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From Learning Loss to Resilience: Assessing Recovery in the Post-COVID Era

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Abstract

The COVID-19 pandemic disrupted traditional learning in schools by abruptly transitioning to distance learning, prompting ongoing evaluation of its effects. This study extends previous research by incorporating additional data collected after two cohorts of students resumed in-person learning for multiple years. Northwest Evaluation Association Measure of Academic Progress (NWEA MAP) mathematics and reading scores were collected on students from Winter 2019 to Fall 2020 during the COVID pandemic and again in Spring 2023, and compared to NWEA normative data during the same time period. Results indicated that students saw a significant drop in mathematics scores during the pandemic, but had recovered by Spring 2023, while reading scores were mostly stable during this time. The method and results underscore how the model presented can be applied to single or multiple schools to monitor growth and gap closures over a period of time after a major shift in instructional practices.

Keywords

Distance Learning, Mathematics, Reading, Learning Loss, COVID-19

From Learning Loss to Resilience: Assessing Recovery in the Post-COVID Era

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In the summer of 2022, the National Assessment of Educational Progress (NAEP) released data confirming what many educators across the country had long anticipated: a decline in math and reading performance across multiple subgroups, including multiple age ranges, races and ethnicities, economically disadvantaged students, and within all identified percentile ranges (U.S. Department of Education, 2023). Students from traditionally underperforming subpopulations experienced the greatest deficit, with proficiencies down an average of more than 10% compared to a decade ago (U.S. Department of Education, 2023). Overall, our nation's youth experienced the lowest recorded scores in almost 30 years for math and in almost 50 years for reading. As has been well-documented across numerous nationally normed standardized assessments, such as NAEP and the Northwest Evaluation Association Measure of Academic Progress (NWEA MAP), much of this decline has been attributed to *COVID Learning Loss*, where students did not experience typical academic growth during the period where in-person learning was disrupted (Chetty et al., 2020; Kuhfeld & Tarasawa, 2020; Kuhfeld & Lewis, 2021; von Hippel, 2020).

The disruption to in-person learning had a significant impact on various student subgroups, particularly for students with limited access to technology, low-income families, and students with disabilities (Francis & Weller, 2022; Hossain, 2021; Karpati et al., 2021). While the effects on academic performance are well documented, the root causes of the reduction in performance are still being identified. A multitude of negative effects on children's mental health including depression and anxiety symptoms are just a few of the problems children experienced with the move to online instruction (Xie et al., 2020).

Students restricted to learning limitations experienced during the pandemic, particularly those subject to marginalization through socioeconomic disparity and those lacking access to effective instructional strategies, were found to have significant learning gaps in addition to those already recognized and acknowledged across the general population (von Hippel, 2020). The educators who have been dedicated to these students over the past several years understood the ramifications of these limitations and have worked incredibly hard to identify and implement instructional strategies by which those gaps can be closed and overcome (Crepeele, 2022; Kentucky Department of Education, 2020).

In a previous study, the researchers of this study demonstrated a model wherein comparative analysis can be utilized to monitor student outcomes pertaining to COVID Learning Loss, or other disruptive events, using NWEA MAP Growth assessment data (Uhing et al., 2023). At the time of the initial study, results indicated that losses in academic progress were apparent in

multiple Midwest schools during the post-pandemic era when distance learning was used as a primary instructional strategy throughout the United States. This was particularly evident in populations experiencing socioeconomic disadvantages, with greater losses in mathematics than in reading.

The model established in the previous study provided a means to determine what and how supports could be effectively provided for teachers, students, and families finding themselves under extenuating circumstances that prevent them from receiving instruction through best practices, as well as ongoing monitoring of how re-entry into in-person instruction or the introduction of changes in instructional best practices can impact academic outcomes. Utilizing this protocol allows researchers and school districts alike to continuously update data sets over time as a means by which to track Post-COVID Recovery, or recovery following other disruptive events resulting in learning loss over time. To that end, the opportunity exists to pursue Post-COVID Recovery strategies through intentional, data-informed instruction.

Purpose and Key Considerations of this Study (Research Questions)

In the researchers' previous study, they were able to determine the extent of COVID Learning Loss in three mid-sized school districts (between 5,000-50,000 students each) found in Midwestern communities across multiple states with similar demographic makeup. Additionally, it was determined that mathematics instruction in particular posed a significant challenge for elementary teachers and students in a distance learning environment – particularly for students with limited resources and socioeconomic challenges at home. While reading instruction proved to be somewhat stable for the general population, students facing socioeconomic disparities did observe moderate losses over time. It was suggested in the conclusive summary of the study that the monitoring of gap closures over time for those most significantly impacted by the pandemic using the model first used to identify COVID Learning Loss could prove to be helpful for educators attempting to better support families in both inequitably and universally deficient areas resulting from disruptive experiences, such as a pandemic, natural disaster, or sudden school closure.

In this study, the researchers sought to build on previous work by incorporating additional data points collected two years after two cohorts of students returned to in-person instruction. *Cohort 1* is comprised of students who were in third grade during the 2019-2020 school year, while *Cohort 2* is comprised of students who were in fourth grade during the 2019-2020 school year.

The study examined the following research questions:

> Research Question 1: Did *Cohort 1* and *Cohort 2* students evidence statistically significant growth in mathematics and reading?
> Research Question 2: Did *Cohort 1* students evidence typical growth in mathematics and reading compared to a national sample?
> Research Question 3: Did *Cohort 2* students evidence typical growth in mathematics and reading compared to a national sample?

The scope of this study is to demonstrate how this model of monitoring COVID Learning Loss can be applied in subsequent school years, with either new or existing data sets, to determine

how changes in instructional strategies impact Post-COVID Recovery. Furthermore, it is the hope of the researchers that this model can be applied to learning recovery in similar unfortunate circumstances wherein students and educators are required to adapt quickly in response to disruptive experiences or events.

Method

Measures

NWEA MAP Testing

NWEA MAP Growth tests are available for students in second through twelfth grades in a variety of subject areas including reading, language usage, mathematics, and science, and students in grades kindergarten and first in reading and mathematics (Kuhfeld & Soland, 2020; Thum & Kuhfeld, 2020). MAP tests are computer adaptive (i.e., the difficulty of questions changes based on correct or incorrect responses) and provided by school districts at the beginning, middle, and end of the school year. The tests are not timed, so students have as much time as they need to complete each assessment. Each test typically takes less than one hour to complete. For this study, the NWEA MAP reading and mathematics assessments for third- through seventh-grade were used to measure student progress.

MAP Growth utilizes the Rasch Unit (RIT) scale to report student achievement, allowing for vertical scaling of longitudinal growth for students at, above, or below grade level over multiple years of assessment. The RIT scale, or Rasch unit scale, is a stable, equal interval scale based on a linear transformation of the Rasch item response theory model (Kuhfeld & Soland, 2020; Rasch, 1980). The difficulty of problems assigned throughout the assessment are based on the learner's position on the RIT scale at that point in time, directly correlating to the learning continuum for the subject proficiency being assessed. Because MAP Growth measures student achievement aligned with state and national standards, RIT-aligned proficiencies and growth in mathematics and reading can be utilized as a direct foundational measure of student skills in a given subject (Hu et al., 2021; Thum & Kuhfeld, 2020).

The NWEA technical manual for MAP testing was released in 2011 and updated in 2019, and indicates strong internal consistency for mathematics and reading across all grades ($\alpha > .90$). Additionally, the manual reports moderate evidence of predictive validity ($\alpha > .70$) to state content-aligned accountability test scores (i.e., state tests given for accountability purposes) (NWEA, 2019).

Comparison Data using NWEA 2020 Testing Normative Data

NWEA released the latest MAP Growth testing normative data in 2020, sampling between 3.6 to 5.5 million test scores from 500,000 to 700,000 students attending over 24,500 public schools in 5,800 school districts across all 50 states (NWEA, 2020). The results allow educators to compare achievement scores of a typical student in different subjects (e.g., mathematics, reading) across grades K-12, and determine the typical performance of a student at the *50^{th} percentile* for a particular testing period and subject in a particular grade (e.g., winter, third-grade mathematics). Additionally, the 2020 normative study provides data on the expected growth of the average student across testing periods (e.g., winter, third-grade mathematics to fall fourth-grade

mathematics). Results of the 2020 normative study for mathematics and reading are presented in **Tables 1 and 2**.

The 2020 MAP Growth testing normative data were collected by NWEA and participating school districts from Fall 2015 to Spring 2018 (i.e., fall, winter, spring data collection for three years), and provided an update to the previous normative data set collected from 2011-2014. Additionally, because data collection was completed in 2018, the data were not impacted by the COVID-19 pandemic and shifts by school districts to different modes of instruction. As a result, they serve as a model for *typical* mathematics and reading growth under normal, in-person classroom instructional conditions.

To determine if the disruption to in-person instruction during the COVID-19 pandemic impacted the mathematics and reading testing scores of students both during the disruption and after the return to in-person learning, 2020 MAP Growth testing normative data were used to determine if the *actual* growth of the two cohorts of students in this study (see participants for more information on the cohorts) matched the *expected* growth outlined in the 2020 normative data. The researchers in this study created a statistic entitled *COVID Learning Loss* to reflect the comparison of actual growth versus expected growth during the disruption to in-person instruction. For example, the average third-grade student scored a 196.23 in winter mathematics testing according to the 2020 normative data, while the average fourth grader scored a 199.55 in fall mathematics testing, which is an *expected* growth of 3.32 points between winter of third grade and fall of fourth grade. If the *actual* growth of the fourth-grade mathematics cohort was 2.5 points during the winter third-grade to fall fourth-grade testing period, the *COVID Learning Loss* (expected growth minus actual growth) is 3.32 – 2.5, or -0.82 points.

Additionally, the researchers created a similar statistic entitled *Post-COVID Recovery*, to reflect the comparison of actual growth versus expected growth in the two years of return to in-person instruction to determine if students made appropriate gains after the COVID-19 pandemic disrupted in-person learning. The *Post-COVID Recovery* statistic is a direct comparison of each cohort's *actual* score versus the *expected* average score based on the 2020 normative data. For example, if the cohort's *actual* score in mathematics was 224.0 and the *expected* average score from the 2020 normative data was 222.3, the *Post-COVID Recovery* score would be +1.7, indicating the mean cohort score was 1.7 points better than the national average.

Table 1

2020 NWEA Mathematics Expected Growth Norms Grades 3-7

	Fall		Winter		Spring	
Grade	Mean	SD	Mean	SD	Mean	SD
3	188.48	13.45	196.23	13.64	201.08	14.11
4	199.55	14.40	206.05	14.90	210.51	15.56
5	209.13	15.19	214.70	15.88	218.75	16.70
6	214.75	16.12	219.56	16.74	222.88	17.47
7	220.21	17.41	224.04	17.96	226.73	18.60

** Data from Thum & Kuhfeld (2020)*

Table 2

2020 NWEA Reading Expected Growth Norms Grades 3-7

	Fall		Winter		Spring	
Grade	Mean	SD	Mean	SD	Mean	SD
3	186.62	16.65	193.90	16.14	197.12	16.27
4	196.67	16.78	202.50	16.25	204.83	16.31
5	204.48	16.38	209.12	15.88	210.98	15.97
6	210.17	16.46	213.81	15.96	215.36	16.03
7	214.20	16.51	217.09	16.21	218.36	16.38

** Data from Thum & Kuhfeld (2020)*

Missing Data

For a student to be included in the study, they had to be present for all three testing periods in mathematics and/or reading. If a student missed one of the testing periods, the data were purged from the data set to ensure all data points were paired to measure growth (e.g., a student who tested in Winter 2019-20 and did not test in Spring 2022-23 was removed from the study). Data for a student who was present for all three testing periods in one subject only (e.g., the student was present for three reading testing periods but not three mathematics testing periods) was included in the study.

Procedures

Institutional Review Board (IRB) approval was gained prior to beginning the study. One school district from a state in the Midwest agreed to provide student MAP Growth testing data for the study in Spring 2023. With respect to the privacy of the district and possible identification, data were combined into one aggregate data set for use in the study and the school district will not be identified in any dissemination, including school district characteristics, per IRB guidelines for this study.

The participating school district moved from in-person to a distance learning environment in March 2020 due to the COVID-19 pandemic, and returned to in-person learning in Fall 2020. The school district provided data on reading and mathematics scores on the MAP Growth test for the Winter 2019-20, Fall 2020-21, and Spring 2022-23 testing periods. The school districts did not test students in Spring 2020 due to the move to distance learning during the COVID-19 pandemic. Data were collected by the researchers, cleaned, and checked by two researchers for accuracy prior to analysis.

Student scores for *Cohort 1* were collected during the third-grade Winter 2019-20 testing period, the fourth-grade Fall 2020-21 testing period (post-COVID distance learning), and the sixth-grade Spring 2022-23 testing period. For *Cohort 2*, scores were collected during the fourth-grade Winter 2019-20 testing period, the fifth-grade Fall 2020-21 testing period (post-COVID distance learning), and the seventh-grade Spring 2022-23 testing period.

Participants

Participants included fourth- and fifth-grade public school students who completed MAP testing in mathematics and/or reading from third- to sixth-grade (*Cohort 1*) and fourth- to seventh-grade (*Cohort 2*). Descriptive statistics with respect to gender and race/ethnicity are provided in **Table 3 and Table 4**.

For this analysis, the data is presented in two distinct cohorts in both mathematics and reading:

- *Cohort 1 Mathematics (n = 296)*
- *Cohort 1 Reading (n = 305)*
- *Cohort 2 Mathematics (n = 286)*
- *Cohort 2 Reading (n = 304)*

The n sizes in each group differ based on the number of students completing testing during all three testing periods. In multiple instances, students completed testing in all three testing periods in one subject (e.g., reading) only.

Table 3

Descriptive Statistics of Cohort 1 in Mathematics and Reading

	Mathematics		Reading	
Characteristic	N Size	%	N Size	%
Gender				
Male	152	51.4	155	50.8
Female	144	48.6	150	49.2
Race				
White/Caucasian	268	90.5	276	90.5
Black or African American	4	1.4	4	1.3
Hispanic or Latino	11	3.7	11	3.6
Asian	5	1.7	5	1.6
American Indian or Alaskan Native	2	0.7	2	0.7
Two or More Races	6	2.0	7	2.3
Hawaii or Pacific Islander	0	0.0	0	0.0

Table 4

Descriptive Statistics of Cohort 2 in Mathematics and Reading

	Mathematics		Reading	
Characteristic	N Size	%	N Size	%
Gender				
Male	145	50.7	156	51.3
Female	141	49.3	148	48.7
Race				
White/Caucasian	267	93.4	283	93.1
Black or African American	0	0.0	0	0.0
Hispanic or Latino	5	1.7	5	1.6
Asian	2	0.7	3	1.0
American Indian or Alaskan Native	0	0.0	0	0.0
Two or More Races	0	0.0	0	0.0
Hawaii or Pacific Islander	0	0.0	0	0.0

Data Analyses

Research Question 1: Did *Cohort 1* and *Cohort 2* students evidence statistically significant growth in mathematics and reading?

Data were analyzed using SPSS Version 28.0. To determine if students in *Cohort 1* and *Cohort 2* made statistically significant gains in mathematics and reading across the three testing periods (Winter 2019-20, Fall 2020-21, and Spring 2022-23), data were analyzed using a repeated measures analysis of variance (ANOVA). An alpha level of .01 was selected for this analysis to minimize the probability of a type I error.

Post-hoc analyses were conducted within *Cohort 1* and 2 in both mathematics and reading to determine if significant differences in performance were found between Time 1 (Winter 2019-20) versus Time 2 (Fall 2020-21) scores, and Time 2 (Fall 2020-21) versus Time 3 (Spring 2022-23) scores. A Bonferroni Correction was used in this analysis to minimize the probability of a type I error resulting from multiple comparisons of the same dependent variable (i.e., mathematics and reading MAP scores).

Research Question 2: **Did *Cohort 1* students evidence typical growth in mathematics and reading compared to a national sample?**

To determine if *Cohort 1* students met expected performance between the three testing periods, growth scores in mathematics and reading were examined for students in third-grade winter to fourth-grade fall (during the interruption to in-person instruction), and fourth-grade fall to sixth-grade spring (to see if students made appropriate gains after the interruption to in-person instruction). The *actual* growth scores were compared to NWEA MAP Testing *expected* growth scores during the same time periods based on the NWEA 2020 mathematics and reading growth norms (see Table 1 and Table 2).

Research Question 3: **Did *Cohort 2* students evidence typical growth in mathematics and reading compared to a national sample?**

To determine if *Cohort 2* students met expected performance between the three testing periods, growth scores in mathematics and reading were examined for students in fourth-grade winter to fifth-grade fall (during the interruption to in-person instruction), and fifth-grade fall to seventh-grade spring (to see if students made appropriate gains after the interruption to in-person instruction). The actual growth scores were compared to NWEA MAP Testing expected growth scores during the same time periods based on the NWEA 2020 mathematics and reading growth norms.

Results

Research Question 1: **Did *Cohort 1* and *Cohort 2* students evidence statistically significant growth in mathematics and reading?**

Results of the repeated-measures ANOVA are presented in **Table 5** for *Cohort 1* and *Cohort 2* in both mathematics and reading. Prior to running each analysis, the assumption of sphericity was tested using Mauchly's Test of Sphericity. In all four cases, the assumption of sphericity was violated. To correct for this violation, the Greenhouse-Geisser statistic was used as a correction. Results indicated that both *Cohort 1* and *Cohort 2* made significantly significant growth in mathematics and reading across the three time points ($p < .001$). Effect sizes using partial eta squared were .887 and .732 for *Cohort 1* in mathematics and reading, respectively. Effect sizes for *Cohort 2* in mathematics and reading were .886 and .716. The effect sizes indicated a large growth across the three time points.

A post-hoc analysis was conducted for both *Cohort 1* and *Cohort 2* in mathematics and reading using the Bonferonni Correction. The results are presented in **Table 6**. For this analysis, the differences between time 1 score (Winter 2019-20) and time 2 score (Fall 2020-21), and time 2 score (Fall 2020-21) and time 3 score (Spring 2023) were examined. The results indicated that scores between time 1 and time 2 were significant at $p<.05$ with the exception of *Cohort 2* mathematics. All scores between time 2 and time 3 were significant at $p<.05$.

Table 5

Repeated-Measures ANOVA for Cohort 1 and Cohort 2 Mathematics and Reading

	Winter 2019-20		*Fall 2020-21*		*Spring 2022-23*					
	M	SD	M	SD	M	SD	*df*	F	*p*	ES
Cohort 1 Math	197.56	9.97	198.51	11.10	224.09	13.25	1.722	2307.1	*<.001	.887
Cohort 1 Reading	195.05	12.76	197.28	13.06	215.11	13.25	1.868	828.4	*<.001	.732
Cohort 2 Math	206.97	10.44	207.66	11.91	230.89	14.36	1.695	62562.5	*<.001	.886
Cohort 2 Reading	203.65	13.032	204.95	14.31	220.35	12.50	1.909	27475.7	*<.001	.716

**Sig. at p<.01*

*** ES = Effect Size using Partial eta squared*

Table 6

Post-Hoc Analyses of Repeated-Measures ANOVA for Cohort 1 and Cohort 2

		95% CI		
	Mdiff	Lower Bound	Upper Bound	*p*
Cohort 1 Math				
T1 to T2	-.953	-1.784	-.122	*.018
T2 to T3	-25.581	-26.714	-24.448	*<.001
Cohort 1 Reading				
T1 to T2	-2.233	-3.368	-1.097	*<.001
T2 to T3	-17.833	-19.144	-16.521	*<.001
Cohort 2 Math				
T1 to T2	-.692	-1.524	.139	.138
T2 to T3	-23.231	-24.261	-22.101	*<.001
Cohort 2 Reading				
T1 to T2	-1.303	-2.316	-.289	*.006
T2 to T3	-15.398	-16.614	-14.182	*<.001

**Significant at p<.05 level.*

*** Adjustment for multiple comparisons: Bonferroni*

**** T1 = Winter 2019-20; T2 = Fall 2020-21; T3 = Spring 2022-23*

Research Question 2: **Did *Cohort 1* students evidence typical growth in mathematics and reading compared to a national sample?**

The results for *Cohort 1* mathematics and reading actual growth versus expected growth (i.e., expected change based on NWEA 2020 norms) are presented in **Table 7**. Results indicate the growth of *Cohort 1* mathematics was 2.4 points below expected between Winter 2019-20 and Fall 2020-21 during the interruption to in-person learning during the COVID-19 pandemic. Between Fall 2020-21 and Spring 2022-23, *Cohort 1* had recovered and scored 1.2 points above expected compared to the 2020 NWEA national sample.

In reading, *Cohort 1* scored 0.5 points below expected between Winter 2019-20 and Fall 2020-21 during the interruption to in-person learning. Between Fall 2020-21 and Spring 2022-23, *Cohort 1* was still 0.3 points below expected growth, indicating only a slight improvement in performance and below the 2020 NWEA national sample based on growth norms.

Table 7

Cohort 1 Mathematics and Reading Actual Growth Versus Expected Growth

	N	*Winter-19-20*	*Fall 20-21*	*Change*	*Expected Change*	***COVID Learning Loss***	*Spring 22-23*	*Expected Score*	***Post-COVID Recovery***
Mathematics	296	197.6	198.5	+0.9	+3.3	-2.4	224.1	222.3	+1.2
Reading	305	195.0	197.3	+2.3	+2.8	-0.5	215.1	215.4	-0.3

Research Question 3: **Did *Cohort 2* students evidence typical growth in mathematics and reading compared to a national sample?**

The results for *Cohort 2* mathematics and reading *actual* growth versus *expected* growth (i.e., expected change based on NWEA 2020 norms) are presented in Table 8. Results indicate the growth of *Cohort 2* mathematics was 2.4 points below expected between Winter 2019-20 and Fall 2020-21 during the interruption to in-person learning during the COVID-19 pandemic. Between Fall 2020-21 and Spring 2022-23, *Cohort 2* had recovered and scored 3.2 points above expected compared to the 2020 national sample.

In reading, *Cohort 2* scored 2.0 points above expected between Winter 2019-20 and Fall 2020-21 during the interruption to in-person learning, indicating no learning loss occurred due to the move to online instruction. Between Fall 2020-21 and Spring 2022-23, *Cohort 2* was still 1.9 points above expected growth, indicating performance remained strong and stable during this time period.

Table 8

Cohort 2 Mathematics and Reading Actual Growth Versus Expected Growth

	N	*Winter-19-20*	*Fall 20-21*	*Change*	*Expected Change*	***COVID Learning Loss***	*Spring 22-23*	*Expected Score*	***Post-COVID Recovery***
Mathematics	286	207.0	207.7	+0.7	+3.1	-2.4	230.9	226.7	+3.2
Reading	304	203.6	205.0	+1.4	+2.0	-0.6	220.3	218.4	+1.9

Discussion

Results from this study underscore how this model presented can be applied to single or multiple schools to monitor growth and gap closures over a period of time following a disruptive event that results in a sudden shift in implementation of instructional strategies. In this case, researchers observed NWEA MAP assessment data from a school district transitioning to distance learning during the COVID-19 pandemic, followed by reintegration to in-person instruction in the years following. Furthermore, this analysis suggests a means by which to compare that performance against national norms, both in terms of *expected* versus *actual* growth over time, in order to better understand the effect and impact of instructional strategies being utilized. The data in this study suggests that instructional decisions being implemented by the school district not only resulted in growth or stabilization following the pandemic, but that this stabilization aligns with projections made in NWEA's 2020 normative study, prior to the pandemic itself. In addition, when compared to *actual* national growth observed in both NWEA and NAEP assessments, the district's ability to close and stabilize the achievement gap in this manner appears to be atypical and worth further study to determine what and how instructional strategies resulted in such significant growth.

Research question 1 investigated whether *Cohort 1* and *Cohort 2* students showed statistically significant improvements in mathematics and reading scores over time, as measured by the MAP Growth assessment. A repeated-measures ANOVA with Greenhouse-Geisser correction revealed significant gains in both mathematics and reading for both cohorts. The effect sizes observed at each of the three points in time indicate large growth in both subject areas.

Research question 2 examined the typical growth in mathematics and reading for *Cohort 1* compared to the projected national sample based on NWEA norms published in 2020, before the COVID-19 pandemic. The results show a Post-COVID Recovery score of +1.2 in mathematics and -0.3 in reading. These scores indicate that the growth trajectory for *Cohort 1* exceeded the actual national scores, with a complete closure of the gap and surpassing the projected growth in mathematics. Although the Post-COVID Recovery score in reading slightly fell short of the projected growth norm, it suggests a stabilization that warrants further investigation to compare against national trends.

Research question 3 examined the typical growth in mathematics and reading for *Cohort 2* compared to the projected national sample based on NWEA norms published in 2020, before the COVID-19 pandemic. Like *Cohort 1*, *Cohort 2's* Post-COVID Recovery scores evidenced a gap

closure and stabilization after the pandemic, with scores of +3.2 in mathematics and +1.9 in reading. These results appear atypical compared to observed growth in nationally normed assessments post-pandemic. This underscores the value of the researchers' model, which enables comparison of outcomes against instructional strategies, revealing both typical and atypical growth patterns. This approach allows for a nuanced interpretation of how instructional strategies impact growth, either uniquely or generally, across one or more school districts experiencing similar circumstances.

Limitations

The findings in this study should be interpreted in light of limitations. First, the present study only sought data from on school district in the Midwest, and the sample is not representative of the total population and is skewed toward Caucasian students. The total sample in this study was over 70% Caucasian, which is higher than the national average (Jones et al., 2021). A study including a less homogenous sample from a larger number of school districts and/or a broader range of states/regions may produce different results.

Second, although information on MAP Growth testing scores were gathered from a school district who moved to distance learning in March 2020, no information on the type of instruction or the resources provided by school districts for teachers was included in this study. The quality of instruction delivered to students in different grades at different schools was unknown, and with so little time to design and develop instructional tools that were deployed across various schools nationally, it is likely the efficacy of instruction varied widely. Hodges et al. (2020) notes that across numerous research studies, effective distance learning is the result of careful instructional design and planning, and this process is largely absent during emergency shifts to this type of instruction.

Third, the present study did not include information on available resources at home, including information regarding access to the internet and/or computers. This information is particularly important for students with limited resources, such as students on free or reduced lunch. For students who have less resources related to technology such as access to devices or internet services to operate effectively online, a term known as the digital divide (Garcia & Weiss, 2020). Research has shown that approximately twice as many students from low-income homes suffer from the digital divide, where they lack the same access to resources as their peers (Garcia et al., 2020).

Future Research

When considered alongside the limitations of this study, it is clear through our findings that further national or regional studies would assist in determining how subgroups of the population were impacted by distance learning on a broader scale in terms race, socioeconomics, and geographical location. COVID learning loss underscores the many challenges faced by both the educators and students who have navigated the COVID-19 pandemic and distance learning. It also highlights the need for additional supports and further research as we continue to acclimate to the norms of an in-pandemic and post-pandemic learning environment.

It is possible that the model outlined in this study could be used to monitor gap closures over time for those most impacted by the modifications in instructional strategies that accompanied distance learning during the pandemic. Further investigation of such strategies could provide

guidance as to which practices were most effective in a distance learning environment, as well as which practices were most effective while transitioning back to in-person learning. In addition, an examination of the at-home resources provided for students in a distance learning environment, studied in parallel with COVID learning loss, could help educators determine how best to support students in both inequitably and universally deficient areas exposed through distance learning during the pandemic.

Conclusion

The COVID-19 pandemic will undoubtedly continue to impact and shape academic strategies and progress of students in schools for the next several years. As such, there will be an increasing need to develop models for monitoring inequities that result from this disruption, and determine strategies that help close the achievement gap.

This study demonstrates one such method for monitoring inequities by providing a model from which to comparatively analyze student outcomes pertaining to COVID learning loss using NWEA MAP Growth assessments. Results revealed that losses in academic progress were experienced during the spring and summer of 2020, at the peak of the COVID-19 pandemic, when distance learning was used as a primary instructional strategy throughout the United States. This was evident to a greater extent in mathematics than in reading. Additionally, some students were able to recover from the learning loss over approximately two years of instruction, particularly in mathematics. As school districts continue to monitor student progress in reading and mathematics over the next few years, more research is needed to demonstrate how recovery is attainable for students.

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