COVID-19 Learning Recovery Signal

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Key Takeaways

- Students' within-year growth was greater pre-pandemic than growth during and post-pandemic, with all students experiencing summer learning slide across these periods.
- Students who were in first grade in 2019–2020 showed reading recovery in third grade, but they did not show recovery in math until fourth grade in the 2022–2023 school year.
- Students will need additional support to catch up to the typical grade-level curriculum, with recovery time varying among grade levels and backgrounds.

Introduction

The COVID-19 pandemic was a global crisis that had far-reaching effects on healthcare, economics, and education worldwide. Many studies have shown that the pandemic had a negative impact on student achievement in both reading and math (Kuhfeld et al., 2020; DeWitt, 2020; Michel, 2020; Bansak & Starr, 2021; Lambert & Schuck, 2021; Office for Civil Rights, 2021; Spitzer & Musslick, 2021; Yan et al., 2021; Locke et al., 2021; Patarapichayatham et al., 2021; Patarapichayatham & Locke, 2022).

While COVID-19 is no longer considered a public health emergency, the aftereffects are still evident in student learning. For example, the Texas Education Agency (TEA) released the 2022 State of Texas Assessments of Academic Readiness (STAAR) scores for grades 3–12, which showed some improvement in student performance compared to 2021, but still showed 10% fewer students meeting or exceeding expectations in math compared to pre-pandemic levels (TEA, 2022). Similarly, the Arkansas Department of Education released the ACT Aspire scores for 2022, which showed some gains over the 2021 test results, but student achievement remained below pre-pandemic levels in both reading and math (Arkansas, 2022).

Further studies using longitudinal data found evidence of academic rebounding in reading and math in fall 2022 (Kuhfeld & Lewis, 2022; Lewis & Kuhfeld, 2022; Locke et al., 2021; Patarapichayatham et al., 2021; Patarapichayatham & Locke, 2022). However, rebounding was uneven across school years and summers, with the youngest students (current third grade students who were in kindergarten when

the pandemic began) showing the least rebounding. Recovery to pre-pandemic levels is likely several years away.

Previous studies using Istation data have investigated the impact of COVID-19 on students' achievement in reading and math, incorporating nine test events across three school years (2018–2019, 2019–2020, and 2020–2021) (Locke et al., 2021; Patarapichayatham et al., 2021; Patarapichayatham & Locke, 2022). The current study further investigates the impact of COVID-19 on students by expanding those studies with more test events to examine the COVID-19 recovery signal, or a measurable indication that academic performance is improving or returning to pre-pandemic levels, in reading and math using five school years of data (Patarapichayatham & Locke, 2023). These results were presented at the National Council on Measurement in Education Annual Meeting in 2023.

Methodology

The study used ISIP Reading and ISIP Math assessments, which operate under a fully computer-adaptive testing environment and are designed to provide continuous differentiated instruction for prekindergarten through eighth grade students (Mathes et al., 2022). The scores are computed from different sub-skills depending on grade level, and overall reading scaled scores and overall math scaled scores are used for the analyses (Ketterlin-Geller, 2021). The scales used in ISIP Reading and ISIP Math cannot be compared across subjects because they use different scales. The current norms were derived using data from the 2018–2019 school year. Growth norms based on student growth percentiles have four ranges outlined in Table 1.

Table 1. *Growth Percentile Ranges*

Below Typical	1st–40th Growth Percentile
Typical	41st–60th Growth Percentile
Above Typical	61st–80th Growth Percentile
Accelerated	81st–99th Growth Percentile

Data were from the Istation database, which includes millions of students across the US who took ISIP assessments in the 2018–2019, 2019–2020, 2020–2021, 2021–2022, and 2022–2023 school years. The study focused on early elementary school grades for each school year, with separate reading and math data sets. The study used three benchmarking assessment months per school year: (1) beginning-of-the-year (BOY), (2) middle-of-the-year (MOY), and (3) end-of-the-year (EOY), which are usually September, January, and May, respectively, and controlled for assessment location effect. The data were merged to create one longitudinal data file across five academic years with 15 test events, and socioeconomic status (SES) at the school level was considered in the sampling without replacement. The final sample consisted of 15,000 students in ISIP Math and 24,000 in ISIP Reading, totaling 39,000 students in the study.

The study had three different cohorts of students in each data file that are presented in Figure 1. The first cohort (Kindergarten) was in kindergarten during the 2018–2019 school year and reached fourth grade in the 2022–2023 school year. The second cohort (G1) was in first grade during the 2018–2019 school year and reached fifth grade in the 2022–2023 school year, while the

third cohort (G2) was in second grade during the 2018–2019 school year and reached sixth grade in the 2022–2023 school year.

Figure 1. *Sample Cohort by School Year*

Cohort	2018-19	2019-20	2020-21	2021-22	2022-23
Kindergarten	Kindergarten	G1	G2	G3	G4
G1	G1	G2	G3	G4	G5
G2	G2	G3	G4	G5	G6

Predictive mean matching was implemented to handle missing data as it calculates the predicted value of a target variable from all complete cases and returns plausible values for missing data. In addition, a piecewise growth model was used to analyze the data. This model is a type of time series analysis that examines the development of individuals on one or more outcome variables over time, and it is used when growth is not linear. The piecewise growth model captures different phases of development with more than one slope growth factor.

Results

ISIP Reading Longitudinal Analysis

Overall ISIP Reading scores from 2018 BOY through 2023 are presented by cohort in Figure 2. In summary, students' within-year growth was greater pre-pandemic than during the pandemic and post-pandemic. It is typical that students grow more during the younger grades, and once they have learned to read, their growth is less. Students experienced summer learning slide pre-pandemic, during the pandemic, and post-pandemic with slightly different magnitudes.
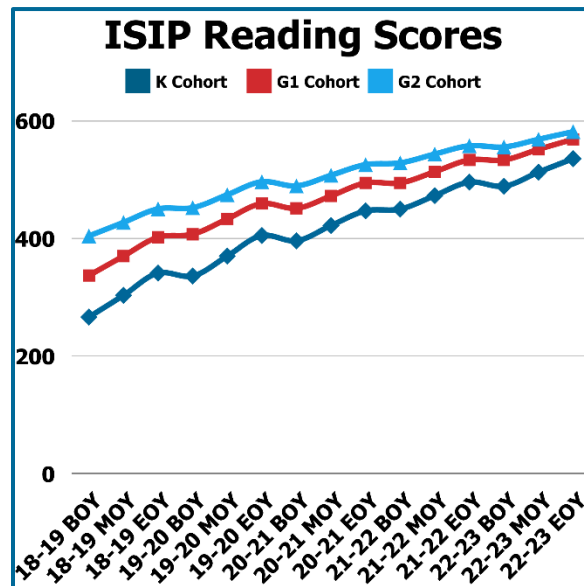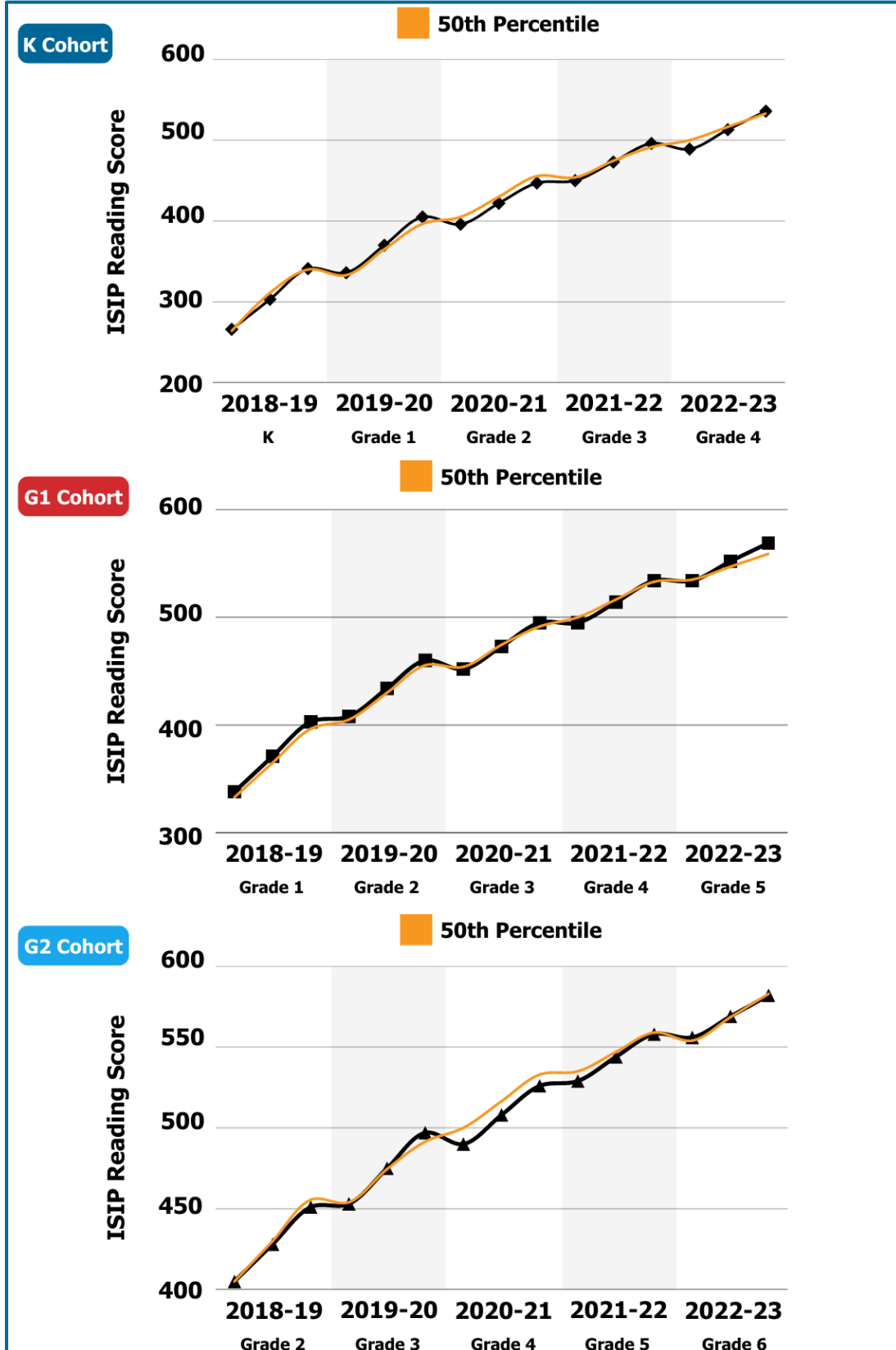
Figure 2. *ISIP Reading Results by Cohort*

Figure 3 shows the longitudinal results by cohort and compares their trajectories from the 2018–2019 to the 2022–2023 school years with the norms for the 50th percentile as a comparison. The kindergarten cohort tracks closely to the 50th percentile until the pandemic, when they fall slightly behind, and then as the pandemic begins to wane, they appear to experience recovery. Results are similar for the first and second grade cohorts, where they track closely to the 50th percentile pre-pandemic, and during the pandemic we see the impact of having lower growth rates than are typical. Notably the gaps between performance and the 50th percentile are greater for the first and second grade cohorts than they are for the kindergarten cohort.

Figure 3. *Growth Trajectories in Reading for All Cohorts Compared to the 50th Percentile*

ISIP Math Longitudinal Analysis

Overall ISIP Math scores from 2018 BOY through 2023 are presented by cohort in Figure 4. Similar to ISIP Reading, students' within-year growth was considerably more pre-pandemic than during the pandemic and post-pandemic. All students experienced summer learning slide pre-pandemic, during the pandemic, and post-pandemic with slightly different magnitudes.

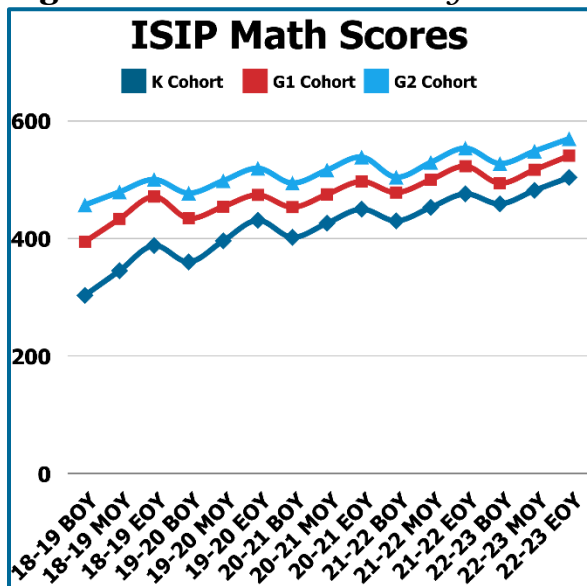**Figure 4.** *ISIP Math Results by Cohort*

Figure 5 shows the longitudinal results by cohort and compares their trajectories from the 2018–2019 to the 2022–2023 school years, with the norms for the 50th percentile as a comparison. Despite typical growth, students started out with lower scores in the BOY, and evidence of the learning lags can be seen during the pandemic years as mean scores are visibly below the 50th percentile.

The kindergarten cohort began to fall behind in first grade, the first pandemic year, and gaps persisted through the pandemic. The first grade cohort also was behind the first year of the pandemic, and their pre-pandemic performance was also below the 40th percentile, but the gaps between performance and the 50th percentile appeared to close in the 2022–2023 school year. The second grade cohort's performance appeared to fall behind slightly during the pandemic, but the learning lags are less evident with this cohort of slightly older students. These results may be partially explained by age and difficulty of the assessment. ISIP Math increases in difficulty starting in second grade to match the increased difficulty in standards and abstract reasoning.

It is not uncommon for students to struggle with math beginning in second grade due to increased difficulty of content standards. The kindergarten cohort may have missed some key instruction at the end of first grade, and in second grade during the first full pandemic school year, remote instruction may have made it difficult for them to catch up, especially if the instruction was focused on reading growth. Students who were in second grade in 2018–2019 and thus in third and fourth grades during the height of the pandemic, appeared to have more typical growth in math.

Discussion

This study investigated the COVID-19 recovery signal in reading and math using five school years of Istation data with 15 benchmarking points. The results showed that students' scores are rebounding but remain below pre-pandemic performance, especially in math. It may take a few more years for students to return to their pre-pandemic grade-level ability.

Figure 5. *Growth Trajectories in Math for All Cohorts Compared to the 50th Percentile*
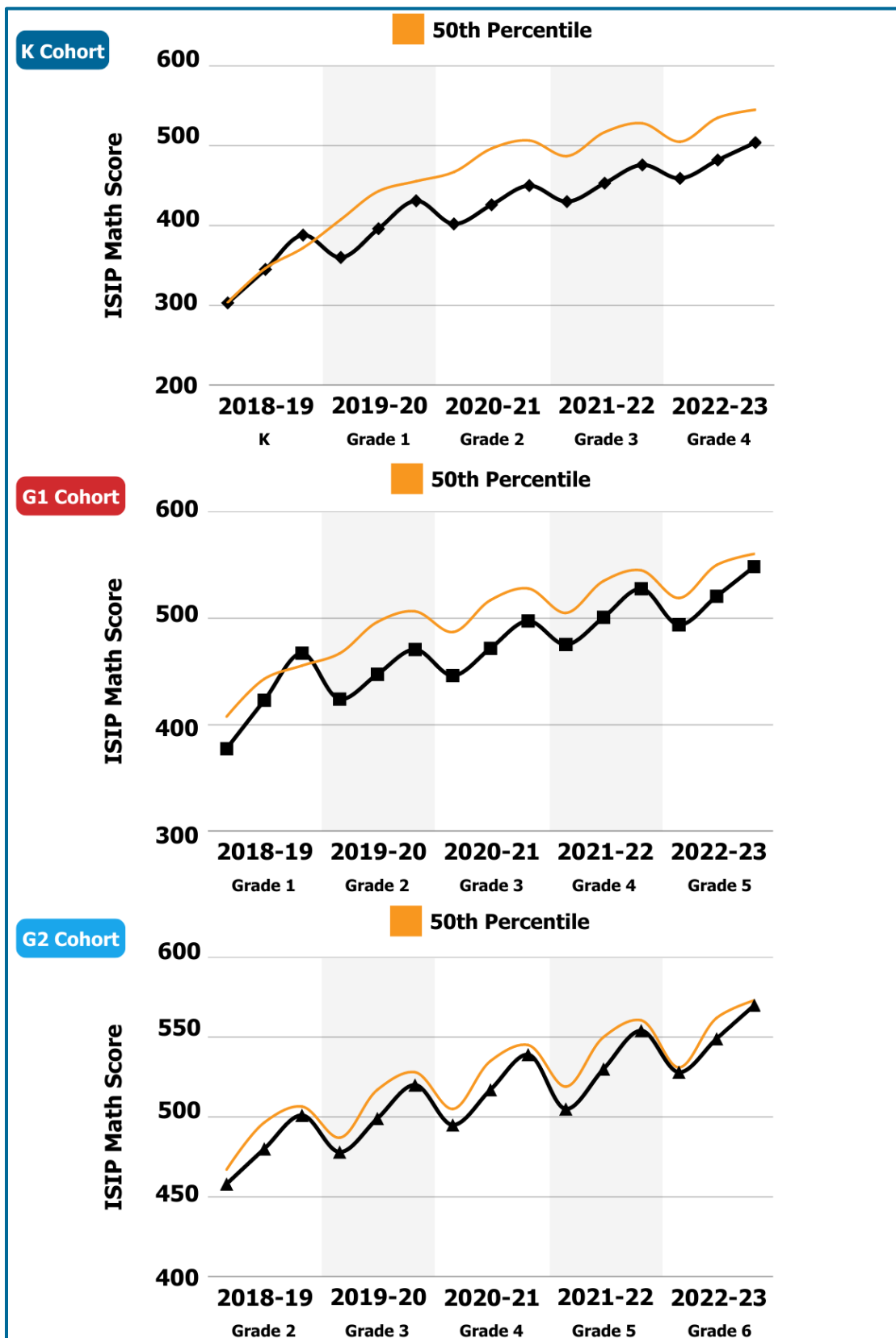
Notable differences were observed between reading and math cohorts. The kindergarten reading cohort showed recovery in third grade, while the kindergarten math cohort did not show recovery until the 2022–2023 school year. The first grade reading cohort experienced some recovery in 2022–2023, while the first grade math cohort recovered closer to the 50th percentile in the same school year. The second grade reading cohort demonstrated recovery in fall 2022, but projections show them falling behind by the end of the school year. However, the second grade math cohort scored close to the 50th percentile by EOY 2023.

The different norming methods for ISIP Reading and ISIP Math may account for the lower-than-expected performance in the 2018–2019 and 2019–2020 school years. To catch up to typical grade-level curriculum, students will require additional support such as on-grade and off-grade instruction, increased attention to learning progress, more studying time, and increased school activities. Additional support and attention may be needed for students with different backgrounds, and recovery time may vary among grade levels.

Limitations and Future Research

This study used longitudinal data across five school years to analyze students' growth and performance in the Istation program, providing valuable insights not possible with cross-sectional data analysis. However, there are limitations and considerations for future research:

- The representativeness of the samples for the entire population pre-, during-, and post-COVID years is unclear.

- The study focuses on the 2018–2019 kindergarten to second grade cohorts, lacking pre-COVID data for third to fifth grade students. Including upper elementary students in future studies would offer more comprehensive information.
- Different students were used for reading and math, resulting in larger sample sizes but making it difficult to pinpoint exact learning lags and cohorts.
- Unaccounted variables include differences in in-person versus virtual learning, the percentage of time spent in each learning format, and differences by school type, which may impact results.

Future research should consider using both longitudinal and cross-sectional data analyses, expanding the focus to upper elementary grades, and accounting for additional variables. The study aims to continue investigating the duration of students' recovery from the COVID-19 pandemic, potentially requiring new reference points and methodology for the post-COVID era.

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