-level race/ethnicity was available.[2] Additional data cleaning was done to ensure that the sample still contained common schools within each subject and grade, with a comparable number of students who used *i-Ready* in each academic year. The addition of student race/ethnicity as well as data cleaning dropped 26% to 33% of the sample per grade. Appendix Table A15 shows the frequencies of each racial/ethnic group by academic year and grade.

To answer Research Question 4a, we calculated weekly usage rates by counting the number of students who used *i-Ready* in each week in a given racial/ethnic group and dividing by the total number of students in that racial/ethnic group in our sample. As with the other weekly usage rate analyses, the differences in usage rates between racial/ethnic groups across academic years was similar

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[2]Sharing student demographic data with Curriculum Associates is voluntary.

across grades, so we're focusing on Grade 3. Additionally, we're focusing on the three racial/ethnic groups that accounted for at least 20% of the sample: Black, Hispanic, and White. Figure 11 shows the weekly usage rates by student racial/ethnic group.

Figure 11: Weekly *i-Ready* Usage Rates in Grade 3 by Student Race/Ethnicity
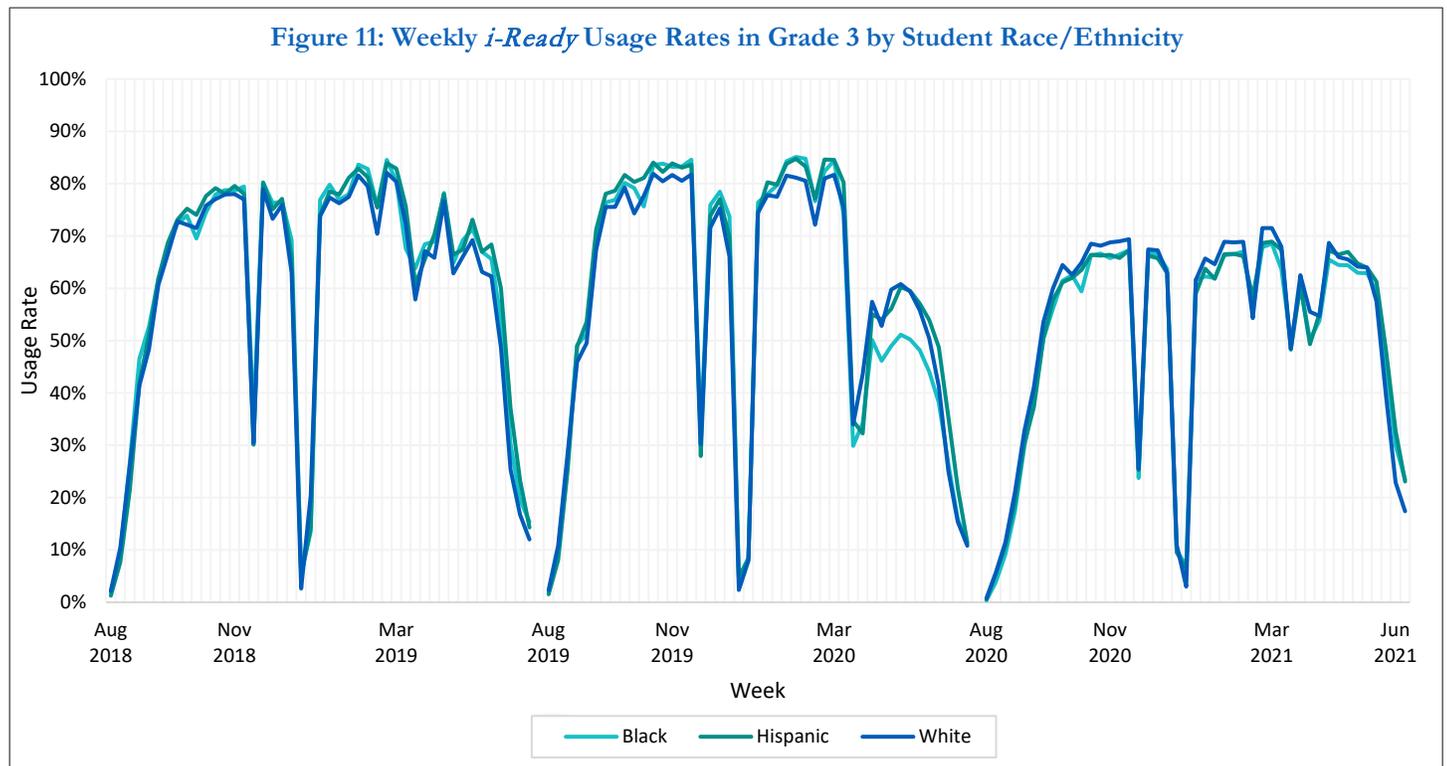
During the baseline year, usage rates were generally comparable between Black, Hispanic, and White students. This trend mostly continued in 2019–2020, but usage was slightly lower among White students than Black and Hispanic students. When schools closed in March 2020, usage immediately dropped among all racial/ethnic groups. During the remainder of spring 2020, usage rates recovered noticeably better for Hispanic and White students compared to Black students. Finally, during the 2020–2021 school year, usage rates were again comparable between racial/ethnic groups. However, this time the usage rates were slightly higher among White students. This was a noticeable deviation from what we saw before the pandemic. Overall, it seems like the weekly usage rates of Hispanic and, particularly, Black students were more affected by the pandemic than were the usage rates of White students.

Aggregate Usage by Student Race/Ethnicity

To answer Research Question 4b, we once again conducted a series of ANOVAs, by subject and grade, where the outcome variable was the number of hours spent in *i-Ready*. The grouping variables in these ANOVAs were school year, student race/ethnicity, and an interaction. All racial/ethnic groups were included in the ANOVAs. In every subject and grade, the overall ANOVA, each of the main effects, and the interaction were all statistically significant, but, again, the partial-η^2 values were all less than .02. Complete ANOVA results, as well as means and effect sizes, can be found in Appendix Tables A16 and A17. Figure 12 shows the average hours of *i-Ready* usage by student race/ethnicity and school year. Once again, trends were similar within grade bands, so we're only showing one exemplar grade per grade band.

Figure 12: Average Hours of *i-Ready* Usage by School Year and Race/Ethnicity

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.

■ Reading ■ Math
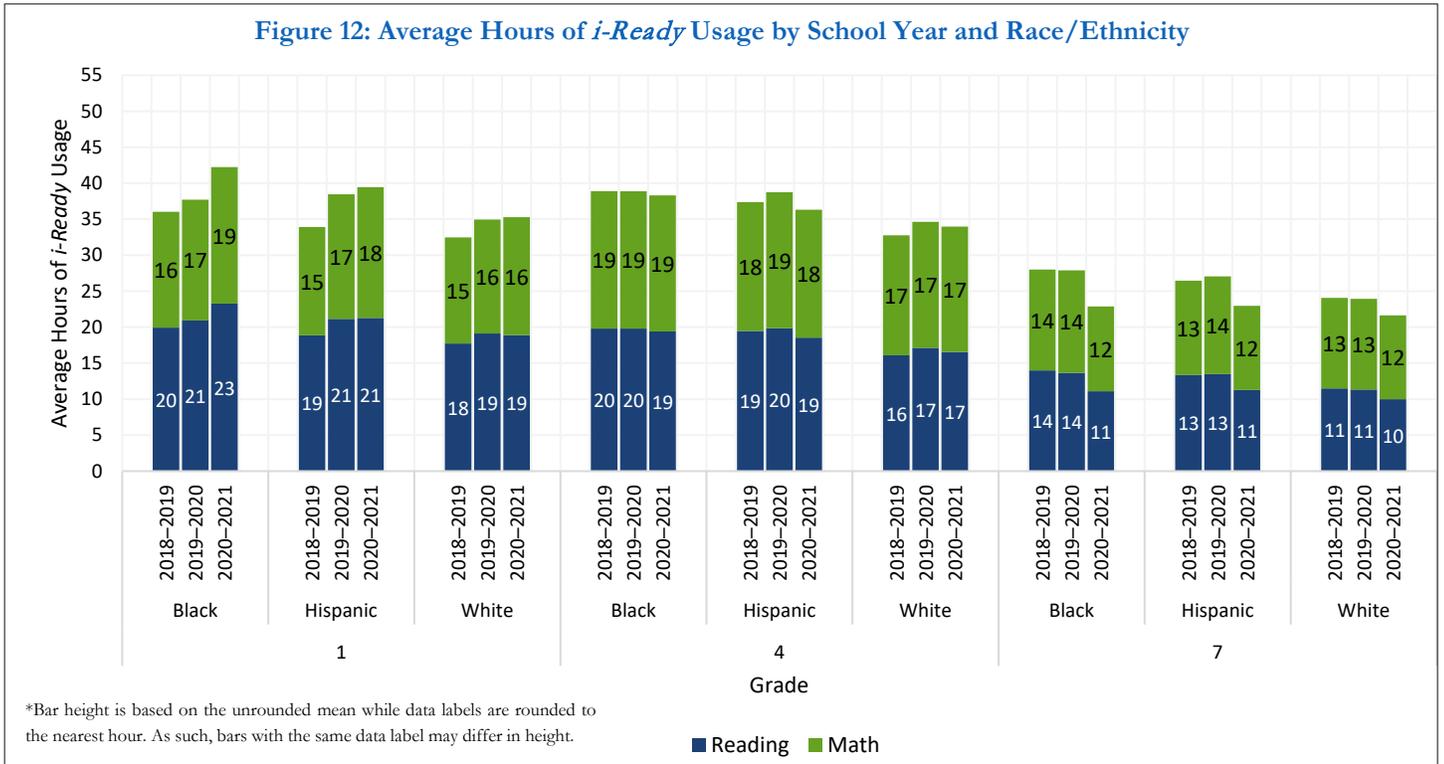
In Grades K–2, the average hours of *i-Ready* usage tended to increase in each school year. This was especially true among Black students, where the number of hours spent in *i-Ready* during the 2020–2021 school year was one to three hours more per subject than in the baseline year. Among Hispanic and White students, the increase in hours was larger between 2018–2019 and 2019–2020 than between 2019–2020 and 2020–2021.

In Grades 3–5, Black students spent roughly the same, or slightly less, time on *i-Ready* in every subsequent school year. In Grade 5, Black students saw a decline in each of the year-to-year comparisons in both subjects. Hispanic students, on the other hand, showed an increase in time spent in *i-Ready* from 2018–2019 to 2019–2020, followed by a return to, or slightly below, baseline levels in 2020–2021. White students spent about one hour more per subject in *i-Ready* during the 2019–2020 school year, compared to 2018–2019. In 2020–2021, White students showed a slight decline in hours of *i-Ready* usage, but the average number of hours was still slightly above baseline levels in both subjects. In Grades 3–5, the effect size of the mean differences between years was always less than .2 for all racial/ethnic groups.

In middle school, the average number of hours of *i-Ready* usage was comparable in 2018–2019 and 2019–2020 for all racial/ethnic groups. All racial/ethnic groups also showed a decline in *i-Ready* usage during the 2020–2021 school year. For Black and Hispanic students, the decline from 2019–2020 to 2020–2021 was about two hours per subject, on average, while the decline for White students was about one hour per subject. Effect sizes in the year-over-year mean differences in Grades 6–8 were generally smallest for White students.

Aggregate Usage by Student Race/Ethnicity and Testing Location

The final analysis examined the interaction of student race/ethnicity and testing location during the 2020–2021 school year and the effects on hours of *i-Ready* usage. We ran another series of ANOVAs with hours of *i-Ready* usage as the outcome and student race/ethnicity, testing location group, and an interaction as independent variables. Once again, the overall ANOVA, main effects, and interactions were statistically significant across all subjects and grades. The partial-η^2 values were larger for the race/ethnicity variable, compared to the testing location variable, but were still small (i.e., less than .02) across subjects and grades. The complete ANOVA results, along with the means and effect sizes, are shown in Appendix Tables A18 and A19, and the averages from Grades 1, 4, and 7 are shown in Figure 13.

Figure 13: Average Hours of *i-Ready* Usage by Testing Location and Race/Ethnicity

*Bar height is based on the unrounded mean while data labels are rounded to the nearest hour. As such, bars with the same data label may differ in height.

■ Reading ■ Math
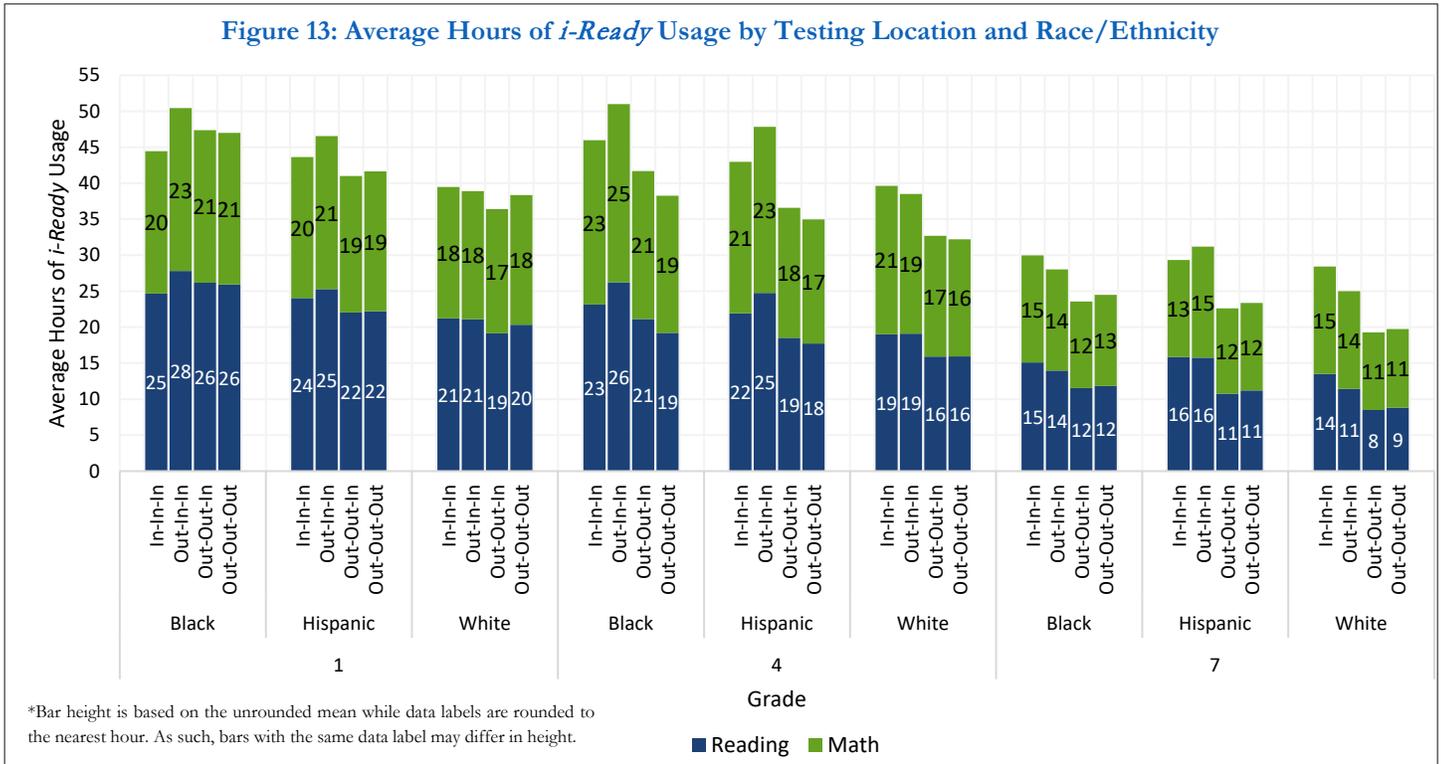
As with the previous analyses, the effects of the pandemic were smaller and harder to detect in the early grades. In Grades K and 1, time spent in *i-Ready* was slightly lower, but it was more consistent across testing location groups for White students, compared to Black and Hispanic students. The trends by testing location were not consistent in Grades K and 1 for Black and Hispanic students, but a clear trend started to emerge in Grade 2. In Grades 2–8, students who tested in school for most of the year spent more hours in *i-Ready*. This was true in each grade and racial/ethnic group. For Black students, the difference between students who tested mostly in school and those who tested mostly out of school ranged from an hour and a half in Grade 8 Reading to four and a half hours in Grade 4 Reading and Grade 6 Mathematics. All had effect sizes of at least .1. For Hispanic students, the differences were larger, ranging from nearly two and a half hours in Grades 7 and 8 Mathematics to almost five and a half hours in Grade 3 reading. All had effect sizes of at least .15. White students showed differences that were comparable to those of Black students, ranging from an hour and a half in Grade 2 Mathematics to four and a half hours in Grade 6 Mathematics. In middle school, however, the effect sizes of the differences between mostly in-school testers and mostly out-of-school testers was noticeably larger for White students, compared to Black and Hispanic students. All effect sizes were small to negligible, according to Cohen's (1988) criteria.

Conclusions

In March 2020, the COVID-19 pandemic forced students and teachers into remote learning. Some communities were better equipped to handle this transition than others (Curriculum Associates, 2020). The 2020–2021 school year saw students in different learning environments at different timepoints, with systematic differences between students of different racial/ethnic groups, geographic regions, and locales (Rome & Cançado, 2021). In this study, we used data from the *i-Ready* digital instruction platform to examine trends in students' online instruction usage before and during the pandemic. We looked at data across three academic years, separated the 2020–2021 data by student testing location, and examined usage by school- and student-level demographics.

We saw a large disruption in weekly *i-Ready* usage rates starting with the week of March 16, 2020, when schools across the country closed. Usage rates recovered during the remainder of the 2019–2020 school year, but they never reached the rates of a normal year (i.e., 2018–2019). During the 2020–2021 school year, weekly *i-Ready* usage rates showed a pattern similar to the baseline year, but markedly lower. Despite lower weekly usage rates, students in Grades K–2, on average, spent more time in *i-Ready* during the

2020–2021 school year, compared to previous years. In Grades 6–8, however, students lost one to two hours of time in *i-Ready* over the course of the 2020–2021 school year, relative to the last two years.

During the pandemic, the variable that appeared to be the biggest driver of variability in *i-Ready* usage was whether students were in the school building or learning remotely. In spring 2020, when nearly all students across the country were out of school, the weekly *i-Ready* usage rates dropped dramatically, and during the 2020–2021 school year, when some students were learning remotely and some were in school buildings, usage rates and time spent in *i-Ready* were markedly lower for students who reported taking their *i-Ready Diagnostic* out of school and, presumably, learning out of school as well. Additionally, there was more variability in time spent in *i-Ready* among students who were out of school for most of the year, indicating a potential lack of consistency across students in remote learning environments.

The effect of testing location was not consistent across all demographic groups. The difference in time spent in *i-Ready* between students who tested mostly out of school and those who tested mostly in school was larger among students in schools in lower-income zip codes, relative to higher-income zip codes, students attending schools in towns and rural areas and, particularly, cities, relative to those in the suburbs, and for Hispanic students, relative to Black and White students. The effect sizes of these differences were relatively small. All Cohen's *d* effect sizes were less than .5. With the exception of Black students showing comparable differences to White students, the differences always tended to work against historically marginalized populations: students in urban, low-income schools and students of color.

Finally, while usage differences between students who tested mostly out of school and those who tested mostly in school were present within all examined demographic groups, there were noticeable interactions between the analyses presented here and previous research demonstrating systematic differences between demographic groups in terms of who was in school or not during the 2020–2021 school year (Harris & Oliver, 2021; Rome & Cançado, 2021). For instance, while students in schools in low-income zip codes showed larger differences between in- and out-of-school testers, relative to those in higher-income zip codes, overall differences in usage rates and time spent in *i-Ready* across income groups were small. This makes sense, given the work of Rome and Cançado, who found that the likelihood of students being in school during the 2020–2021 school year was not related to school zip code median annual income. However, looking across school years and all 2020–2021 testing locations, we saw that White students had weekly usage rates and time spent in *i-Ready* that were closer to the baseline year than did Black and Hispanic students. In other words, despite comparable differences between in-school and out-of-school students among White and Black students, in the aggregate, White students were less affected because they were more likely to be testing in school for most of the 2020–2021 school year.

This study sheds new light on how the pandemic impacted students' access to digital instruction. The largest disruption to students' *i-Ready* instruction usage was to students who were not regularly in their school building. This is indicative of the lack of access at home reported in various surveys throughout the pandemic (Ong, 2020; Stelitano et al., 2020; Gao & Hayes, 2021). In the school building, students generally have access to internet and devices, while this is not always true at home. This effect was present in all school income groups, locales, and student racial/ethnic groups, although students from historically marginalized groups tended to be more heavily impacted. Because students from certain groups were systematically more likely to be out of school—namely, Black and Hispanic students and students in cites—these groups suffered from the compounded effect of lack of access to instruction due to lack of access to the school building.

Limitations

There were several limitations worth noting. First, for the weekly usage rates, we set a very low bar for usage: the student simply had to work on a lesson. There was no minimum requirement for time spent or screens or lessons completed. Additionally, while our aggregate analyses focus on Time-on-Task, this is not the only variable worth considering in defining *i-Ready* usage. We did not examine total weeks of *i-Ready* usage, total logins, lesson pass rates, lessons completed, or whether students met the *i-Ready* implementation guidance.

Next, the testing location variable was derived from student self-reported data. There are several reasons why a student may have answered this question incorrectly. Additionally, we derived the yearlong testing location variable by simplifying location data from many testing sessions across the entire school year. This is an over-simplification of where students were testing—and learning—

during the 2020–2021 school year. For our purposes, this simplification allowed us to gain insight into *i-Ready* usage by testing location, even if in a very coarse way. Unfortunately, we did not collect location data for *i-Ready Personalized Instruction* sessions, so we had to rely on the *i-Ready Diagnostic* location data. As noted previously, testing location data was collected only at the time of the *i-Ready Diagnostic* administration. As such, it can be thought of only as a rough approximation of students' learning location.

As mentioned throughout the paper, the effect sizes of the ANOVAs and the mean comparisons were quite small. The partial-η^2 values from the ANOVAs were all less than .03, indicating that the predictors accounted for less than 3% of the variability in hours of *i-Ready* usage. Cohen's *d* of the mean comparisons were all less than .5, the value considered by Cohen (1988) to be a moderate effect size. While the effect sizes were not large, we do believe that the differences are meaningful—as we are seeing, directionally— effects that continue to work against students from historically marginalized populations.

Additionally, it is worth restating the finding from Appendix B: There was a noticeable drop in the number of unique students who used *i-Ready* during the 2020–2021 school year. Because our dataset contained only students who used *i-Ready* during the given school year, our calculations of average hours of *i-Ready* usage do not account for students who were unable to access *i-Ready* at all during the school year. As such, we hypothesize that the effects shown in this paper are an underestimate of the true effect of the pandemic on digital instruction access for students from historically marginalized populations.

Finally, it is worth noting that the sample used for this study is one of convenience. We looked at all available students in schools that used *i-Ready* across the three school years, with some additional filtering to clean out implementations that changed during the study period. We did not take any steps to stratify our sample such that it represents the national student population or the *i-Ready* student population. As such, we are careful not to generalize our findings to all digital instruction platforms.

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Appendix A

Table A1: Demographics of Included Schools

Subject	Grade	Locale			Avg. % Black	Avg. % Hispanic	Avg. % White	Avg. Median Income
		% City	% Suburb	% Town/Rural				
Reading	K	35.2%	41.4%	23.4%	25.1%	30.4%	33.9%	$51,262.0
	1	35.8%	41.2%	22.9%	24.4%	30.9%	33.8%	$52,352.0
	2	36.0%	40.9%	23.1%	24.6%	30.8%	33.9%	$52,419.0
	3	35.8%	41.5%	22.7%	24.6%	30.9%	33.9%	$52,560.5
	4	35.4%	40.7%	23.8%	24.6%	31.3%	33.9%	$52,352.0
	5	35.6%	41.0%	23.4%	24.6%	31.4%	33.3%	$52,278.0
	6	33.3%	38.3%	28.3%	24.4%	31.5%	33.3%	$51,521.0
	7	34.2%	37.5%	28.2%	28.7%	31.3%	31.7%	$50,388.0
	8	35.3%	36.7%	28.0%	29.3%	31.8%	30.8%	$49,615.5
Mathematics	K	34.1%	39.6%	26.3%	23.3%	29.0%	37.3%	$52,462.0
	1	34.8%	39.1%	26.1%	22.8%	29.2%	37.6%	$52,618.0
	2	35.3%	39.2%	25.5%	22.6%	29.7%	37.4%	$52,686.5
	3	35.3%	39.2%	25.4%	22.3%	29.8%	37.6%	$52,618.0
	4	35.1%	38.8%	26.1%	22.5%	30.0%	37.6%	$52,500.0
	5	35.5%	39.0%	25.5%	22.6%	30.2%	36.9%	$52,618.0
	6	34.3%	36.3%	29.4%	23.5%	30.1%	35.9%	$52,159.5
	7	35.2%	35.1%	29.7%	27.6%	30.4%	33.9%	$50,396.0
	8	35.6%	34.0%	30.5%	27.9%	30.3%	33.7%	$50,185.0

Table A2: Hours of *i-Ready* Usage by School Year: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Partial-η^2	Effect: School Year Planned Contrasts: F Value (*p*-value) 2019–2020–2018–2019	2020–2021–2018–2019	2020–2021–2019–2020
Reading	K	2,197.7 (*p* < .001)*	.005	1,875.9 (*p* < .001)[+]	4,193.7 (*p* < .001)[+]	523.9 (*p* < .001)[+]
	1	2,024.4 (*p* < .001)*	.004	1,881.0 (*p* < .001)[+]	3,806.0 (*p* < .001)[+]	372.8 (*p* < .001)[+]
	2	436.2 (*p* < .001)*	.001	798.1 (*p* < .001)[+]	448.4 (*p* < .001)[+]	41.2 (*p* < .001)[+]
	3	774.1 (*p* < .001)*	.001	1,049.0 (*p* < .001)[+]	16.3 (*p* < .001)[+]	1,248.2 (*p* < .001)[+]
	4	428.5 (*p* < .001)*	.001	532.6 (*p* < .001)[+]	21.6 (*p* < .001)[+]	733.3 (*p* < .001)[+]
	5	695.7 (*p* < .001)*	.001	284.9 (*p* < .001)[+]	450.0 (*p* < .001)[+]	1,388.5 (*p* < .001)[+]
	6	2,114.6 (*p* < .001)*	.005	23.1 (*p* < .001)[+]	2,979.8 (*p* < .001)[+]	3,488.5 (*p* < .001)[+]
	7	1,976.2 (*p* < .001)*	.006	14.2 (*p* < .001)[+]	3,230.4 (*p* < .001)[+]	2,808.2 (*p* < .001)[+]
	8	1,306.8 (*p* < .001)*	.004	1.4 (*p* = .244)	1,935.6 (*p* < .001)[+]	2,054.5 (*p* < .001)[+]
Mathematics	K	7,070.2 (*p* < .001)*	.014	4,576.6 (*p* < .001)[+]	13,970.6 (*p* < .001)[+]	2,804.2 (*p* < .001)[+]
	1	4,535.4 (*p* < .001)*	.008	2,721.5 (*p* < .001)[+]	9,017.2 (*p* < .001)[+]	1,936.4 (*p* < .001)[+]
	2	1,656.7 (*p* < .001)*	.003	1,565.5 (*p* < .001)[+]	3,102.3 (*p* < .001)[+]	287.9 (*p* < .001)[+]
	3	421.6 (*p* < .001)*	.001	828.1 (*p* < .001)[+]	297.1 (*p* < .001)[+]	114.3 (*p* < .001)[+]
	4	374.7 (*p* < .001)*	.001	566.0 (*p* < .001)[+]	0.2 (*p* = .667)	554.3 (*p* < .001)[+]
	5	637.5 (*p* < .001)*	.001	553.4 (*p* < .001)[+]	153.8 (*p* < .001)[+]	1,222.5 (*p* < .001)[+]
	6	1,127.1 (*p* < .001)*	.002	40.9 (*p* < .001)[+]	1,445.8 (*p* < .001)[+]	1,955.8 (*p* < .001)[+]
	7	1,700.6 (*p* < .001)*	.004	2.4 (*p* = .119)	2,510.4 (*p* < .001)[+]	2,674.1 (*p* < .001)[+]
	8	1,555.6 (*p* < .001)*	.005	8.8 (*p* = .003)	2,212.2 (*p* < .001)[+]	2,507.3 (*p* < .001)[+]

*Statistically significant at α = .05 / 18 (adjusted for one significance test per subject and grade)

[+]Statistically significant at α = .05 / 54 (adjusted for three significance tests per subject and grade)

Table A3: Hours of *i-Ready* Usage by School Year: Means and Effect Sizes

Subject	Grade	2018–2019		2019–2020		2020–2021		Cohen's *d*		
		N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	2019–2020 – 2018–2019	2020–2021 – 2018–2019	2020–2021 – 2019–2020
Reading	K	310,127	14.71 (11.48)	302,656	16.11 (12.28)	262,846	16.87 (14.03)	.117	.168	.058
	1	364,241	17.91 (12.70)	355,769	19.34 (13.58)	322,376	20.00 (15.75)	.109	.146	.045
	2	396,613	19.10 (13.45)	386,086	20.02 (14.06)	354,487	19.80 (15.71)	.067	.048	.014
	3	425,897	18.99 (13.95)	416,056	20.03 (14.78)	373,377	18.85 (15.73)	.073	.009	.077
	4	422,379	17.16 (12.99)	407,610	17.85 (13.33)	379,890	17.01 (14.67)	.053	.010	.059
	5	424,214	16.42 (12.46)	405,691	16.90 (12.73)	366,944	15.80 (13.83)	.038	.047	.083
	6	288,087	13.91 (12.36)	284,694	14.07 (12.38)	249,001	12.06 (12.49)	.013	.149	.162
	7	237,051	12.34 (12.06)	233,495	12.21 (11.90)	206,895	10.31 (11.64)	.011	.171	.161
	8	211,057	11.26 (11.52)	215,085	11.31 (11.29)	190,890	9.69 (11.14)	.004	.139	.144
Mathematics	K	356,459	11.81 (9.40)	349,169	13.51 (10.20)	299,631	14.90 (12.10)	.173	.285	.124
	1	414,841	14.79 (10.56)	407,086	16.15 (11.33)	366,232	17.33 (13.45)	.124	.210	.095
	2	440,615	15.85 (11.27)	429,376	16.89 (11.92)	391,309	17.36 (13.71)	.090	.120	.036
	3	466,956	16.94 (12.23)	455,895	17.72 (12.60)	409,791	17.42 (14.04)	.062	.036	.022
	4	468,403	17.14 (12.17)	451,045	17.78 (12.70)	417,990	17.13 (14.18)	.052	.001	.049
	5	472,521	16.71 (12.32)	452,947	17.35 (12.91)	409,363	16.37 (14.03)	.051	.026	.073
	6	330,046	15.05 (13.32)	329,696	15.26 (13.34)	294,777	13.74 (14.07)	.016	.095	.111
	7	279,185	13.46 (13.10)	281,223	13.52 (13.02)	253,362	11.66 (13.34)	.004	.137	.141
	8	231,876	12.18 (12.48)	234,568	12.29 (12.18)	215,115	10.45 (12.28)	.009	.140	.151

Table A4: Testing Location Patterns

Grade	Frequency (%)				
	In-In-In: Fall = In School Winter = In School Spring = In School	**Out-In-In** Fall = Out of School Winter = In School Spring = In School	**Out-Out-In** Fall = Out of School Winter = Out of School Spring = In School	**Out-Out-Out** Fall = Out of School Winter = Out of School Spring = Out of School	**Other**
K	75,496 (22.2%)	36,243 (10.6%)	32,647 (9.6%)	55,718 (16.3%)	140,716 (41.3%)
1	84,842 (20.5%)	50,192 (12.1%)	51,918 (12.5%)	93,136 (22.5%)	134,085 (32.4%)
2	92,432 (20.7%)	54,219 (12.2%)	63,539 (14.3%)	108,516 (24.3%)	127,130 (28.5%)
3	92,751 (20.0%)	58,468 (12.6%)	67,820 (14.6%)	111,311 (24.0%)	133,404 (28.8%)
4	87,792 (18.6%)	57,161 (12.1%)	69,251 (14.6%)	122,010 (25.8%)	136,615 (28.9%)
5	81,815 (17.7%)	51,450 (11.1%)	68,082 (14.7%)	123,897 (26.8%)	136,893 (29.6%)
6	44,107 (13.1%)	25,795 (7.6%)	49,591 (14.7%)	107,482 (31.8%)	110,859 (32.8%)
7	33,683 (11.4%)	19,948 (6.7%)	40,126 (13.6%)	100,441 (33.9%)	101,816 (34.4%)
8	29,548 (11.0%)	17,540 (6.5%)	34,405 (12.8%)	91,961 (34.3%)	94,766 (35.3%)

Table A5: Hours of *i-Ready* Usage by Testing Location: Analysis of Variance Results

Subject	Grade	Overall F Value (p-value)	Effect: Testing Location	
			Partial-η^2	**Planned Contrast:** Mostly in School–Mostly out of School **F Value (p-value)**
Reading	K	324.6 ($p < .001$)*	.006	151.1 ($p < .001$)*
	1	141.3 ($p < .001$)*	.002	191.9 ($p < .001$)*
	2	535.9 ($p < .001$)*	.006	1,409.2 ($p < .001$)*
	3	1,074.2 ($p < .001$)*	.012	2,659.8 ($p < .001$)*
	4	1,514.3 ($p < .001$)*	.016	3,922.1 ($p < .001$)*
	5	1,276.5 ($p < .001$)*	.014	3,317.0 ($p < .001$)*
	6	1,131.4 ($p < .001$)*	.019	2,907.5 ($p < .001$)*
	7	925.4 ($p < .001$)*	.020	2,502.5 ($p < .001$)*
	8	498.0 ($p < .001$)*	.012	1,416.5 ($p < .001$)*
Mathematics	K	737.1 ($p < .001$)*	.012	639.0 ($p < .001$)*
	1	92.4 ($p < .001$)*	.001	10.9 ($p < .001$)*
	2	304.9 ($p < .001$)*	.003	888.1 ($p < .001$)*
	3	893.7 ($p < .001$)*	.009	2,430.0 ($p < .001$)*
	4	1,670.1 ($p < .001$)*	.017	4,536.5 ($p < .001$)*
	5	2,055.7 ($p < .001$)*	.021	4,972.9 ($p < .001$)*
	6	1,143.8 ($p < .001$)*	.017	2,821.8 ($p < .001$)*
	7	541.4 ($p < .001$)*	.010	1,276.9 ($p < .001$)*
	8	403.9 ($p < .001$)*	.009	842.4 ($p < .001$)*

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)

Table A6: Hours of *i-Ready* Usage by Testing Location: Means and Effect Sizes

Subject	Grade	In-In-In		Out-In-In		Out-Out-In		Out-Out-Out		Cohen's *d*
		N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	Mostly In − Mostly Out
Reading	K	58,304	18.32 (11.57)	29,719	20.43 (13.64)	26,003	19.65 (14.63)	44,479	20.93 (16.93)	.099
	1	64,657	21.79 (12.65)	40,567	23.45 (14.87)	41,013	21.33 (16.11)	74,946	21.98 (18.29)	.043
	2	71,178	22.23 (12.72)	44,317	24.00 (14.90)	49,699	20.67 (15.80)	90,436	20.69 (18.09)	.143
	3	72,058	21.43 (12.97)	49,125	23.76 (15.77)	53,721	19.59 (15.83)	94,051	19.07 (17.85)	.198
	4	68,908	19.74 (12.35)	48,114	21.74 (15.02)	54,477	17.35 (14.41)	102,831	16.78 (16.21)	.245
	5	63,164	18.35 (11.54)	42,363	19.68 (13.45)	52,498	16.06 (13.97)	102,690	15.37 (15.26)	.240
	6	33,438	16.02 (12.14)	20,155	15.45 (13.10)	36,010	12.01 (11.93)	82,364	11.88 (13.44)	.304
	7	24,132	14.23 (12.00)	15,345	13.48 (12.52)	27,987	9.75 (10.89)	72,094	10.38 (12.54)	.307
	8	21,538	12.77 (10.80)	13,458	12.59 (11.89)	24,511	9.35 (10.60)	68,333	10.16 (12.32)	.238
Mathematics	K	67,808	15.67 (9.60)	31,476	17.61 (11.59)	27,798	17.40 (12.54)	49,943	19.00 (15.09)	.172
	1	76,638	18.67 (10.74)	42,964	19.78 (12.43)	44,406	18.66 (13.29)	83,437	19.42 (16.16)	.006
	2	82,021	19.41 (11.02)	46,008	20.30 (12.67)	54,756	18.08 (13.47)	97,216	18.41 (16.20)	.106
	3	83,010	20.33 (11.90)	48,650	20.86 (13.54)	59,371	18.15 (14.08)	99,836	17.66 (16.05)	.191
	4	78,871	20.56 (12.26)	47,276	21.08 (13.93)	61,365	17.42 (13.66)	108,781	16.85 (15.85)	.263
	5	74,917	20.35 (12.55)	44,716	19.79 (13.14)	60,440	16.65 (13.74)	111,901	15.74 (15.45)	.294
	6	39,121	18.01 (13.72)	22,003	17.13 (14.80)	43,672	13.74 (13.22)	94,427	13.57 (15.11)	.284
	7	29,638	15.17 (12.73)	16,474	14.33 (14.24)	34,727	11.94 (13.25)	87,055	11.85 (14.22)	.220
	8	24,382	13.91 (12.01)	13,096	12.56 (13.19)	27,675	10.78 (12.19)	74,268	10.86 (13.32)	.204

Table A7: Hours of *i-Ready* Usage by School Year and Median Income: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	School Year F Value (*p*-value)	Partial-η^2	Median Income F Value (*p*-value)	Partial-η^2	Interaction F Value (*p*-value)	Partial-η^2
Reading	K	876.8 ($p < .001$)*	2,113.0 ($p < .001$)+	.005	791.4 ($p < .001$)+	.002	261.7 ($p < .001$)+	.001
	1	1,004.8 ($p < .001$)*	1,930.5 ($p < .001$)+	.004	1,558.7 ($p < .001$)+	.003	222.5 ($p < .001$)+	.001
	2	623.8 ($p < .001$)*	562.5 ($p < .001$)+	.001	1,620.3 ($p < .001$)+	.003	220.7 ($p < .001$)+	.001
	3	1,299.4 ($p < .001$)*	855.1 ($p < .001$)+	.001	4,065.5 ($p < .001$)+	.007	155.6 ($p < .001$)+	.001
	4	1,138.3 ($p < .001$)*	545.1 ($p < .001$)+	.001	3,782.9 ($p < .001$)+	.006	152.4 ($p < .001$)+	.001
	5	1,057.9 ($p < .001$)*	659.7 ($p < .001$)+	.001	3,250.1 ($p < .001$)+	.005	109.6 ($p < .001$)+	< .001
	6	1,235.1 ($p < .001$)*	1,769.9 ($p < .001$)+	.004	2,465.3 ($p < .001$)+	.006	137.3 ($p < .001$)+	.001
	7	1,451.5 ($p < .001$)*	1,673.5 ($p < .001$)+	.005	3,499.9 ($p < .001$)+	.010	116.7 ($p < .001$)+	.001
	8	1,058.4 ($p < .001$)*	1,024.8 ($p < .001$)+	.003	2,759.8 ($p < .001$)+	.009	45.7 ($p < .001$)+	< .001
Mathematics	K	2,040.8 ($p < .001$)*	6,262.1 ($p < .001$)+	.012	680.2 ($p < .001$)+	.001	205.3 ($p < .001$)+	.001
	1	1,524.6 ($p < .001$)*	4,205.2 ($p < .001$)+	.007	1,137.9 ($p < .001$)+	.002	207.8 ($p < .001$)+	.001
	2	944.6 ($p < .001$)*	1,690.6 ($p < .001$)+	.003	1,687.2 ($p < .001$)+	.003	212.0 ($p < .001$)+	.001
	3	707.3 ($p < .001$)*	567.3 ($p < .001$)+	.001	2,041.2 ($p < .001$)+	.003	170.0 ($p < .001$)+	.001
	4	675.2 ($p < .001$)*	503.5 ($p < .001$)+	.001	2,066.6 ($p < .001$)+	.003	122.5 ($p < .001$)+	< .001
	5	561.8 ($p < .001$)*	705.1 ($p < .001$)+	.001	1,272.0 ($p < .001$)+	.002	152.1 ($p < .001$)+	< .001
	6	795.4 ($p < .001$)*	985.9 ($p < .001$)+	.002	1,902.7 ($p < .001$)+	.004	52.0 ($p < .001$)+	< .001
	7	1,179.8 ($p < .001$)*	1,426.6 ($p < .001$)+	.003	2,821.4 ($p < .001$)+	.007	60.7 ($p < .001$)+	< .001
	8	1,169.0 ($p < .001$)*	1,306.9 ($p < .001$)+	.004	2,948.2 ($p < .001$)+	.009	58.0 ($p < .001$)+	< .001

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)

+Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A8: Hours of *i-Ready* Usage by School Year and Median Income: Means and Effect Sizes

Subject	Grade	Median Income	2018–2019		2019–2020		2020–2021		Cohen's *d*		
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	2019–2020 – 2018–2019	2020–2021 – 2018–2019	2020–2021 – 2019–2020
Reading	K	< $50,000	137,142	15.52 (11.28)	132,530	15.78 (12.04)	113,944	17.26 (14.15)	.022	.136	.113
		$50,000–$74,999	115,547	14.48 (11.58)	113,167	16.72 (12.52)	99,120	17.13 (14.02)	.186	.206	.031
		≥ $75,000	57,438	13.27 (11.61)	56,959	15.63 (12.30)	49,782	15.46 (13.69)	.198	.173	.013
	1	< $50,000	150,995	18.93 (12.92)	146,635	19.26 (13.58)	130,935	20.78 (16.14)	.025	.126	.102
		$50,000–$74,999	141,440	17.71 (12.53)	138,021	19.90 (13.77)	126,321	20.12 (15.77)	.166	.169	.015
		≥ $75,000	71,806	16.16 (12.35)	71,113	18.44 (13.13)	65,120	18.20 (14.73)	.179	.150	.017
	2	< $50,000	162,941	20.19 (13.59)	157,773	20.03 (14.21)	143,991	20.57 (16.05)	.012	.026	.036
		$50,000–$74,999	155,508	18.92 (13.50)	151,395	20.39 (14.21)	139,595	19.89 (15.82)	.106	.066	.034
		≥ $75,000	78,164	17.18 (12.81)	76,918	19.26 (13.39)	70,901	18.08 (14.63)	.159	.066	.085
	3	< $50,000	174,562	20.53 (14.60)	168,021	20.64 (15.18)	148,919	19.85 (16.31)	.007	.044	.050
		$50,000–$74,999	166,850	18.75 (13.80)	164,274	20.33 (14.80)	148,495	18.98 (15.90)	.110	.015	.088
		≥ $75,000	84,485	16.26 (12.37)	83,761	18.22 (13.74)	75,963	16.65 (13.91)	.150	.030	.114
	4	< $50,000	173,315	18.63 (13.60)	164,965	18.51 (13.83)	153,977	18.07 (15.46)	.009	.038	.030
		$50,000–$74,999	168,117	16.80 (12.69)	162,456	17.83 (13.19)	152,151	16.85 (14.29)	.080	.004	.071
		≥ $75,000	80,947	14.74 (11.78)	80,189	16.52 (12.42)	73,762	15.14 (13.47)	.147	.031	.107
	5	< $50,000	171,237	17.72 (12.96)	163,883	17.52 (12.95)	146,076	16.59 (14.40)	.015	.082	.067
		$50,000–$74,999	169,195	16.15 (12.34)	162,041	16.97 (12.69)	146,736	15.82 (13.75)	.066	.025	.087
		≥ $75,000	83,782	14.31 (11.26)	79,767	15.49 (12.25)	74,132	14.18 (12.64)	.100	.011	.105
	6	< $50,000	118,392	15.15 (12.74)	116,680	14.72 (12.42)	103,093	12.38 (12.74)	.034	.217	.186
		$50,000–$74,999	116,841	13.65 (12.41)	115,742	14.27 (12.46)	100,853	12.52 (12.73)	.050	.090	.139
		≥ $75,000	52,854	11.72 (10.95)	52,272	12.17 (11.95)	45,055	10.29 (11.17)	.039	.129	.163
	7	< $50,000	101,913	13.60 (12.28)	101,421	12.93 (11.83)	90,166	10.77 (11.92)	.055	.234	.182
		$50,000–$74,999	91,967	12.13 (12.36)	89,422	12.65 (12.39)	80,281	10.89 (12.01)	.041	.102	.144
		≥ $75,000	43,171	9.83 (10.31)	42,652	9.59 (10.60)	36,448	7.91 (9.64)	.023	.192	.166
	8	< $50,000	93,341	12.15 (11.50)	95,865	11.96 (11.13)	85,387	10.06 (11.05)	.017	.185	.171
		$50,000–$74,999	80,148	11.34 (12.09)	80,934	11.69 (11.94)	72,566	10.18 (11.84)	.028	.097	.127

		≥ $75,000	37,568	8.89 (9.83)	38,286	8.85 (9.88)	32,937	7.65 (9.41)	.003	.128	.124
Mathematics	K	< $50,000	153,597	12.41 (9.49)	149,295	13.32 (10.08)	126,910	15.25 (12.36)	.093	.258	.171
		$50,000–$74,999	139,279	11.66 (9.33)	137,157	13.85 (10.30)	118,543	15.02 (11.99)	.224	.313	.104
		≥ $75,000	63,583	10.73 (9.22)	62,717	13.22 (10.25)	54,178	13.83 (11.64)	.255	.295	.056
	1	< $50,000	173,253	15.59 (10.85)	168,807	16.08 (11.44)	149,888	17.80 (13.64)	.044	.179	.137
		$50,000–$74,999	163,631	14.58 (10.30)	160,868	16.49 (11.30)	145,504	17.40 (13.40)	.176	.236	.074
		≥ $75,000	77,957	13.46 (10.29)	77,411	15.59 (11.11)	70,840	16.17 (13.04)	.198	.230	.048
	2	< $50,000	181,557	16.84 (11.54)	175,573	17.01 (12.11)	159,803	18.05 (14.05)	.014	.094	.079
		$50,000–$74,999	176,026	15.57 (11.07)	171,695	17.07 (11.95)	156,065	17.26 (13.57)	.130	.136	.015
		≥ $75,000	83,032	14.27 (10.9)	82,108	16.27 (11.44)	75,441	16.09 (13.16)	.179	.151	.015
	3	< $50,000	193,588	18.00 (12.71)	186,907	18.00 (12.88)	165,967	18.00 (14.39)	.000	.000	.000
		$50,000–$74,999	186,430	16.69 (12.01)	183,188	17.82 (12.51)	165,123	17.48 (14.13)	.092	.060	.026
		≥ $75,000	86,938	15.11 (11.32)	85,800	16.86 (12.13)	78,701	16.05 (13.00)	.149	.077	.064
	4	< $50,000	195,516	18.10 (12.67)	185,934	18.13 (13.12)	172,135	17.78 (14.72)	.002	.024	.025
		$50,000–$74,999	188,631	16.93 (11.89)	182,016	17.81 (12.45)	168,899	17.15 (13.96)	.073	.017	.050
		≥ $75,000	84,256	15.37 (11.38)	83,095	16.95 (12.27)	76,956	15.61 (13.31)	.133	.020	.104
	5	< $50,000	191,716	17.52 (12.42)	183,927	17.46 (12.90)	163,863	16.7 (14.22)	.005	.062	.056
		$50,000–$74,999	191,531	16.71 (12.44)	183,977	17.54 (12.91)	165,993	16.56 (14.11)	.066	.011	.073
		≥ $75,000	89,274	15.00 (11.66)	85,043	16.71 (12.92)	79,507	15.29 (13.39)	.139	.023	.108
	6	< $50,000	136,164	16.06 (13.65)	135,564	15.82 (13.35)	122,089	14.23 (14.36)	.018	.130	.115
		$50,000–$74,999	131,508	14.88 (13.27)	132,281	15.45 (13.35)	118,210	13.98 (13.89)	.043	.066	.108
		≥ $75,000	62,374	13.19 (12.41)	61,851	13.64 (13.15)	54,478	12.12 (13.65)	.035	.082	.113
	7	< $50,000	118,295	15.00 (13.53)	119,516	14.60 (13.25)	108,121	12.58 (13.75)	.030	.178	.149
		$50,000–$74,999	111,378	12.65 (12.87)	111,694	13.11 (12.90)	102,043	11.35 (13.27)	.036	.099	.134
		≥ $75,000	49,512	11.62 (12.16)	50,013	11.86 (12.51)	43,198	10.06 (12.23)	.019	.128	.145
	8	< $50,000	103,414	13.69 (12.94)	105,216	13.25 (12.13)	96,108	11.45 (12.93)	.035	.173	.144
		$50,000–$74,999	88,683	11.38 (12.08)	88,980	11.93 (12.44)	82,539	10.10 (12.07)	.045	.106	.149
		≥ $75,000	39,779	10.05 (11.63)	40,372	10.57 (11.43)	36,468	8.61 (10.64)	.044	.130	.177

Table A9: Hours of *i-Ready* Usage by School Year and Locale: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Effect					
			School Year		Locale		Interaction	
			F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2
Reading	K	1,578.7 ($p < .001$)*	1,729.3 ($p < .001$)+	.004	3,569.9 ($p < .001$)+	.008	280.2 ($p < .001$)+	.001
	1	1,287.9 ($p < .001$)*	1,484.2 ($p < .001$)+	.003	2,442.6 ($p < .001$)+	.005	333.9 ($p < .001$)+	.001
	2	1,053.3 ($p < .001$)*	265.2 ($p < .001$)+	< .001	3,383.2 ($p < .001$)+	.006	178.3 ($p < .001$)+	.001
	3	1,227.9 ($p < .001$)*	486.9 ($p < .001$)+	.001	3,802.9 ($p < .001$)+	.006	130.6 ($p < .001$)+	< .001
	4	1,234.5 ($p < .001$)*	244.8 ($p < .001$)+	< .001	4,217.6 ($p < .001$)+	.007	129.1 ($p < .001$)+	< .001
	5	1,229.1 ($p < .001$)*	447.4 ($p < .001$)+	.001	3,840.7 ($p < .001$)+	.006	164.7 ($p < .001$)+	.001
	6	907.4 ($p < .001$)*	1,939.5 ($p < .001$)+	.005	1,285.8 ($p < .001$)+	.003	91.2 ($p < .001$)+	< .001
	7	832.1 ($p < .001$)*	1,862.2 ($p < .001$)+	.005	1,183.7 ($p < .001$)+	.003	58.1 ($p < .001$)+	< .001
	8	719.8 ($p < .001$)*	1,294.8 ($p < .001$)+	.004	1,407.3 ($p < .001$)+	.005	64.5 ($p < .001$)+	< .001
Mathematics	K	2,516.8 ($p < .001$)*	6,425.2 ($p < .001$)+	.013	2,305.4 ($p < .001$)+	.005	330.1 ($p < .001$)+	.001
	1	1,832.8 ($p < .001$)*	3,913.5 ($p < .001$)+	.007	1,975.2 ($p < .001$)+	.003	382.6 ($p < .001$)+	.001
	2	1,271.1 ($p < .001$)*	1,320.6 ($p < .001$)+	.002	2,806.0 ($p < .001$)+	.004	291.7 ($p < .001$)+	.001
	3	946.7 ($p < .001$)*	254.4 ($p < .001$)+	< .001	2,984.7 ($p < .001$)+	.004	179.1 ($p < .001$)+	.001
	4	1,125.0 ($p < .001$)*	224.3 ($p < .001$)+	< .001	3,753.0 ($p < .001$)+	.006	192.5 ($p < .001$)+	.001
	5	1,198.5 ($p < .001$)*	427.6 ($p < .001$)+	.001	3,716.9 ($p < .001$)+	.006	232.9 ($p < .001$)+	.001
	6	542.4 ($p < .001$)*	985.3 ($p < .001$)+	.002	822.5 ($p < .001$)+	.002	91.9 ($p < .001$)+	< .001
	7	559.3 ($p < .001$)*	1,654.6 ($p < .001$)+	.004	413.6 ($p < .001$)+	.001	49.2 ($p < .001$)+	< .001
	8	474.4 ($p < .001$)*	1,504.5 ($p < .001$)+	.004	188.8 ($p < .001$)+	.001	62.9 ($p < .001$)+	< .001

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)

+Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A10: Hours of *i-Ready* Usage by School Year and Locale: Means and Effect Sizes

Subject	Grade	Locale	2018–2019		2019–2020		2020–2021		Cohen's *d*		
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	2019–2020 – 2018–2019	2020–2021 – 2018–2019	2020–2021 – 2019–2020
Reading	K	City	104,206	14.54 (11.82)	101,550	15.94 (12.54)	86,837	17.38 (14.88)	.115	.211	.105
		Suburb	136,369	15.34 (11.85)	132,793	17.54 (13.00)	114,752	17.74 (14.34)	.177	.183	.015
		Town/Rural	69,552	13.75 (10.07)	68,313	13.57 (9.77)	61,257	14.52 (11.77)	.019	.070	.088
	1	City	123,596	17.00 (12.85)	120,616	18.73 (14.12)	108,200	19.98 (16.73)	.128	.200	.081
		Suburb	161,908	18.67 (13.00)	158,105	20.82 (14.04)	142,778	20.85 (16.04)	.159	.150	.002
		Town/Rural	78,737	17.80 (11.70)	77,048	17.28 (11.19)	71,398	18.34 (13.28)	.045	.043	.086
	2	City	134,094	18.13 (13.68)	130,369	19.35 (14.68)	119,221	19.27 (16.63)	.087	.075	.005
		Suburb	177,264	20.17 (13.84)	171,832	21.59 (14.55)	157,075	20.79 (16.01)	.100	.041	.053
		Town/Rural	85,255	18.39 (12.03)	83,885	17.82 (11.43)	78,191	18.64 (13.38)	.049	.019	.066
	3	City	142,940	17.75 (13.94)	138,965	19.20 (15.20)	124,565	18.04 (16.59)	.099	.019	.073
		Suburb	193,030	20.27 (14.67)	189,363	21.56 (15.51)	168,378	19.88 (16.18)	.085	.025	.106
		Town/Rural	89,927	18.19 (12.03)	87,728	18.05 (11.83)	80,434	17.96 (13.07)	.012	.019	.008
	4	City	138,962	16.07 (13.22)	134,089	16.95 (13.65)	124,220	15.91 (15.12)	.065	.011	.072
		Suburb	188,105	18.36 (13.51)	182,568	19.37 (14.03)	169,769	18.08 (15.16)	.073	.019	.088
		Town/Rural	95,312	16.37 (11.28)	90,953	16.12 (10.85)	85,901	16.50 (12.73)	.023	.011	.032
	5	City	136,880	15.31 (12.36)	131,157	16.05 (12.95)	117,698	14.66 (14.36)	.058	.049	.102
		Suburb	193,518	17.48 (12.96)	184,483	18.29 (13.37)	167,889	16.74 (14.17)	.062	.054	.112
		Town/Rural	93,816	15.85 (11.31)	90,051	15.29 (10.57)	81,357	15.50 (12.10)	.051	.030	.018
	6	City	86,510	12.98 (12.38)	84,880	13.10 (12.32)	73,118	11.29 (12.73)	.010	.134	.144
		Suburb	127,291	14.44 (12.74)	126,759	15.14 (13.00)	111,203	12.64 (12.71)	.054	.141	.194
		Town/Rural	74,286	14.09 (11.59)	73,055	13.34 (11.16)	64,680	11.92 (11.77)	.066	.186	.123
	7	City	69,821	11.40 (12.03)	69,042	11.29 (11.59)	60,402	9.61 (11.51)	.009	.152	.146
		Suburb	106,096	12.94 (12.5)	103,422	13.25 (12.69)	91,747	10.94 (12.07)	.025	.163	.187
		Town/Rural	61,134	12.39 (11.21)	61,031	11.50 (10.66)	54,746	10.05 (10.99)	.082	.211	.134
	8	City	62,688	10.23 (10.93)	64,287	10.29 (10.68)	58,158	9.10 (11.48)	.005	.101	.107
		Suburb	94,728	11.91 (12.43)	96,767	12.29 (12.52)	84,393	10.53 (11.69)	.030	.114	.145

		Town/Rural	53,641	11.33 (10.36)	54,031	10.76 (9.37)	48,339	8.94 (9.51)	.058	.241	.193
	K	City	115,417	11.59 (9.71)	112,526	13.06 (10.38)	95,512	15.30 (12.96)	.146	.324	.191
		Suburb	151,726	12.22 (9.68)	148,596	14.67 (10.77)	126,015	15.49 (12.37)	.240	.295	.071
		Town/Rural	89,316	11.43 (8.44)	88,047	12.14 (8.65)	78,104	13.47 (10.31)	.083	.217	.140
	1	City	137,733	13.91 (10.75)	134,320	15.32 (11.72)	119,786	17.11 (14.27)	.126	.254	.137
		Suburb	176,360	15.26 (10.77)	173,303	17.39 (11.81)	154,869	17.98 (13.74)	.189	.221	.046
		Town/Rural	100,748	15.18 (9.85)	99,463	15.10 (9.59)	91,577	16.50 (11.66)	.009	.122	.131
	2	City	146,810	14.75 (11.19)	142,976	15.80 (12.12)	129,497	16.57 (14.29)	.091	.142	.058
		Suburb	188,930	16.40 (11.56)	183,894	18.23 (12.48)	166,514	18.12 (14.04)	.152	.133	.008
		Town/Rural	104,875	16.41 (10.75)	102,506	16.02 (10.27)	95,298	17.10 (12.15)	.036	.060	.095
	3	City	156,457	15.96 (12.31)	152,011	16.63 (12.95)	136,363	16.40 (14.73)	.053	.032	.017
		Suburb	199,986	17.61 (12.55)	196,080	19.05 (13.10)	174,716	18.23 (14.29)	.113	.046	.060
		Town/Rural	110,513	17.11 (11.41)	107,804	16.81 (10.83)	98,712	17.38 (12.46)	.027	.022	.049
	4	City	154,324	15.99 (12.27)	148,385	16.64 (12.96)	136,104	15.62 (14.45)	.051	.028	.074
Mathematics		Suburb	198,777	17.94 (12.48)	192,377	19.10 (13.20)	178,310	18.00 (14.63)	.090	.005	.079
		Town/Rural	115,302	17.30 (11.37)	110,283	17.03 (11.17)	103,576	17.60 (12.83)	.024	.025	.047
	5	City	154,676	15.44 (12.08)	148,515	16.27 (13.11)	132,707	14.74 (14.05)	.065	.054	.112
		Suburb	203,838	17.44 (12.68)	194,599	18.56 (13.42)	177,250	17.19 (14.44)	.085	.018	.098
		Town/Rural	114,007	17.13 (11.85)	109,833	16.68 (11.46)	99,406	17.07 (13.04)	.039	.005	.031
	6	City	103,863	14.47 (13.53)	103,324	14.25 (13.06)	91,151	12.97 (14.46)	.016	.107	.093
		Suburb	139,120	15.46 (13.77)	139,761	16.20 (14.24)	125,255	14.00 (14.08)	.053	.104	.155
		Town/Rural	87,063	15.09 (12.25)	86,611	14.96 (11.99)	78,371	14.23 (13.54)	.011	.067	.057
	7	City	86,687	13.04 (13.69)	87,717	12.76 (12.99)	77,934	10.95 (13.29)	.021	.155	.138
		Suburb	118,757	13.48 (13.16)	117,992	14.09 (13.74)	106,452	11.90 (13.75)	.045	.118	.160
		Town/Rural	73,741	13.92 (12.26)	75,514	13.50 (11.80)	68,976	12.08 (12.71)	.035	.148	.116
	8	City	72,134	11.88 (13.11)	74,070	11.77 (12.40)	66,685	10.03 (12.36)	.009	.145	.140
		Suburb	96,000	12.02 (12.48)	96,474	12.75 (12.81)	88,425	10.44 (12.44)	.058	.126	.183
		Town/Rural	63,742	12.77 (11.69)	64,024	12.20 (10.84)	60,005	10.92 (11.94)	.051	.157	.112

Table A11: Hours of *i-Ready* Usage by Testing Location and Median Income: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Effect					
			Testing Location		Median Income		Interaction	
			F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2
Reading	K	133.3 ($p < .001$)*	242.4 ($p < .001$)+	.005	192.2 ($p < .001$)+	.002	26.5 ($p < .001$)+	.001
	1	179.8 ($p < .001$)*	125.5 ($p < .001$)+	.002	725.1 ($p < .001$)+	.007	32.4 ($p < .001$)+	.001
	2	314.6 ($p < .001$)*	420.9 ($p < .001$)+	.005	896.3 ($p < .001$)+	.007	34.4 ($p < .001$)+	.001
	3	563.6 ($p < .001$)*	866.5 ($p < .001$)+	.010	1,391.8 ($p < .001$)+	.010	49.3 ($p < .001$)+	.001
	4	648.0 ($p < .001$)*	1,242.9 ($p < .001$)+	.013	1,184.4 ($p < .001$)+	.009	55.0 ($p < .001$)+	.001
	5	563.8 ($p < .001$)*	1,006.7 ($p < .001$)+	.011	1,017.9 ($p < .001$)+	.008	72.3 ($p < .001$)+	.002
	6	444.7 ($p < .001$)*	590.1 ($p < .001$)+	.010	398.1 ($p < .001$)+	.005	84.6 ($p < .001$)+	.003
	7	367.9 ($p < .001$)*	416.1 ($p < .001$)+	.009	331.8 ($p < .001$)+	.005	36.5 ($p < .001$)+	.002
	8	234.1 ($p < .001$)*	188.5 ($p < .001$)+	.004	321.1 ($p < .001$)+	.005	13.6 ($p < .001$)+	.001
Mathematics	K	248.6 ($p < .001$)*	561.9 ($p < .001$)+	.009	214.7 ($p < .001$)+	.002	26.6 ($p < .001$)+	.001
	1	119.0 ($p < .001$)*	91.2 ($p < .001$)+	.001	475.1 ($p < .001$)+	.004	30.8 ($p < .001$)+	.001
	2	219.4 ($p < .001$)*	181.5 ($p < .001$)+	.002	718.8 ($p < .001$)+	.005	36.5 ($p < .001$)+	.001
	3	379.1 ($p < .001$)*	653.1 ($p < .001$)+	.007	681.5 ($p < .001$)+	.005	20.8 ($p < .001$)+	< .001
	4	624.9 ($p < .001$)*	1,101.6 ($p < .001$)+	.011	780.2 ($p < .001$)+	.005	91.3 ($p < .001$)+	.002
	5	639.5 ($p < .001$)*	1,535.9 ($p < .001$)+	.016	300.0 ($p < .001$)+	.002	56.7 ($p < .001$)+	.001
	6	422.9 ($p < .001$)*	465.1 ($p < .001$)+	.007	492.8 ($p < .001$)+	.005	71.0 ($p < .001$)+	.002
	7	231.1 ($p < .001$)*	201.8 ($p < .001$)+	.004	352.6 ($p < .001$)+	.004	31.7 ($p < .001$)+	.001
	8	228.6 ($p < .001$)*	128.2 ($p < .001$)+	.003	481.5 ($p < .001$)+	.007	16.2 ($p < .001$)+	.001

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)
+Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A12: Hours of *i-Ready* Usage by Testing Location and Median Income: Means and Effect Sizes

Subject	Grade	Median Income	In-In-In		Out-In-In		Out-Out-In		Out-Out-Out		Cohen's *d*
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	Mostly In – Mostly Out
Reading	K	< $50,000	25,823	18.36 (11.06)	11,306	21.26 (13.71)	11,236	20.47 (15.17)	18,496	21.37 (17.35)	.123
		$50,000–$74,999	22,546	18.42 (11.40)	12,590	20.16 (13.59)	9,425	20.10 (14.53)	17,078	21.42 (17.05)	.132
		≥ $75,000	9,935	17.95 (13.15)	5,823	19.40 (13.50)	5,342	17.15 (13.33)	8,905	19.08 (15.66)	.009
	1	< $50,000	27,293	22.95 (12.61)	14,948	25.61 (15.85)	15,440	22.64 (16.92)	27,515	22.49 (18.59)	.083
		$50,000–$74,999	25,076	21.68 (12.44)	17,347	22.91 (14.38)	15,629	21.61 (16.19)	30,135	22.40 (18.62)	.003
		≥ $75,000	12,288	19.45 (12.83)	8,272	20.70 (13.45)	9,944	18.87 (14.31)	17,296	20.44 (17.14)	.006
	2	< $50,000	29,525	23.33 (12.71)	16,473	26.07 (15.29)	18,618	22.18 (16.33)	33,644	21.29 (18.47)	.170
		$50,000–$74,999	28,142	22.15 (12.49)	19,175	23.66 (14.86)	19,059	20.86 (15.92)	37,095	20.95 (18.46)	.117
		≥ $75,000	13,511	19.99 (12.92)	8,669	20.80 (13.59)	12,022	18.02 (14.35)	19,697	19.18 (16.58)	.108
	3	< $50,000	29,911	23.23 (13.25)	18,548	25.96 (16.47)	19,308	21.17 (16.78)	34,267	19.95 (18.75)	.236
		$50,000–$74,999	29,057	21.23 (12.86)	20,612	23.29 (15.96)	21,291	20.06 (15.96)	38,237	19.22 (17.92)	.162
		≥ $75,000	13,090	17.74 (11.70)	9,965	20.62 (13.24)	13,122	16.51 (13.58)	21,547	17.42 (16.04)	.138
	4	< $50,000	28,245	21.55 (12.84)	18,484	23.84 (16.00)	19,819	18.85 (15.49)	39,058	17.48 (17.00)	.293
		$50,000–$74,999	28,804	19.15 (11.76)	20,412	20.92 (14.28)	21,966	17.48 (14.14)	41,624	16.86 (16.07)	.197
		≥ $75,000	11,859	16.83 (11.86)	9,218	19.34 (14.05)	12,692	14.75 (12.65)	22,149	15.36 (14.90)	.206
	5	< $50,000	25,478	20.27 (11.99)	16,134	21.55 (14.15)	18,956	17.10 (14.85)	38,832	15.91 (15.82)	.313
		$50,000–$74,999	27,344	17.79 (11.00)	18,004	18.96 (13.15)	20,755	16.36 (14.03)	40,490	15.64 (15.37)	.176
		≥ $75,000	10,342	15.11 (10.92)	8,225	17.59 (12.17)	12,787	14.02 (12.23)	23,368	14.00 (14.02)	.176
	6	< $50,000	15,975	17.71 (12.59)	8,489	16.31 (13.30)	12,423	12.29 (11.97)	30,102	12.11 (13.72)	.388
		$50,000–$74,999	14,273	15.12 (11.57)	8,960	14.97 (12.97)	14,604	13.02 (12.45)	34,612	12.46 (13.88)	.190
		≥ $75,000	3,190	11.52 (10.60)	2,706	14.33 (12.71)	8,983	9.99 (10.70)	17,650	10.36 (11.87)	.222
	7	< $50,000	12,341	15.14 (12.34)	6,729	14.41 (12.75)	10,507	10.12 (11.05)	28,104	10.60 (12.74)	.356
		$50,000–$74,999	10,111	13.73 (11.68)	6,793	13.21 (12.56)	10,060	11.15 (12.09)	29,256	11.07 (13.01)	.195
		≥ $75,000	1,680	10.63 (10.46)	1,823	11.07 (11.01)	7,420	7.32 (8.25)	14,734	8.59 (10.96)	.258
	8	< $50,000	11,419	13.47 (10.62)	6,147	12.94 (11.71)	9,926	9.72 (10.84)	26,781	10.60 (12.27)	.255
		$50,000–$74,999	8,578	12.56 (11.02)	5,885	12.92 (12.20)	8,358	10.38 (11.35)	28,001	10.71 (13.13)	.170

		≥ $75,000	1,541	8.78 (9.87)	1,426	9.77 (10.91)	6,227	7.37 (8.73)	13,551	8.18 (10.32)	.131
	K	< $50,000	28,851	15.75 (9.63)	12,919	18.53 (12.09)	11,290	18.04 (12.89)	20,985	19.30 (15.25)	.178
		$50,000–$74,999	28,551	15.68 (9.56)	13,077	17.35 (11.31)	10,782	17.74 (12.53)	18,898	19.39 (15.30)	.207
		≥ $75,000	10,406	15.38 (9.64)	5,480	16.07 (10.82)	5,726	15.47 (11.65)	10,060	17.64 (14.24)	.104
	1	< $50,000	31,956	19.29 (10.71)	17,102	21.28 (12.90)	16,499	19.32 (13.42)	31,353	19.78 (16.42)	.026
		$50,000–$74,999	32,182	18.74 (10.94)	17,981	19.39 (12.30)	17,054	18.97 (13.29)	32,185	19.59 (16.18)	.030
		≥ $75,000	12,500	16.94 (10.08)	7,881	17.42 (11.18)	10,853	17.17 (12.96)	19,899	18.57 (15.69)	.074
	2	< $50,000	33,824	20.38 (11.07)	18,393	21.84 (12.87)	19,880	19.30 (14.18)	36,305	18.95 (16.53)	.131
		$50,000–$74,999	35,231	19.32 (11.04)	19,593	19.84 (12.62)	20,939	17.95 (13.17)	38,488	18.33 (16.31)	.097
		≥ $75,000	12,966	17.14 (10.46)	8,022	17.92 (11.83)	13,937	16.51 (12.66)	22,423	17.66 (15.42)	.017
	3	< $50,000	34,481	21.32 (12.05)	19,863	22.12 (14.08)	20,853	19.35 (14.74)	37,037	18.23 (16.50)	.206
		$50,000–$74,999	35,549	20.26 (11.90)	20,283	20.34 (13.41)	24,213	18.18 (14.07)	39,621	17.83 (16.37)	.165
		≥ $75,000	12,980	17.93 (11.10)	8,504	19.11 (12.26)	14,305	16.38 (12.88)	23,178	16.45 (14.63)	.154
	4	< $50,000	32,645	21.98 (12.51)	19,523	22.64 (14.77)	22,041	18.59 (14.69)	41,526	16.98 (16.13)	.322
Mathematics		$50,000–$74,999	34,257	20.32 (12.03)	20,071	20.51 (13.11)	24,813	17.26 (13.22)	43,634	17.08 (15.95)	.235
		≥ $75,000	11,969	17.37 (11.59)	7,682	18.61 (13.35)	14,511	15.91 (12.57)	23,621	16.21 (15.14)	.132
	5	< $50,000	29,541	21.57 (12.94)	17,954	20.63 (13.36)	21,715	17.00 (13.93)	41,816	15.75 (15.53)	.357
		$50,000–$74,999	33,538	20.13 (12.28)	18,812	19.53 (13.26)	24,069	16.91 (13.87)	44,021	16.00 (15.72)	.258
		≥ $75,000	11,838	17.92 (11.93)	7,950	18.52 (12.22)	14,656	15.70 (13.20)	26,064	15.30 (14.83)	.206
	6	< $50,000	18,633	19.46 (14.34)	9,233	18.43 (15.16)	15,408	14.50 (13.67)	34,785	14.03 (15.49)	.334
		$50,000–$74,999	16,874	17.57 (13.13)	9,701	16.65 (14.41)	17,194	14.09 (13.16)	38,779	13.59 (14.66)	.250
		≥ $75,000	3,614	12.56 (11.45)	3,069	14.72 (14.51)	11,070	12.14 (12.51)	20,863	12.77 (15.23)	.073
	7	< $50,000	14,589	16.77 (13.31)	7,278	15.84 (14.64)	12,803	12.92 (13.26)	32,980	12.61 (14.64)	.268
		$50,000–$74,999	13,030	13.86 (12.11)	7,396	13.20 (13.83)	12,871	11.94 (14.02)	36,236	11.47 (14.16)	.151
		≥ $75,000	2,019	12.07 (10.64)	1,800	12.86 (13.68)	9,053	10.55 (11.91)	17,839	11.21 (13.49)	.116
	8	< $50,000	12,518	14.81 (12.54)	6,044	14.27 (14.14)	11,518	12.51 (13.61)	29,309	11.96 (13.93)	.187
		$50,000–$74,999	10,173	13.43 (11.55)	5,715	11.33 (12.38)	9,976	10.12 (11.48)	29,631	10.59 (13.45)	.177
		≥ $75,000	1,691	10.18 (9.50)	1,337	10.07 (10.95)	6,181	8.63 (9.81)	15,328	9.28 (11.60)	.097

Table A13: Hours of *i-Ready* Usage by Testing Location and Locale: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Effect					
			Testing Location		Locale		Interaction	
			F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2
Reading	K	230.6 ($p < .001$)*	143.5 ($p < .001$)+	.003	655.3 ($p < .001$)+	.008	20.5 ($p < .001$)+	.001
	1	143.5 ($p < .001$)*	151.0 ($p < .001$)+	.002	454.9 ($p < .001$)+	.004	59.6 ($p < .001$)+	.002
	2	254.1 ($p < .001$)*	507.7 ($p < .001$)+	.006	420.2 ($p < .001$)+	.003	52.7 ($p < .001$)+	.001
	3	438.1 ($p < .001$)*	820.3 ($p < .001$)+	.009	477.8 ($p < .001$)+	.004	91.0 ($p < .001$)+	.002
	4	594.8 ($p < .001$)*	1,299.7 ($p < .001$)+	.014	705.3 ($p < .001$)+	.005	98.3 ($p < .001$)+	.002
	5	499.3 ($p < .001$)*	1,206.1 ($p < .001$)+	.014	453.4 ($p < .001$)+	.003	97.8 ($p < .001$)+	.002
	6	373.8 ($p < .001$)*	1,179.5 ($p < .001$)+	.020	184.5 ($p < .001$)+	.002	33.9 ($p < .001$)+	.001
	7	343.0 ($p < .001$)*	929.5 ($p < .001$)+	.020	287.2 ($p < .001$)+	.004	34.1 ($p < .001$)+	.001
	8	254.3 ($p < .001$)*	598.4 ($p < .001$)+	.014	448.0 ($p < .001$)+	.007	34.9 ($p < .001$)+	.002
Mathematics	K	308.1 ($p < .001$)*	399.9 ($p < .001$)+	.007	510.2 ($p < .001$)+	.006	25.0 ($p < .001$)+	.001
	1	74.1 ($p < .001$)*	61.3 ($p < .001$)+	.001	160.6 ($p < .001$)+	.001	37.8 ($p < .001$)+	.001
	2	152.2 ($p < .001$)*	283.1 ($p < .001$)+	.003	144.5 ($p < .001$)+	.001	63.1 ($p < .001$)+	.001
	3	353.0 ($p < .001$)*	702.3 ($p < .001$)+	.007	234.7 ($p < .001$)+	.002	94.0 ($p < .001$)+	.002
	4	577.6 ($p < .001$)*	1,357.6 ($p < .001$)+	.014	401.2 ($p < .001$)+	.003	55.2 ($p < .001$)+	.001
	5	695.2 ($p < .001$)*	1,685.2 ($p < .001$)+	.017	373.2 ($p < .001$)+	.003	50.2 ($p < .001$)+	.001
	6	341.6 ($p < .001$)*	1,045.4 ($p < .001$)+	.015	35.7 ($p < .001$)+	< .001	33.1 ($p < .001$)+	.001
	7	185.0 ($p < .001$)*	447.7 ($p < .001$)+	.008	15.5 ($p < .001$)+	< .001	44.9 ($p < .001$)+	.002
	8	117.7 ($p < .001$)*	362.3 ($p < .001$)+	.008	1.1 ($p = .329$)	< .001	9.4 ($p < .001$)+	< .001

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)
+Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A14: Hours of *i-Ready* Usage by Testing Location and Locale: Means and Effect Sizes

Subject	Grade	Locale	In-In-In		Out-In-In		Out-Out-In		Out-Out-Out		Cohen's *d* Mostly In – Mostly Out
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
Reading	K	City	15,085	18.97 (11.88)	7,901	21.40 (14.12)	9,749	20.99 (15.43)	17,763	20.90 (17.33)	.076
		Suburb	22,171	19.57 (11.96)	15,675	21.06 (13.78)	11,876	20.03 (14.41)	22,174	21.54 (16.70)	.057
		Town/Rural	21,048	16.53 (10.68)	6,143	17.56 (12.17)	4,378	15.65 (12.58)	4,542	18.07 (16.21)	.010
	1	City	14,684	23.06 (13.34)	11,436	24.07 (15.48)	15,509	22.13 (17.22)	30,342	21.31 (18.82)	.117
		Suburb	25,542	21.87 (13.08)	20,368	24.15 (15.04)	18,526	21.88 (15.82)	37,190	22.99 (18.06)	.016
		Town/Rural	24,431	20.94 (11.67)	8,763	21.03 (13.35)	6,978	18.12 (13.77)	7,414	19.68 (16.87)	.147
	2	City	15,848	23.61 (13.77)	12,508	24.15 (15.48)	19,278	20.46 (16.18)	35,838	19.92 (18.60)	.230
		Suburb	27,793	22.42 (13.2)	21,949	25.07 (15.23)	22,104	21.75 (16.16)	45,942	21.53 (17.76)	.126
		Town/Rural	27,537	21.24 (11.46)	9,860	21.42 (13.01)	8,317	18.28 (13.49)	8,656	19.40 (17.43)	.175
	3	City	15,473	22.13 (13.97)	13,522	24.11 (16.84)	20,483	19.33 (16.51)	37,554	17.81 (18.08)	.285
		Suburb	28,487	21.76 (13.75)	24,709	25.12 (16.12)	24,282	20.59 (15.92)	47,143	20.18 (17.79)	.186
		Town/Rural	28,098	20.71 (11.46)	10,894	20.22 (12.79)	8,956	17.47 (13.59)	9,354	18.57 (16.83)	.186
	4	City	14,415	19.48 (13.25)	13,204	21.50 (16.06)	19,672	16.59 (14.38)	40,461	15.66 (16.00)	.296
		Suburb	26,618	19.88 (12.67)	23,667	23.33 (15.13)	24,547	18.81 (14.96)	51,216	17.98 (16.58)	.216
		Town/Rural	27,875	19.73 (11.53)	11,243	18.68 (12.91)	10,258	15.29 (12.64)	11,154	15.27 (14.72)	.322
	5	City	12,555	18.62 (12.73)	11,339	19.29 (13.54)	18,635	15.39 (14.44)	40,213	14.16 (15.24)	.311
		Suburb	24,839	18.11 (11.39)	20,830	20.82 (13.98)	24,320	17.27 (14.42)	51,153	16.66 (15.49)	.178
		Town/Rural	25,770	18.45 (11.07)	10,194	17.79 (11.91)	9,543	14.26 (11.39)	11,324	13.84 (13.74)	.352
	6	City	5,084	17.97 (13.12)	4,322	15.08 (12.83)	11,488	11.53 (11.90)	30,159	11.27 (13.40)	.407
		Suburb	11,787	16.09 (12.46)	9,973	16.33 (13.53)	16,254	12.87 (12.28)	40,559	12.64 (13.46)	.267
		Town/Rural	16,567	15.36 (11.51)	5,860	14.23 (12.41)	8,268	11.00 (11.11)	11,646	10.82 (13.33)	.345
	7	City	3,123	15.94 (13.53)	3,189	12.63 (11.93)	8,807	8.95 (10.63)	26,179	9.73 (12.09)	.384
		Suburb	7,691	14.49 (11.86)	7,587	15.12 (13.20)	12,646	10.72 (11.28)	35,787	11.24 (13.03)	.294
		Town/Rural	13,318	13.68 (11.66)	4,569	11.36 (11.31)	6,534	8.94 (10.32)	10,128	9.01 (11.69)	.360
	8	City	3,081	14.85 (13.25)	2,888	11.85 (11.82)	7,937	8.87 (10.29)	25,496	9.55 (12.47)	.325
		Suburb	6,809	13.25 (11.20)	6,644	14.42 (12.53)	10,709	10.58 (11.66)	33,618	11.07 (12.56)	.237

		Town/Rural	11,648	11.94 (9.69)	3,926	10.05 (10.16)	5,865	7.74 (8.49)	9,219	8.53 (10.57)	.329
	K	City	15,883	15.94 (10.18)	8,674	18.66 (12.57)	9,684	18.55 (13.27)	19,511	19.20 (15.36)	.159
		Suburb	24,310	16.60 (9.77)	15,471	17.99 (11.46)	12,423	17.70 (12.52)	24,803	19.32 (15.03)	.131
		Town/Rural	27,615	14.68 (9.00)	7,331	15.59 (10.34)	5,691	14.79 (10.83)	5,629	16.91 (14.22)	.087
	1	City	16,579	19.13 (11.60)	12,108	20.43 (13.44)	15,815	18.80 (13.72)	33,146	18.75 (16.36)	.065
		Suburb	28,081	18.80 (10.99)	20,315	20.26 (12.60)	19,733	19.08 (13.36)	41,023	20.07 (16.11)	.025
		Town/Rural	31,978	18.33 (10.02)	10,541	18.10 (10.58)	8,858	17.49 (12.23)	9,268	18.90 (15.57)	.005
	2	City	17,374	20.03 (11.76)	13,390	20.49 (13.11)	20,197	17.37 (13.54)	38,504	17.42 (16.42)	.202
		Suburb	29,847	19.26 (10.94)	21,448	20.90 (12.76)	24,059	18.96 (13.89)	48,451	19.23 (16.13)	.059
		Town/Rural	34,800	19.24 (10.68)	11,170	18.93 (11.83)	10,500	17.41 (12.15)	10,261	18.23 (15.51)	.108
	3	City	16,895	20.61 (12.85)	14,300	21.08 (14.22)	21,594	17.53 (14.51)	40,417	16.33 (16.19)	.279
		Suburb	30,770	20.29 (11.97)	22,418	21.85 (13.91)	26,213	18.99 (14.18)	48,749	18.71 (15.95)	.151
		Town/Rural	35,345	20.24 (11.35)	11,932	18.73 (11.65)	11,564	17.44 (12.88)	10,670	17.91 (15.54)	.170
	4	City	15,897	19.88 (13.16)	13,401	20.31 (14.65)	21,659	16.40 (13.48)	43,032	15.60 (15.64)	.292
Mathematics		Suburb	28,547	20.49 (12.19)	21,634	22.33 (14.30)	26,930	18.50 (14.21)	53,376	17.93 (16.17)	.219
		Town/Rural	34,427	20.93 (11.88)	12,241	19.71 (12.18)	12,776	16.85 (12.56)	12,373	16.53 (14.83)	.304
	5	City	14,551	19.72 (12.98)	12,890	18.91 (13.19)	21,342	15.55 (13.93)	44,072	14.26 (14.95)	.336
		Suburb	27,677	20.22 (12.44)	20,601	20.74 (13.54)	27,084	17.60 (14.08)	55,133	17.02 (15.97)	.227
		Town/Rural	32,689	20.74 (12.44)	11,225	19.07 (12.21)	12,014	16.46 (12.40)	12,696	15.34 (14.31)	.343
	6	City	6,220	18.55 (14.71)	5,559	16.99 (15.43)	14,534	13.67 (13.82)	35,478	13.20 (15.59)	.297
		Suburb	12,059	17.24 (13.28)	9,367	17.84 (14.83)	19,290	14.03 (13.07)	45,693	14.16 (14.96)	.238
		Town/Rural	20,842	18.29 (13.64)	7,077	16.29 (14.19)	9,848	13.28 (12.59)	13,256	12.52 (14.20)	.361
	7	City	4,310	15.72 (13.43)	3,937	13.22 (13.47)	11,003	11.76 (13.73)	32,100	11.23 (13.78)	.232
		Suburb	8,517	13.99 (11.67)	7,212	15.50 (14.72)	15,343	12.01 (13.21)	41,842	12.51 (14.80)	.167
		Town/Rural	16,811	15.63 (13.02)	5,325	13.56 (14.02)	8,381	12.05 (12.64)	13,113	11.24 (13.28)	.272
	8	City	3,591	14.87 (12.94)	3,302	12.35 (13.50)	9,017	10.78 (12.39)	27,590	10.59 (13.36)	.230
		Suburb	6,606	13.76 (12.49)	5,338	12.87 (13.83)	11,386	10.53 (11.64)	35,018	11.09 (13.40)	.184
		Town/Rural	14,185	13.74 (11.51)	4,456	12.35 (12.14)	7,272	11.19 (12.75)	11,660	10.82 (12.99)	.199

Table A15: Student Demographic Frequencies by Academic Year and Grade

Academic Year	Grade	American Indian or Alaskan	Asian	Black	Hawaiian or Pacific Islander	Hispanic	White	Two or More Races
					Number of Students (%)			
2018–2019	K	1,069 (.4%)	12,946 (4.6%)	65,583 (23.3%)	2,035 (.7%)	90,921 (32.3%)	95,710 (34.0%)	13,182 (4.7%)
	1	1,367 (.4%)	15,340 (4.7%)	73,646 (22.6%)	2,276 (.7%)	108,315 (33.2%)	110,718 (34.0%)	14,419 (4.4%)
	2	1,382 (.4%)	15,499 (4.5%)	77,092 (22.2%)	2,609 (.8%)	118,869 (34.3%)	116,831 (33.7%)	14,636 (4.2%)
	3	1,650 (.5%)	16,344 (4.5%)	80,647 (22.2%)	2,828 (.8%)	125,844 (34.6%)	121,402 (33.4%)	14,547 (4.0%)
	4	1,584 (.4%)	14,367 (4.0%)	78,592 (22.1%)	1,994 (.6%)	125,140 (35.3%)	119,857 (33.8%)	13,337 (3.8%)
	5	1,549 (.4%)	15,128 (4.2%)	77,363 (21.7%)	2,329 (.7%)	126,700 (35.5%)	120,543 (33.8%)	13,528 (3.8%)
	6	1,271 (.5%)	11,531 (4.4%)	61,220 (23.5%)	1,911 (.7%)	90,088 (34.5%)	85,711 (32.9%)	9,088 (3.5%)
	7	1,038 (.5%)	8,947 (4.1%)	53,497 (24.5%)	799 (.4%)	79,503 (36.4%)	68,159 (31.2%)	6,470 (3.0%)
	8	918 (.5%)	7,775 (4.2%)	46,320 (25.1%)	745 (.4%)	66,897 (36.2%)	57,468 (31.1%)	4,636 (2.5%)
2019–2020	K	1,020 (.4%)	12,360 (4.4%)	64,356 (22.9%)	2,152 (.8%)	91,054 (32.5%)	95,672 (34.1%)	13,948 (5.0%)
	1	1,291 (.4%)	15,386 (4.7%)	72,662 (22.3%)	2,426 (.7%)	108,388 (33.3%)	110,257 (33.9%)	14,955 (4.6%)
	2	1,381 (.4%)	16,146 (4.7%)	75,901 (22.0%)	2,770 (.8%)	117,316 (34.0%)	116,164 (33.7%)	14,999 (4.4%)
	3	1,566 (.4%)	15,791 (4.4%)	80,180 (22.2%)	2,850 (.8%)	125,933 (34.8%)	120,408 (33.3%)	14,763 (4.1%)
	4	1,601 (.5%)	15,143 (4.3%)	76,116 (21.8%)	2,294 (.7%)	123,417 (35.3%)	117,273 (33.5%)	13,828 (4.0%)
	5	1,510 (.4%)	14,162 (4.1%)	74,862 (21.6%)	2,140 (.6%)	123,453 (35.7%)	116,660 (33.7%)	13,094 (3.8%)
	6	1,276 (.5%)	11,801 (4.5%)	62,093 (23.5%)	2,135 (.8%)	91,896 (34.7%)	85,694 (32.4%)	9,608 (3.6%)
	7	1,013 (.5%)	8,687 (3.9%)	54,561 (24.6%)	912 (.4%)	80,124 (36.1%)	69,625 (31.4%)	6,742 (3.0%)
	8	948 (.5%)	7,741 (4.1%)	48,255 (25.4%)	772 (.4%)	69,903 (36.8%)	56,876 (29.9%)	5,417 (2.9%)
2020–2021	K	902 (.4%)	11,163 (4.6%)	56,009 (22.9%)	1,963 (.8%)	79,961 (32.7%)	82,783 (33.8%)	12,011 (4.9%)
	1	1,227 (.4%)	14,062 (4.7%)	65,248 (21.9%)	2,446 (.8%)	99,392 (33.4%)	100,612 (33.8%)	14,576 (4.9%)
	2	1,305 (.4%)	15,373 (4.8%)	69,926 (21.9%)	2,795 (.9%)	108,540 (34.0%)	107,022 (33.5%)	14,537 (4.5%)
	3	1,445 (.4%)	15,757 (4.8%)	71,387 (21.7%)	2,937 (.9%)	112,822 (34.3%)	110,155 (33.5%)	14,204 (4.3%)
	4	1,428 (.4%)	14,003 (4.2%)	73,159 (22.2%)	2,258 (.7%)	117,331 (35.5%)	108,841 (33.0%)	13,206 (4.0%)
	5	1,415 (.4%)	14,450 (4.5%)	68,232 (21.4%)	2,434 (.8%)	113,636 (35.6%)	106,189 (33.3%)	12,838 (4.0%)
	6	1,163 (.5%)	10,220 (4.3%)	56,444 (23.7%)	1,665 (.7%)	83,867 (35.2%)	76,561 (32.1%)	8,436 (3.5%)
	7	917 (.5%)	8,168 (4.0%)	50,771 (25.1%)	854 (.4%)	73,358 (36.2%)	62,191 (30.7%)	6,398 (3.2%)
	8	767 (.4%)	6,970 (4.0%)	45,344 (26.0%)	748 (.4%)	63,775 (36.5%)	51,887 (29.7%)	5,019 (2.9%)

Table A16: Hours of *i-Ready* Usage by School Year and Student Race/Ethnicity: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Effect: F Value (*p*-value)					
			School Year		Race/Ethnicity		Interaction	
			F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2
Reading	K	543.1 ($p < .001$)*	220.7 ($p < .001$)[+]	.001	1,027.5 ($p < .001$)[+]	.010	75.1 ($p < .001$)[+]	.001
	1	499.7 ($p < .001$)*	147.4 ($p < .001$)[+]	$< .001$	953.5 ($p < .001$)[+]	.008	84.0 ($p < .001$)[+]	.001
	2	315.1 ($p < .001$)*	32.4 ($p < .001$)[+]	$< .001$	859.8 ($p < .001$)[+]	.006	26.3 ($p < .001$)[+]	$< .001$
	3	537.6 ($p < .001$)*	54.1 ($p < .001$)[+]	$< .001$	1,511.4 ($p < .001$)[+]	.010	22.8 ($p < .001$)[+]	$< .001$
	4	481.3 ($p < .001$)*	31.2 ($p < .001$)[+]	$< .001$	1,437.5 ($p < .001$)[+]	.010	31.6 ($p < .001$)[+]	$< .001$
	5	401.4 ($p < .001$)*	30.6 ($p < .001$)[+]	$< .001$	1,118.9 ($p < .001$)[+]	.008	29.2 ($p < .001$)[+]	$< .001$
	6	282.9 ($p < .001$)*	171.8 ($p < .001$)[+]	.001	296.6 ($p < .001$)[+]	.003	35.6 ($p < .001$)[+]	.001
	7	284.1 ($p < .001$)*	66.3 ($p < .001$)[+]	$< .001$	448.7 ($p < .001$)[+]	.006	17.6 ($p < .001$)[+]	$< .001$
	8	321.8 ($p < .001$)*	46.7 ($p < .001$)[+]	$< .001$	786.9 ($p < .001$)[+]	.012	7.9 ($p < .001$)[+]	$< .001$
Mathematics	K	824.4 ($p < .001$)*	631.8 ($p < .001$)[+]	.002	811.2 ($p < .001$)[+]	.007	97.2 ($p < .001$)[+]	.002
	1	571.8 ($p < .001$)*	348.3 ($p < .001$)[+]	.001	638.5 ($p < .001$)[+]	.005	96.0 ($p < .001$)[+]	.001
	2	265.7 ($p < .001$)*	147.9 ($p < .001$)[+]	$< .001$	359.8 ($p < .001$)[+]	.002	51.0 ($p < .001$)[+]	.001
	3	246.6 ($p < .001$)*	44.8 ($p < .001$)[+]	$< .001$	618.8 ($p < .001$)[+]	.004	32.6 ($p < .001$)[+]	$< .001$
	4	193.1 ($p < .001$)*	15.5 ($p < .001$)[+]	$< .001$	488.4 ($p < .001$)[+]	.003	34.3 ($p < .001$)[+]	$< .001$
	5	117.0 ($p < .001$)*	40.6 ($p < .001$)[+]	$< .001$	209.4 ($p < .001$)[+]	.001	40.5 ($p < .001$)[+]	.001
	6	119.1 ($p < .001$)*	111.6 ($p < .001$)[+]	$< .001$	88.7 ($p < .001$)[+]	.001	24.1 ($p < .001$)[+]	$< .001$
	7	145.3 ($p < .001$)*	109.8 ($p < .001$)[+]	$< .001$	136.0 ($p < .001$)[+]	.001	18.9 ($p < .001$)[+]	$< .001$
	8	203.6 ($p < .001$)*	132.0 ($p < .001$)[+]	.001	343.5 ($p < .001$)[+]	.005	12.0 ($p < .001$)[+]	$< .001$

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)

[+]Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A17: Hours of *i-Ready* Usage by School Year and Student Race/Ethnicity: Means and Effect Sizes

Subject	Grade	Race/Ethnicity	2018–2019		2019–2020		2020–2021		Cohen's d		
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	2019–2020 – 2018–2019	2020–2021 – 2018–2019	2020–2021 – 2019–2020
Reading	K	Black	52,725	16.80 (12.15)	51,701	17.79 (13.63)	45,704	20.11 (16.32)	.077	.230	.155
		Hispanic	74,637	15.61 (11.79)	74,112	17.83 (13.11)	65,058	18.19 (14.61)	.178	.194	.026
		White	70,549	14.40 (10.73)	70,848	15.82 (11.00)	61,858	15.83 (12.12)	.130	.125	.001
	1	Black	59,644	19.94 (13.38)	59,008	20.94 (14.77)	53,444	23.27 (18.35)	.071	.208	.140
		Hispanic	90,234	18.87 (13.04)	89,803	21.15 (14.46)	82,044	21.28 (16.34)	.165	.163	.009
		White	81,917	17.74 (11.61)	81,464	19.12 (11.94)	74,796	18.89 (12.98)	.117	.094	.018
	2	Black	66,295	20.99 (14.70)	65,303	21.58 (15.39)	60,414	22.23 (17.73)	.039	.077	.040
		Hispanic	99,244	20.61 (13.79)	97,231	21.95 (14.91)	89,752	21.41 (16.39)	.093	.053	.034
		White	87,841	18.74 (12.22)	87,189	19.76 (12.22)	80,779	19.18 (13.27)	.084	.035	.045
	3	Black	71,948	22.08 (15.86)	71,600	22.48 (16.79)	63,407	21.65 (18.31)	.024	.025	.047
		Hispanic	106,443	21.12 (14.73)	106,781	22.43 (15.97)	94,443	20.65 (16.60)	.085	.030	.110
		White	92,418	18.00 (12.08)	91,549	19.33 (12.34)	83,606	18.11 (12.83)	.109	.009	.097
	4	Black	69,493	19.80 (14.93)	67,291	19.80 (15.13)	64,525	19.41 (17.23)	.000	.024	.024
		Hispanic	105,524	19.48 (13.66)	103,644	19.85 (14.15)	98,510	18.54 (15.25)	.027	.064	.089
		White	90,846	16.10 (11.32)	88,865	17.14 (11.40)	82,427	16.55 (12.36)	.092	.038	.049
	5	Black	67,915	19.02 (14.17)	65,814	18.89 (14.22)	59,776	18.04 (16.12)	.009	.065	.056
		Hispanic	107,470	18.41 (13.05)	104,406	18.82 (13.53)	95,270	17.25 (14.38)	.031	.084	.113
		White	91,097	15.72 (11.09)	87,643	16.40 (11.05)	79,583	15.86 (11.88)	.061	.012	.047
	6	Black	49,494	15.45 (13.21)	49,760	15.42 (13.75)	44,507	12.72 (13.58)	.002	.204	.198
		Hispanic	72,443	15.04 (13.50)	73,278	15.29 (13.35)	65,813	12.61 (12.69)	.019	.185	.206
		White	60,759	13.43 (11.19)	60,681	13.40 (11.13)	52,923	12.20 (11.38)	.003	.109	.106
	7	Black	42,119	14.00 (13.09)	42,448	13.65 (13.31)	38,398	11.09 (13.14)	.026	.222	.193
		Hispanic	60,797	13.36 (13.35)	60,016	13.50 (13.21)	53,581	11.28 (12.46)	.010	.161	.173
		White	45,084	11.50 (11.02)	45,259	11.35 (10.37)	39,632	10.00 (10.27)	.013	.141	.131
	8	Black	36,020	12.86 (12.20)	37,850	13.13 (12.75)	35,108	11.00 (12.68)	.022	.150	.168
		Hispanic	51,819	12.71 (13.33)	54,142	12.87 (12.92)	47,677	11.10 (12.53)	.013	.124	.139

		White	38,510	10.31 (10.23)	38,038	9.96 (9.41)	33,648	8.90 (9.17)	.036	.146	.114
Mathematics	**K**	Black	57,313	13.32 (10.27)	56,255	14.39 (11.10)	49,085	16.71 (13.63)	.101	.282	.187
		Hispanic	79,179	12.14 (9.50)	79,461	14.72 (10.98)	68,945	15.95 (12.70)	.251	.340	.104
		White	82,305	11.69 (8.96)	82,292	13.27 (9.16)	71,133	13.98 (10.26)	.174	.237	.072
	1	Black	64,696	16.09 (11.36)	63,984	16.77 (12.28)	57,354	18.97 (14.96)	.057	.216	.161
		Hispanic	93,934	15.04 (10.63)	94,121	17.32 (12.18)	85,682	18.17 (13.91)	.199	.252	.065
		White	96,332	14.72 (10.04)	96,088	15.83 (10.10)	87,579	16.38 (11.39)	.110	.154	.051
	2	Black	68,050	17.05 (12.31)	66,804	17.63 (13.05)	61,481	18.79 (15.13)	.045	.126	.082
		Hispanic	103,489	16.24 (11.15)	102,067	18.05 (12.65)	93,748	18.19 (14.17)	.152	.153	.010
		White	100,673	15.99 (10.80)	100,003	16.74 (10.71)	91,529	16.91 (11.77)	.070	.082	.016
	3	Black	70,790	19.17 (14.10)	70,476	19.21 (14.30)	62,621	19.23 (15.97)	.003	.004	.001
		Hispanic	109,743	17.56 (12.33)	109,829	18.93 (13.36)	98,268	18.16 (14.43)	.107	.045	.056
		White	106,131	16.59 (11.33)	105,229	17.46 (11.00)	96,050	17.32 (12.16)	.078	.062	.012
	4	Black	69,615	19.11 (13.78)	67,368	19.08 (14.06)	64,432	18.89 (16.31)	.003	.015	.012
		Hispanic	109,471	17.89 (12.37)	107,964	18.91 (13.44)	101,897	17.77 (14.55)	.079	.009	.081
		White	105,329	16.67 (11.18)	102,638	17.49 (11.18)	94,869	17.42 (12.38)	.074	.064	.006
	5	Black	68,657	18.57 (13.71)	66,543	18.27 (14.03)	60,443	17.62 (15.89)	.021	.063	.043
		Hispanic	110,781	17.31 (12.37)	107,951	18.27 (13.44)	98,605	16.79 (14.43)	.074	.039	.106
		White	105,110	16.65 (11.98)	101,933	17.23 (11.70)	92,450	17.10 (12.76)	.049	.036	.011
	6	Black	55,099	16.11 (14.07)	55,940	15.64 (14.31)	50,883	14.13 (15.45)	.033	.134	.101
		Hispanic	77,712	15.07 (13.83)	79,734	15.63 (14.23)	72,655	13.56 (14.04)	.040	.109	.146
		White	72,903	14.66 (12.39)	73,078	15.21 (12.46)	65,345	14.09 (13.02)	.044	.045	.087
	7	Black	47,855	14.02 (13.35)	49,011	14.24 (13.87)	44,860	11.79 (14.42)	.017	.160	.173
		Hispanic	66,456	13.10 (13.57)	67,630	13.56 (13.76)	61,860	11.68 (13.83)	.034	.103	.136
		White	57,853	12.58 (11.36)	59,263	12.60 (11.48)	52,383	11.65 (12.41)	.001	.078	.079
	8	Black	39,452	12.89 (12.67)	40,835	13.32 (12.98)	37,862	11.33 (13.60)	.034	.118	.149
		Hispanic	50,222	12.15 (13.19)	51,754	12.44 (13.25)	48,389	10.26 (12.75)	.022	.146	.168
		White	45,737	11.43 (10.61)	44,850	11.22 (10.42)	41,171	10.11 (10.93)	.020	.122	.104

Table A18: Hours of *i-Ready* Usage by Testing Location and Student Race/Ethnicity: Analysis of Variance Results

Subject	Grade	Overall F Value (*p*-value)	Effect: F Value (*p*-value)					
			Testing Location		Race/Ethnicity		Interaction	
			F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2	F Value (*p*-value)	Partial-η^2
Reading	K	128.1 ($p < .001$)*	25.8 ($p < .001$)+	.001	293.5 ($p < .001$)+	.014	23.7 ($p < .001$)+	.003
	1	131.1 ($p < .001$)*	9.1 ($p < .001$)+	< .001	455.3 ($p < .001$)+	.016	15.9 ($p < .001$)+	.002
	2	160.4 ($p < .001$)*	40.5 ($p < .001$)+	.001	425.8 ($p < .001$)+	.013	22.7 ($p < .001$)+	.002
	3	247.5 ($p < .001$)*	94.4 ($p < .001$)+	.001	618.9 ($p < .001$)+	.018	30.8 ($p < .001$)+	.003
	4	256.4 ($p < .001$)*	106.1 ($p < .001$)+	.002	499.8 ($p < .001$)+	.015	22.1 ($p < .001$)+	.002
	5	185.0 ($p < .001$)*	99.0 ($p < .001$)+	.002	342.1 ($p < .001$)+	.011	23.8 ($p < .001$)+	.002
	6	106.7 ($p < .001$)*	91.2 ($p < .001$)+	.002	93.6 ($p < .001$)+	.004	6.7 ($p < .001$)+	.001
	7	95.9 ($p < .001$)*	46.7 ($p < .001$)+	.001	122.3 ($p < .001$)+	.007	7.4 ($p < .001$)+	.001
	8	63.2 ($p < .001$)*	14.1 ($p < .001$)+	< .001	147.1 ($p < .001$)+	.010	4.4 ($p < .001$)+	.001
Mathematics	K	139.8 ($p < .001$)*	59.8 ($p < .001$)+	0001	184.8 ($p < .001$)+	.008	12.5 ($p < .001$)+	.002
	1	86.4 ($p < .001$)*	6.8 ($p < .001$)+	< .001	275.3 ($p < .001$)+	.009	15.9 ($p < .001$)+	.002
	2	91.2 ($p < .001$)*	18.1 ($p < .001$)+	< .001	242.5 ($p < .001$)+	.007	14.7 ($p < .001$)+	.001
	3	154.3 ($p < .001$)*	49.6 ($p < .001$)+	.001	337.2 ($p < .001$)+	.009	22.2 ($p < .001$)+	.002
	4	198.5 ($p < .001$)*	114.7 ($p < .001$)+	.002	266.1 ($p < .001$)+	.008	18.8 ($p < .001$)+	.002
	5	167.5 ($p < .001$)*	104.6 ($p < .001$)+	.002	105.1 ($p < .001$)+	.003	14.7 ($p < .001$)+	.001
	6	107.9 ($p < .001$)*	77.4 ($p < .001$)+	.002	44.4 ($p < .001$)+	.002	10.0 ($p < .001$)+	.001
	7	46.4 ($p < .001$)*	39.7 ($p < .001$)+	.001	10.6 ($p < .001$)+	.001	10.0 ($p < .001$)+	.002
	8	53.1 ($p < .001$)*	14.0 ($p < .001$)+	< .001	47.9 ($p < .001$)+	.003	6.1 ($p < .001$)+	.001

*Statistically significant at $\alpha = .05 / 18$ (adjusted for one significance test per subject and grade)
+Statistically significant at $\alpha = .05 / 54$ (adjusted for three significance tests per subject and grade)

Table A19: Hours of *i-Ready* Usage by Testing Location and Student Race/Ethnicity: Means and Effect Sizes

Subject	Grade	Race/Ethnicity	In-In-In		Out-In-In		Out-Out-In		Out-Out-Out		Cohen's *d*
			N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	Mostly In – Mostly Out
Reading	K	Black	7,444	20.02 (13.18)	5,194	23.89 (15.62)	5,437	24.18 (16.70)	9,837	24.6 (18.63)	.175
		Hispanic	11,221	21.16 (12.72)	9,530	21.41 (13.53)	7,570	19.84 (14.47)	13,670	21.09 (16.10)	.044
		White	21,384	17.45 (10.67)	7,632	19.14 (12.55)	4,856	17.83 (13.20)	5,683	19.70 (15.28)	.073
	1	Black	7,438	24.68 (14.21)	6,859	27.80 (17.28)	7,362	26.17 (18.67)	14,037	25.93 (20.53)	.009
		Hispanic	12,217	24.05 (14.38)	12,069	25.30 (15.25)	11,920	22.04 (16.24)	23,586	22.22 (17.46)	.157
		White	24,380	21.23 (11.15)	11,087	21.12 (12.57)	7,996	19.14 (13.29)	9,985	20.34 (16.17)	.103
	2	Black	7,887	25.61 (14.82)	7,601	28.38 (16.69)	8,947	24.61 (17.79)	18,281	22.67 (19.20)	.211
		Hispanic	12,571	25.04 (13.79)	12,903	26.75 (15.14)	14,587	21.59 (16.27)	28,864	21.41 (17.55)	.280
		White	27,295	21.58 (11.38)	11,925	21.35 (12.77)	9,461	18.94 (13.30)	11,422	19.66 (15.86)	.163
	3	Black	8,127	25.44 (16.37)	8,668	28.63 (18.35)	9,370	24.51 (18.64)	17,114	21.95 (19.63)	.230
		Hispanic	13,120	24.41 (14.57)	13,954	27.06 (16.67)	15,663	20.36 (15.84)	29,482	20.16 (17.42)	.339
		White	27,013	20.44 (11.08)	13,310	20.65 (12.56)	10,577	17.67 (13.09)	11,996	17.77 (15.61)	.212
	4	Black	7,185	23.15 (14.70)	8,464	26.25 (17.49)	9,282	21.13 (16.86)	19,167	19.21 (18.25)	.292
		Hispanic	12,740	21.92 (12.84)	14,333	24.75 (15.60)	16,378	18.53 (14.99)	32,834	17.73 (15.76)	.362
		White	24,954	19.00 (11.09)	12,724	19.11 (12.32)	10,669	15.91 (12.30)	12,826	15.94 (14.48)	.248
	5	Black	6,419	21.84 (13.63)	7,083	23.03 (15.32)	8,689	19.67 (16.46)	18,104	17.97 (17.31)	.249
		Hispanic	11,342	20.02 (12.63)	12,431	23.04 (13.80)	15,713	17.21 (14.43)	33,229	16.41 (15.00)	.350
		White	23,999	18.02 (10.52)	11,226	17.60 (11.32)	9,999	15.35 (11.93)	11,827	15.20 (13.74)	.220
	6	Black	4,145	17.95 (13.90)	3,844	16.49 (13.44)	5,302	13.31 (13.45)	14,965	12.81 (14.46)	.309
		Hispanic	4,930	16.33 (12.49)	6,063	17.08 (13.75)	10,791	12.83 (12.29)	27,862	12.52 (13.05)	.317
		White	13,769	15.63 (11.42)	5,204	13.57 (12.17)	7,763	10.85 (10.50)	9,436	10.93 (12.38)	.359
	7	Black	2,926	15.11 (14.25)	3,081	13.98 (13.79)	4,534	11.54 (12.87)	13,528	11.82 (14.30)	.198
		Hispanic	3,821	15.85 (13.58)	4,963	15.77 (13.39)	8,111	10.77 (11.56)	23,604	11.22 (12.98)	.360
		White	8,950	13.52 (10.56)	3,497	11.44 (10.50)	5,853	8.49 (8.81)	8,134	8.82 (11.69)	.402
	8	Black	2,724	13.64 (11.74)	2,676	13.00 (12.37)	3,896	11.46 (12.59)	12,352	12.18 (14.55)	.101
		Hispanic	3,176	14.40 (12.89)	4,373	14.27 (12.71)	7,140	11.17 (11.77)	21,469	11.32 (13.13)	.238

Subject	Grade	Race	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	
		White	7,182	11.57 (9.41)	2,947	10.44 (9.69)	4,809	7.78 (8.51)	7,014	8.51 (9.90)	.321
Mathematics	K	Black	7,749	16.08 (10.80)	5,286	19.55 (13.05)	5,281	20.02 (13.83)	11,885	20.46 (15.46)	.210
		Hispanic	11,843	16.63 (10.20)	9,608	18.90 (11.75)	7,646	17.76 (12.51)	14,637	19.38 (14.74)	.094
		White	25,622	15.19 (8.96)	7,530	16.41 (10.32)	5,146	16.13 (11.11)	6,130	17.72 (13.71)	.138
	1	Black	7,735	19.77 (11.64)	6,745	22.63 (14.16)	7,049	21.20 (14.38)	16,864	21.06 (16.97)	.000
		Hispanic	13,000	19.57 (11.39)	12,000	21.26 (12.50)	11,802	18.95 (13.61)	24,518	19.43 (15.66)	.081
		White	29,845	18.26 (10.05)	11,604	17.79 (10.52)	8,933	17.26 (11.29)	11,302	17.99 (14.44)	.039
	2	Black	7,968	21.35 (12.18)	7,326	23.11 (13.42)	8,449	20.72 (14.75)	19,559	19.44 (16.93)	.161
		Hispanic	13,712	20.32 (11.22)	12,932	21.97 (12.86)	14,919	18.38 (13.83)	29,870	18.65 (15.77)	.187
		White	32,120	18.96 (10.25)	12,186	18.69 (11.35)	10,470	17.01 (11.51)	12,813	17.45 (14.11)	.138
	3	Black	7,937	22.79 (14.30)	7,871	24.39 (15.38)	8,834	21.87 (15.96)	17,837	19.70 (17.34)	.199
		Hispanic	13,981	21.51 (12.40)	13,318	22.78 (13.66)	15,989	18.14 (13.86)	30,905	18.12 (15.62)	.284
		White	32,369	19.97 (11.02)	13,358	19.03 (11.61)	12,264	17.13 (11.94)	13,467	16.71 (14.49)	.226
	4	Black	7,078	22.81 (13.58)	7,509	24.75 (16.24)	8,968	20.55 (15.94)	19,950	19.05 (17.82)	.265
		Hispanic	13,389	21.05 (12.55)	13,439	23.08 (14.02)	16,879	18.06 (14.26)	33,938	17.23 (15.41)	.321
		White	29,450	20.62 (11.30)	12,414	19.40 (11.73)	12,712	16.77 (12.05)	14,318	16.25 (14.06)	.305
	5	Black	6,589	22.18 (13.73)	6,870	21.92 (14.86)	8,456	19.23 (15.65)	19,418	17.39 (17.18)	.263
		Hispanic	12,262	20.50 (12.92)	12,139	21.83 (13.26)	16,194	16.93 (14.14)	35,127	16.19 (15.24)	.337
		White	28,867	20.46 (11.98)	11,872	18.80 (11.95)	11,814	16.57 (12.33)	13,930	15.83 (14.21)	.299
	6	Black	4,090	19.61 (15.36)	4,124	18.39 (16.25)	6,056	14.55 (15.28)	17,765	14.21 (16.14)	.296
		Hispanic	5,753	16.35 (13.49)	6,113	17.99 (15.04)	11,322	13.83 (13.34)	30,627	13.61 (14.64)	.246
		White	16,476	17.91 (13.24)	5,765	16.22 (14.06)	10,204	12.51 (11.64)	11,976	12.54 (13.55)	.377
	7	Black	3,057	14.87 (13.94)	3,352	14.04 (15.25)	5,127	12.02 (13.60)	16,446	12.66 (15.61)	.130
		Hispanic	4,388	13.47 (12.31)	4,729	15.42 (14.44)	9,163	11.85 (13.46)	27,124	12.14 (14.90)	.172
		White	11,802	14.90 (12.35)	3,766	13.56 (13.82)	7,957	10.79 (12.24)	11,257	10.92 (12.88)	.293
	8	Black	2,667	15.22 (13.38)	2,643	13.32 (13.39)	4,046	11.51 (13.13)	13,603	12.79 (15.55)	.125
		Hispanic	3,367	12.82 (12.43)	3,554	13.12 (14.97)	6,438	10.45 (12.76)	21,573	10.69 (13.27)	.174
		White	9,347	13.42 (10.99)	2,892	11.87 (11.52)	5,584	9.96 (11.51)	8,337	9.16 (11.25)	.317

Appendix B

In constructing the sample for this study, we noticed a precipitous drop in the number of students included between the first two school years and the 2020–2021 school year, despite applying the same filtering rules to all years. To better understand this drop, we pulled *i-Ready* data for the last four school years and counted the number of students who completed at least one *i-Ready* lesson. We applied similar filtering rules to select a sample of schools that used *i-Ready* relatively consistently in each of the four years. Examining a four-year cross-sectional sample allowed us to look at how the number of students completing at least one lesson changed between two normal years (2017–2018 and 2018–2019), followed by a mostly normal year (2019–2020), which helps provide context for the drop that we saw in 2020–2021. Table B1 shows the number of students in each school year, by subject and grade, as well as the percent change relative to the 2017–2018 school year.

Table B1: Number of Students Completing at Least One Lesson over the Last Four Years

Subject	Grade	2017–2018	2018–2019		2019–2020		2020–2021	
		Count	Count	% Change	Count	% Change	Count	% Change
Reading	K	224,249	227,749	101.6%	225,658	100.6%	198,678	88.6%
	1	271,841	270,004	99.3%	265,525	97.7%	244,766	90.0%
	2	293,137	296,366	101.1%	288,323	98.4%	269,217	91.8%
	3	319,398	323,642	101.3%	318,187	99.6%	288,940	90.5%
	4	314,244	310,913	98.9%	303,106	96.5%	285,372	90.8%
	5	300,353	309,112	102.9%	299,070	99.6%	269,155	89.6%
	6	180,810	188,444	104.2%	190,125	105.2%	163,767	90.6%
	7	136,291	146,364	107.4%	147,431	108.2%	128,491	94.3%
	8	118,177	122,324	103.5%	128,149	108.4%	113,557	96.1%
Mathematics	K	237,151	242,877	102.4%	241,319	101.8%	209,588	88.4%
	1	287,147	287,602	100.2%	283,186	98.6%	260,393	90.7%
	2	308,933	314,457	101.8%	306,448	99.2%	283,874	91.9%
	3	335,451	338,345	100.9%	331,560	98.8%	301,439	89.9%
	4	337,314	335,283	99.4%	324,645	96.2%	305,434	90.5%
	5	322,498	335,534	104.0%	323,473	100.3%	291,279	90.3%
	6	211,685	218,374	103.2%	222,988	105.3%	193,464	91.4%
	7	163,957	177,281	108.1%	178,902	109.1%	156,686	95.6%
	8	130,532	135,745	104.0%	138,690	106.2%	124,494	95.4%

Between the first two school years, the number of students completing at least one lesson increased slightly in every subject and grade with the exception for Grades 1 and 4 Reading and Grade 4 Mathematics. During the 2019–2020 school year, we saw more unique students in the middle school grades with roughly the same number of students (within five percentage points) as 2017–2018 in Grades K–5. However, the number of students completing at least one lesson dropped significantly during the 2020–2021 school year. The drops ranged from about four percentage points in Grade 8 Reading to almost 12 percentage points in Grade K, both subjects. These drops are consistent with, albeit slightly larger than, those reported by the US Department of Education (2021a). This finding is important to note for the study at hand, as all of our ANOVAs and average time spent on *i-Ready* analyses utilize only those students who exist in our dataset. As such, the means from 2020–2021 are likely underestimates, as there are students missing from the data entirely who spent no time in *i-Ready* at all.