STETSON UNIVERSITY

Voices of Reform: Educational Research to Inform and Reform

Volume 6 ● Issue 1 ● Article 5

Nina B. Hollis Institute for Educational Reform

December 2023

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Recommended Citation

Uhing, B., Amolins, M., & Boer, R. (2023). COVID learning loss: Evaluating elementary mathematics and reading growth in a distance learning environment. *Voices of Reform, 6*(1), 81-105. Retrieved from https://www.voicesofreform.com/article/123141-covid-learning-loss-evaluating-elementary-mathematics-and-reading-growth-in-a-distance-learning-environment. doi: 10.32623/6.00007

http://dx.doi.org/10.3623/6.00007

Revisions

Submission date: October 22nd, 2022
1st Revision: November 4th, 2022
Acceptance: March 23rd, 2023
Publication date: December 31st, 2023

COVID Learning Loss: Evaluating Elementary Mathematics and Reading Growth in a Distance Learning Environment

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Abstract

The COVID-19 pandemic disrupted traditional learning in schools with the sudden shift to distance learning. Schools continue to see the effects of this shift but must better understand the academic effects on students. The purpose of this study was to determine the extent of COVID Learning Loss in the mathematics and reading scores of elementary students, including students with less available resources (i.e., students receiving free/reduced lunch). Northwest Evaluation Association Measure of Academic Progress (NWEA MAP) mathematics and reading scores were collected on students from Winter 2019 to Fall 2020 and compared to NWEA 2020 normative data during the same time periods to determine if students evidenced typical growth scores in each area. The findings indicated that reading scores evidenced stable growth over the study period for the four cohorts, while mathematics scores did not grow at the expected rate, particularly for students on free/reduced lunch. These results provide evidence that mathematics instruction presented a significant challenge for elementary teachers and students in a distance learning environment.

Keywords

distance learning, mathematics, reading, learning loss

Introduction

In the spring of 2020, the COVID-19 pandemic served as a tinderbox for the traditional education system. With school closures occurring rapidly, educators were challenged against

resourcefulness, creativity, and grit to completely overhaul traditional instructional practices in favor of a massive paradigm shift toward virtual and distance learning (Bacher-Hicks et al., 2021; Diliberti & Kaufman, 2020; Lake & Dusseault, 2020). As expected, teachers adjusted instruction and in a matter of days restructured their lesson plans, modes of instruction, and assessment strategies to ensure that their students had the best possible academic, social, and emotional support system available to them under the circumstances. All the while, educators were putting their own emotional stability to the test as they attempted to navigate a new normal without the necessary guidance, preparation time, or resources to do so in a consistently sound manner (Kurtz, 2020).

Some of the decisions made under the duress of the pandemic, both positive and negative, will have long-lasting effects on how instruction is implemented for future students. Shortcomings in need of attention for decades were addressed in a matter of months. Highly impactful learning environments, embedded in research-based practices, were no longer available as they were deemed to be hotbeds for spreading the virus. Technologies that were once considered out of reach for school districts under financial strain were now made available, albeit inconsistently, in the homes of students (Kurtz, 2020). Yet in the short term, questions remained as to how students who experienced the pandemic first-hand would be impacted, considering the variability of how these changes were carried out from district to district and how this was experienced in real time from home to home (Dilberti & Kaufman, 2020; Kuhfeld & Tarasawa, 2020; Lee et al., 2021).

Inequities in the availability of instructional resources, the opportunity to connect with educators and peers, the ability to focus on school work in an array of home environments, and the degree to which needs could be reasonably met in a distal setting have all emerged as areas of concern as the global learning community determines how best to identify and ultimately close learning gaps that have begun to surface, or are suspect to surface, in the wake of COVID-19 (Chetty et al., 2020; Kuhfeld et al., 2020; von Hippel, 2020). In an effort to target reasonable measures of growth and proficiency, schools find themselves first in search of a baseline from which to comparatively analyze student outcomes pertaining to COVID-19 learning loss. Because the pandemic continues to cast its grip to varying degrees through peaks and valleys across time and geographical location, schools have found it difficult to gauge the validity and reliability of the assessments through which this is being accomplished.

While it is notable that numerous research studies and meta-analyses have identified many of the overarching effects that the pandemic and distance learning have had on learning and academic, social, and emotional growth (Betthäuser et al., 2022; Hammerstein et al., 2021; Lewis et al., 2021), many of these research studies do not take into consideration the perspective of the practitioner and the impact that such leaders can have on the learners in their communities.

School leaders must be able to generate straightforward, tangible, and accessible data sets that will allow them to make informed decisions and continue to monitor progress based on the specific needs of their learners. As a result, it is necessary to identify a data source that provides the stability and control of a national, robust assessment of fundamental skills, while also allowing for the flexibility of measure and administration that will no doubt play a role as a result of local

responsiveness to the pandemic, specifically acknowledging the variability that can occur from region to region, state to state, and district to district.

In this study, we focused on Northwest Evaluation Association Measure of Academic Progress (NWEA MAP) Growth test scores in elementary mathematics and reading as a means by which this can be accomplished. Specifically, looking at MAP Growth scores across three school districts in the Midwest as a model for not only measuring the growth and proficiency of students within each district, but also utilizing the national MAP Growth data compiled from millions of students across the country as a control group to specifically identify learning loss that has resulted from the COVID-19 pandemic. From this data, we hope to provide school districts with a means by which to inform instruction and systems of support as they begin to pick up the pieces and determine how best to move forward in educating our youth.

Research Questions

Provided the assumption that all students were impacted in some fashion by COVID-19, it becomes essential that school districts have a means by which to determine the extent of learning loss that has resulted from this pandemic – in particular, from Winter 2019 to Fall 2020, when the greatest universal cancellation of in-person schooling over the course the pandemic occurred in the United States. Furthermore, it is possible that subgroups of the population would demonstrate greater learning loss as a result of heightened vulnerabilities found in the isolation experienced during this time. Examples of this would include certain racial and ethnic groups, those experiencing high levels of poverty, and those needing specialized services, such as those with special needs or those who are learning English as a second language (Bailey et al., 2021; Barnett & Jung, 2020; Rapaport et al., 2020). Therefore, having a means by which to identify and analyze such vulnerabilities would also be pertinent.

A recent report from NWEA suggests that potential differences between the general population and specific racial and ethnic groups are emerging, however it is too soon to conclude such outcomes to any degree of significance (Kuhfeld & Tarasawa, 2020). Ongoing studies would be necessary in order to make this determination. In this report, a focused sub analysis on students receiving free or reduced lunch serves as an example of vulnerable populations, allowing us to model one possible way of identifying these differences in a manner that may be translatable to other subpopulations, and may also contribute to the understandings desired by NWEA and others. To that end, the purpose of this study was to determine the extent of COVID Learning Loss in the mathematics and reading scores of elementary students, including students with less available resources (i.e., students receiving free/reduced lunch). This study examined the following research questions:

1. Did third- and fourth-grade elementary students evidence statistically significant growth in mathematics and reading scores?

2. Did third- and fourth-grade elementary students evidence typical growth scores in mathematics?

3. Did third- and fourth-grade elementary students evidence typical growth scores in reading?

4. Did third- and fourth-grade elementary students on free or reduced lunch evidence typical growth scores in mathematics and reading?

By studying three mid-sized school districts (between 5,000-50,000 students each) found in Midwestern communities across multiple states with similar demographic makeup, we will attempt to answer these questions by telling the broader story of COVID-19 learning loss in elementary students in mathematics and reading experienced by the general population, as well as those facing socioeconomic hardship. It is our hope that this information will result in actionable steps for school districts as they attempt to inform instruction and support of students and staff in the immediate future and beyond.

Methodology

Measures

NWEA MAP Testing

NWEA MAP Growth tests are available for students in grades second through twelve 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, et al., 2020; Thum & Kuhfeld, 2020). MAP tests are computer adaptive 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 fifth grade were used to measure student progress.

MAP Growth utilizes the 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, et al., 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 reading and math can be utilized as a direct foundational measure of student skills in a given subject (NWEA Psychometric Solutions, 2021; Thum & Kuhfeld, 2020).

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

Comparison Data using NWEA 2020 Testing Normative Data

NWEA released 2020 MAP Growth testing normative data, 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 50th 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 COVID impacted the mathematics and reading testing scores of students, the 2020 MAP Growth testing normative data was used to determine if the *actual* growth of the eight cohorts of students in this study (see participants for more information on the eight 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 based on the 2020 normative data. 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.

Table 1

2020 NWEA Mathematics Expected Growth Norms Grades 3-5

	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

Note. Data from Thum & Kuhfeld (2020)

Table 2

2020 NWEA Reading Expected Growth Norms Grades 3-5

	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

Note. Data from Thum & Kuhfeld (2020)

Missing Data

For a student to be included in the study, they had to be present for both testing periods in mathematics and/or reading. If a student missed one of the testing periods, the data was 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 Fall 2020-21 was removed from the study). Data for a student who was present for both testing periods in one subject only (e.g., was present for both reading testing periods but not both mathematics testing periods) was included in the study.

Procedures

Three school districts from two states in the Midwest were recruited to provide student MAP Growth testing data for the study in Spring 2021. With respect to the privacy of these districts and their possible identification, data were combined into one aggregate data set for use in the study and the school districts will not be identified in any dissemination, including school district characteristics, per *Institutional Review Board (IRB)* guidelines and approval.

Participating school districts moved from in-person to a distance learning environment in March 2020 due to the COVID-19 pandemic. School districts who agreed to participate in the study provided data on reading and mathematics scores on the MAP Growth test for the Winter 2019-20 testing period and Fall 2020-21 testing period. The three school districts did not test students in Spring 2020 due to the move to distance learning during the COVID-19 pandemic. Data was collected by the authors of this study, cleaned, and checked by two researchers for accuracy prior to analysis.

Student scores were collected for fourth-grade students from the third-grade Winter 2019-20 testing period to the fourth-grade Fall 2020-21 testing period, and the fifth-grade students from the fourth-grade Winter 2019-20 testing period to the fifth-grade Fall 2020-21 testing period to determine changes in performance. Students eligible for free or reduced lunch were included in the analyses of all students but were also separated for their own analysis.

Participants

Participants included fourth- and fifth-grade public school students who completed MAP Growth testing in mathematics and/or reading from third- to fourth-grade or fourth- to fifth-grade. Descriptive statistics with respect to age, gender, and race are provided in Table 3.

For this analysis, the data is presented in eight distinct cohorts:

- *3^{rd} to 4^{th} Grade Math (n = 1,365)*
- *3^{rd} to 4^{th} Grade Free/Reduced Math (n = 357)*
- *3^{rd} to 4^{th} Grade Reading (n = 3,237)*
- *3^{rd} to 4^{th} Grade Free/Reduced Reading (n = 357)*
- *4^{th} to 5^{th} Grade Math (n = 3,237)*

- *4th to 5th Grade Free/Reduced Math (n = 375)*
- *4th to 5th Grade Reading (n = 3,294)*
- *4th to 5th Grade Free/Reduced Reading (n = 374)*

Because some students were present for both testing periods in one subject only (e.g., present for both reading tests but not present for both mathematics tests), N size differences exist between the groups. Additionally, one school district did not test students in mathematics in fourth grade and would not provide information on free or reduced lunch, resulting in a significantly different N size for the *3rd to 4th Grade Math* group. Descriptive statistics of the groups are presented in Tables 3 and 4.

Table 3

Descriptive Statistics of 3rd to 4th Grade Samples

	3rd to 4th Math		3rd to 4th Reading		3rd to 4th Math Free/Reduced		3rd to 4th Reading Free/Reduced	
Characteristic	N Size	%	N Size	%	N Size	%	N Size	%
Gender								
Male	627	45.9	1539	47.5	158	44.3	158	44.3
Female	738	54.1	1698	52.5	199	55.7	199	55.7
Race								
White/Caucasian	1048	76.8	2358	72.8	165	46.2	165	46.2
Black or African American	82	6.0	163	5.0	56	15.7	56	15.7
Hispanic or Latino	82	6.0	293	9.1	50	14.0	50	14.0
Asian	16	1.2	111	3.4	2	0.6	2	0.6
American Indian or Alaskan Native	48	3.5	56	1.7	42	11.8	42	11.8
Two or More Races	86	6.4	252	7.8	42	11.8	42	11.8
Hawaii or Pacific Islander	2	0.1	4	0.1	0	0.0	0	0.0

Table 4

Descriptive Statistics of 4th to 5th Grade Samples

	4th to 5th Math		4th to 5th Reading		4th to 5th Math Free/Reduced		4th to 5th Reading Free/Reduced	
Characteristic	N Size	%	N Size	%	N Size	%	N Size	%
Gender								
Male	1540	47.4	1564	47.5	187	49.9	186	49.7
Female	1706	52.6	1730	52.5	188	50.1	188	50.3
Race								
White/Caucasian	2326	71.7	2349	71.3	157	41.9	157	42.0
Black or African American	195	6.0	201	6.1	70	18.7	69	18.4
Hispanic or Latino	346	10.7	358	10.9	60	16.0	60	16.0
Asian	96	3.0	97	2.9	6	1.6	6	1.6
American Indian or Alaskan Native	39	1.2	39	1.2	26	6.9	26	7.0
Two or More Races	243	7.5	249	7.6	56	14.9	56	15.0
Hawaii or Pacific Islander	1	0.1	1	0.1	0	0.0	0	0.0

Data Analysis

Statistical Significance of Reading and Mathematics Scores

A paired-samples *t*-test was performed to determine if statistically significant differences existed between fourth-grade students from the third-grade Winter 2019-20 testing period to the Fall 2020-21 testing period, and fifth-grade students from the fourth-grade Winter 2019-20 testing period to the Fall 2020-21 testing period. The paired-samples *t*-test was used for mathematics and reading growth scores from both the fourth-grade and fifth-grade cohorts, including students on free or reduced lunch. Data were analyzed using SPSS (Statistical Package for the Social Sciences). An alpha level of .01 was selected for the study to minimize the probability of a type I error.

Fourth- and Fifth-Grade Mathematics Growth versus Expected Growth

To determine if students made expected gains between testing periods, growth scores in mathematics were examined for students for both fourth-grade (third-grade Winter 2019-2020 to fourth-grade Fall 2020-21 testing period) and fifth-grade (fourth-grade Winter 2019-20 to fifth-grade Fall 2020-21 testing period) cohorts. The growth scores were compared to expected growth during the same time periods based on the NWEA 2020 mathematics growth norms tables (see Table 1) to determine if COVID learning loss occurred in mathematics.

Fourth- and Fifth-Grade Mathematics Growth versus Expected Growth

Growth scores in reading were also examined for students for both fourth-grade (third-grade Winter 2019-2020 to fourth-grade Fall 2020-21 testing period) and fifth-grade (fourth-grade Winter 2019-20 to fifth-grade Fall 2020-21 testing period) cohorts. The growth scores were compared to expected growth during the same time periods based on the NWEA 2020 reading growth norms tables (see Table 2) to determine if COVID learning loss occurred in reading.

Fourth and Fifth-Grade Free and Reduced Lunch Mathematics and Reading Growth versus Expected Growth

To determine if students on free or reduced lunch made expected gains, growth scores in mathematics and reading were examined for students for both fourth-grade (third-grade Winter 2019-2020 to fourth-grade Fall 2020-21 testing period) and fifth-grade (fourth-grade Winter 2019-20 to fifth-grade Fall 2020-21 testing period) free or reduced lunch cohorts. The growth scores were compared to expected growth during the same time periods based on the NWEA 2020 mathematics and reading growth norms tables to determine if COVID learning loss occurred in these content areas.

Results

Statistical Significance of Mathematics and Reading Scores

The differences between math and reading scores in the Winter 2019-20 and Fall 2020-21 testing periods for all eight cohorts are presented in Table 5. For all students in the 3rd to 4th-grade and 4th to 5th-grade cohorts, growth scores were found to be statistically significant in both reading and math. For students on free or reduced lunch, growth scores were found to be statistically

significant for both 3rd to 4th-grade reading and 4th to 5th-grade reading cohorts. Students on free or reduced lunch did not evidence statistically significant gains in the area of mathematics for both the 3rd to 4th-grade and 4th to 5th-grade cohorts.

Table 5

Paired Samples T-Test for Math and Reading Cohorts

Group	Winter 2019-20 Mean	SD	N	Fall 2020-21 Mean	SD	N	t	df	Sig.
3rd to 4th Math	198.8	9.90	1365	199.9	11.00	1365	-6.76	1364	.000*
3rd to 4th Reading	201.0	12.67	3237	204.2	12.59	3237	-24.29	3236	.000*
4th to 5th Math	211.9	11.08	3246	213.1	12.31	3246	-10.95	3245	.000*
4th to 5th Reading	209.4	11.79	3294	211.7	12.00	3294	-11.22	3293	.000*
3rd to 4th Math Free/Reduced	194.3	10.56	357	194.8	10.79	357	-1.30	356	.194
3rd to 4th Reading Free/Reduced	192.6	13.36	357	195.2	13.23	357	-5.71	356	.000*
4th to 5th Math Free/Reduced	205.4	10.66	375	205.5	11.00	375	-.33	374	.743
4th to 5th Reading Free/Reduced	202.7	12.12	373	205.1	12.84	373	-5.79	372	.000*

Note. *Sig. at p<.01

Fourth- and Fifth-Grade Mathematics Growth versus Expected Growth

The results for mathematics actual growth versus expected growth (i.e., expected change based on NWEA 2020 norms) are presented in Table 6. Results indicate that students in both the 3rd to 4th-grade cohort and 4th to 5th-grade cohort fell well short of expected mathematics gains based on NWEA 2020 norms. Students in the 3rd to 4th-grade cohort evidenced an actual change of +1.1 points. The expected change for this cohort was +3.3 points, indicating a difference in expected growth of -2.2 points. Students in the 4th to 5th-grade cohort evidenced an actual change of +1.2 points. The expected change for this cohort was +3.1 points, indicating a difference in expected growth of -1.2 points.

Table 6

Mathematics Growth Scores for All Students

Group	N Size	Winter 2019-20 Mean	Fall 2020-21 Mean	Change	Expected Change (NWEA)	COVID Learning Loss
3rd to 4th Math	1365	198.8	199.9	+1.1	+3.3	-2.2
4th to 5th Math	3246	211.9	213.1	+1.2	+3.1	-1.9

Fourth- and Fifth-Grade Reading Growth versus Expected Growth

The results for reading actual growth versus expected growth (i.e., expected change based on NWEA 2020 norms) are presented in Table 7. Results indicate that students in both the 3rd to 4th-grade cohort and 4th to 5th-grade cohort slightly exceeded expected reading gains based on NWEA 2020 norms. Students in the 3rd to 4th-grade cohort evidenced an actual change of +3.2 points. The expected change for this cohort was +2.8 points, indicating a difference in expected growth of +0.4 points. Students in the 4th to 5th-grade cohort evidenced an actual change of +2.3 points. The expected change for this cohort was +2.0 points, indicating a difference in expected growth of +0.3 points.

Table 7

Reading Growth Scores for All Students

Group	N Size	Winter 2019-20 Mean	Fall 2020-21 Mean	Change	Expected Change (NWEA)	COVID Learning Loss
3rd to 4th Reading	3237	201.0	204.2	+3.2	+2.8	+0.4
4th to 5th Reading	3294	209.4	211.7	+2.3	+2.0	+0.3

Fourth and Fifth-Grade Free and Reduced Lunch Mathematics and Reading Growth versus Expected Growth

The results for mathematics and reading actual growth versus expected growth (i.e., expected change based on NWEA 2020 norms) are presented in Table 8. Results indicate that students in the 3rd to 4th-grade cohort performed just below expected in reading (-0.2 points), while the 4th to 5th-grade cohort exceeded expected performance in reading (+0.5 points) based on NWEA 2020 norms. Students in the 3rd to 4th-grade cohort (-2.8 points) and 4th to 5th-grade cohort (-3.0 points) performed significantly below expected performance in mathematics.

Table 8

Mathematics and Reading Growth Scores for Students on Free and Reduced Lunch

Group	N Size	Winter 2019-20 Mean	Fall 2020-21 Mean	Change	Expected Change (NWEA)	COVID Learning Loss
3rd to 4th Math Free/Reduced	357	194.3	194.8	+0.5	+3.3	-2.8
3rd to 4th Reading Free/Reduced	357	192.6	195.2	+2.6	+2.8	-0.2
4th to 5th Math Free/Reduced	375	205.4	205.5	+0.1	+3.1	-3.0
4th to 5th Reading Free/Reduced	374	202.6	205.1	+2.5	+2.0	+0.5

Discussion

The results obtained in this study highlight the interplay between the instructional challenges faced by teachers and the learning challenges faced by students with the move to distance learning during the COVID-19 pandemic. These results provide evidence that mathematics instruction and learning was a significant challenge for elementary teachers and students in a distance learning environment, while reading instruction and learning remained stable during this time.

The first research question in this study explored whether or not third- and fourth-grade elementary students evidenced statistically significant gains in mathematics and reading scores as measured by MAP Growth testing. The findings indicated that six of the eight cohorts evidenced statistically significant gains in either mathematics or reading MAP Growth testing scores. The two cohorts that did not evidence statistically significant gains were third- to fourth-grade and fourth- to fifth-grade students on free or reduced lunch in the area of mathematics. The findings suggest that these students may need significantly greater support in the area of mathematics, either through stronger instructional strategies or more resources for students to support mathematics instruction in a distance learning environment.

The second research question in this study explored whether or not third- and fourth-grade elementary students evidenced typical growth scores in mathematics. The findings indicated that students in the third- to fourth-grade cohort fell -2.2 points short of expected growth, while students in the fourth- to fifth-grade cohort fell -1.9 points short of expected growth. The findings parallel those described earlier in the literature that indicate students in grades 3-8 evidenced lower gains in mathematics in Fall 2020 (Kuhfeld et al., 2020), and again suggest that mathematics instruction in a distance learning environment remains a concern for elementary teachers and students.

The third research question explored whether or not third- and fourth-grade elementary students evidenced typical growth scores in reading. The findings indicated that students in both the third- to fourth-grade and fourth- to fifth-grade cohorts evidenced slight gains in reading over expected growth of 0.4 points and 0.3 points, respectively. Again, the findings parallel those described by Kuhfeld et al. (2020), which found that students in grades 3-8 performed similarly in reading in Fall 2020 versus prior years. It's possible that reading instruction is easier to support than mathematics in the distance learning environment, as students in this study had access to books via the school library despite not attending school in person.

The final research question explored whether or not third- and fourth-grade elementary students on free or reduced lunch evidenced typical growth scores in mathematics and reading. In the area of reading, third- and fourth-grade students evidenced a slight reduction in gains over expected growth of 0.2 points, while fourth- and fifth-grade students evidenced a slight gain over expected growth of 0.5 points. In mathematics, students in both the third- to fourth-grade and fourth- to fifth-grade cohorts evidenced deficits over expected growth of 2.8 and 3.0 points, respectively. The COVID Learning Loss of the two free or reduced cohorts in mathematics were the largest losses in the present study, and again suggest that support mathematics was a major challenge during the COVID-19 pandemic, particularly with students receiving free or reduced lunch.

Limitations

The findings in this study should be interpreted in light of limitations. First, even though we sought data from multiple school districts located in multiple states, 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). Additionally, the study was confined to only three school districts in two states in the Midwest. 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 was gathered from school districts 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, 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 lunches. For students who have less resources related to technology such as access to devices or internet services to operate effectively online, the term is known as the digital divide (García & 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 (García, Weiss, & Engdahl, 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 bravely navigated the COVID-19 pandemic and distance learning. It also highlights the need for additional support 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 analytical methods outlined in this study could be used to not only identify COVID learning loss experienced in specific academic subjects or population subgroups, but also 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 throughout the United States and beyond. As such, there will increasingly be a need to develop models for monitoring inequities that result from this learning environment. This study demonstrates one such model by providing a baseline 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 in three Midwest schools 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 and was particularly notable in both subject areas for students who were economically disadvantaged. These findings would suggest that at-home access to support, and familiarity with content, were major factors in the success of a distance learning model – particularly at the height of the COVID-19 pandemic. It could be further suggested that inequities that have always been inherent within various subgroups of the population were further exposed during this time. Further studies would allow researchers to determine exactly what and how support could be effectively provided for teachers, students, and families who find themselves in such circumstances.

Author's Note: Financial support for this work was provided by the Jane and Charles Zaloudek Faculty Research Fellowship and the Augustana Research and Artist Fund (ARAF).

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