

An Evaluation of North Dakota Math Corps

ANNUAL EVALUATION REPORT



2021-2022



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COLLABORATIVE

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About the National Science & Service Collaborative

We believe partnerships between researchers, AmeriCorps programs, and communities can transform research and practice, leading to sustainable, community-driven solutions. We value a broad and inclusive definition of “collaboration” because improving societal outcomes is maximized when the tools of science, expertise of communities, and resources of AmeriCorps are deployed in a truly collaborative way.

The Center’s portfolio includes projects to evaluate the impact of AmeriCorps programming, projects to advance the existing knowledge base in education, and development projects to bring new and innovative programming to communities across the nation.

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Executive Summary

Math Corps is an AmeriCorps program that provides schools with tutors to support math development for students in Grades 4 through 8. Math Corps tutors are trained to provide research-based math support and to administer assessment protocols. Tutors are supported by a multi-level coaching model that includes site-based and external coaches. Full-time tutors work with approximately 24 students for 90 each week. Tutoring is provided through standard-protocol interventions and is complementary to the core math instruction provided at each school. The ultimate goal of tutoring is to raise individual students' math skills so that they are on track to meet or exceed state math proficiency standards.

The Math Corps evaluation addresses four broad questions with data collected during the 2021-22 school year.

1. What is the scope of the Math Corps program?

Fourteen Math Corps tutors served a total of 236 students across 14 schools. White was the largest racial/ethnic categories for participating students.

2. To what extent was the Math Corps program implemented as intended?

Math Corps coaches observed tutors delivering interventions throughout the school year. These observations allow for coaches to build on the tutor's formal training and to help tutors improve their implementation of the Math Corps model. The results of the observations show interventions were conducted with high levels of mean fidelity (>90% accuracy) and in accordance with their established evidence base.

On average, students received 64 minutes of tutoring per week across 18 weeks. White students tended to receive slightly more tutoring sessions and more minutes of tutoring per week than non-white students.

3. To what extent did participating students improve their math skills?

Tutors administer the STAR Math assessment – a measure of overall math proficiency – to identify eligible students and track student progress during intervention. Tutors also administer a multi-skill math fluency assessment that includes basic addition, subtraction, multiplication, and division math facts.

Results from STAR Math indicate 56% of students exceeded their target growth. In Grade 4, white students and non-white students exceeded target growth at a similar rate. In Grade 5, a greater percentage of white students exceeded target growth compared to non-white students. Across all grades, 75% of students made growth on the Fact Fluency measure.

When asked in a survey about the impact of the program on students, 100% of tutor respondents indicated their service in Math Corps had a positive impact on students and increased students' confidence in math.

4. How did serving as a tutor impact their skills and knowledge related to education and their future career goals?

100% of tutor respondents to an end-of-year survey from the evaluation team indicated Math Corps had a positive impact on them personally, and 91% of respondents said their service increased their knowledge and skills related to education. Additionally, 45% of respondents answered that they are likely or very likely to pursue a career in education as a result of their service. These results indicate Math Corps likely contributes to the education career pipeline in the communities where tutors serve.

Introduction

Math Corps Overview

Math Corps is an AmeriCorps program that provides schools with tutors to support math development for students in Grades 4 through 8. Math Corps tutors are trained to provide research-based math support and to administer assessment protocols.

The Math Corps model aligns with Response-to-Intervention (RTI) or Multi-Tier System of Supports (MTSS), which are two descriptions of a framework for delivering educational services effectively and efficiently (Burns et al., 2016). The key aspects of that alignment include the following:

- Data-driven screening decisions identify students who are at-risk for poor math outcomes
- Evidence-based interventions
- Formative assessment
- High quality training in program procedures, coaching, and observations to support fidelity of implementation

In the RTI and MTSS frameworks, data play the key roles of screening student eligibility for additional services and monitoring student progress toward achieving academic goals. Eligible students (defined as students below state proficiency expectations) are determined potential candidates to receive supplemental Math Corps support, which is often referred to as Tier 2 support.

Math Corps is focused on improving student skills in foundational math content areas focusing on numbers, numerical operations, and algebra—skills identified by the National Mathematics Advisory Panel (2008) as essential to overall math success.

Tutoring is provided through standard-protocol interventions and is complementary to the core math instruction provided at each school. The ultimate goal of tutoring is to raise individual students' math skills so that they are on track to meet or exceed state math proficiency standards.



Overview of the Evaluation

The Math Corps evaluation addresses four broad questions. The evaluation report is organized around each of these questions using data that are collected throughout the school year and are recorded by the implementers of Math Corps. Program administrators collect data about tutors and schools, including survey responses. Tutors collect data about student dosage and math outcomes. Coaches collect specific details about tutor implementation of interventions.

These data are used to answer the following questions:

1. What is the scope of the Math Corps program?
2. To what extent was the Math Corps program implemented as intended?
3. To what extent did participating students improve their math skills?
4. How did serving as a tutor impact their skills and knowledge related to education and their future career goals?

1. What is the scope of the Math Corps program?

Schools and Tutors

Math Corps partners with schools and districts to implement the program. Math Corps program staff and participating schools recruit community members to serve as Math Corps tutors through AmeriCorps. Tutors commit to serving a set number of hours per week (i.e. full-time AmeriCorps members commit to complete 1,200 hours of service). Tutors receive a living allowance as well as other benefits and are provided coaching by school staff and a program “Coaching Specialist” throughout their service term. Upon completion of their service, members receive a Segal AmeriCorps Education Award that can be used to pay education costs at qualified institutions of higher education, for educational training, or to repay qualified student loans.

Table 1 displays the number of participating schools, Coaching Specialists, and tutors that served during the 2021-22 program year.

Table 1. Schools, Coaches, and Tutors

Schools	Coaching Specialists	Tutors*
14	2	14

**Defined as having entered tutoring minutes for at least one student in the Math Corps data management system.*

Math Corps tutors receive training through an online Learning Management System (LMS). The intensive, information-filled courses on the LMS provide foundational training in

the research-based math interventions employed by Math Corps. Throughout the courses, tutors learn the skills, knowledge, and tools needed to serve as math interventionists. Tutors are provided with a detailed program manual as well as online resources that mirror and supplement the contents of the manual (e.g., videos of model interventions and best practices). Both the manual and online resources are intended to provide tutors with just-in-time support and opportunities for continued professional development and skill refinement. Additional training is provided throughout the tutors' year of service.

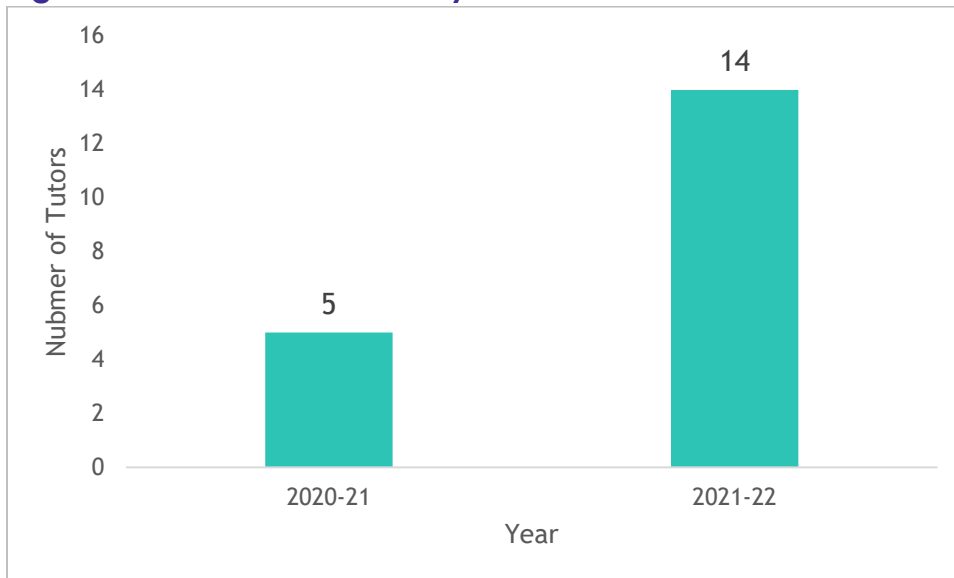
In addition to extensive training, Math Corps provides tutors with multiple layers of supervision to ensure integrity of program implementation. Schools identify a staff member to serve as an Internal Coach, who is typically a math specialist, teacher, or curriculum director, to serve as immediate on-site supervisor, mentor, and advocate for tutors. The Internal Coach's role is to monitor tutors and provide guidance in the implementation of Math Corps's assessments and interventions. As the front-line supervisor, the Internal Coach is a critical component of the supervisory structure.

Coaching Specialists, who are either program staff or contracted consultants for Math Corps, provide both tutors and Internal Coaches with expert support on math instruction and ensure implementation integrity of Math Corps

program elements. In addition to these two coaching layers, a third layer consisting of AmeriCorps program support helps ensure a successful year of AmeriCorps service. Program support staff are Math Corps employees who provide administrative oversight for program implementation to schools participating in Math Corps.

The number of tutors serving varies by program year based on a number of factors including tutor recruitment, tutor types (i.e. full-time or part-time tutors), school interest, tutor retention, and available public and private funding. Figure 1 displays the number of tutors who served each year of the program.

Figure 1. Number of Tutors by Year

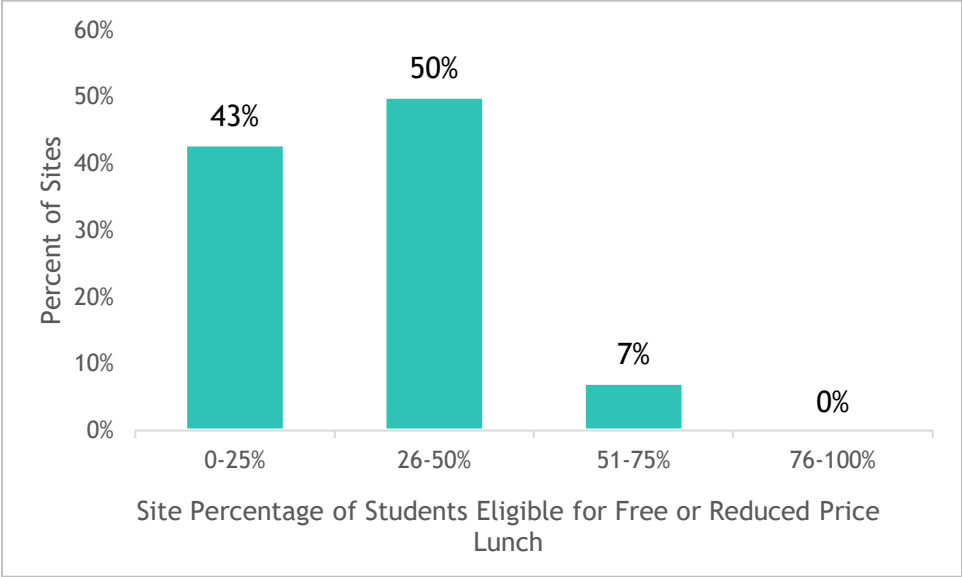


School Characteristics

Math Corps strives to serve students and schools that would benefit the most from additional resources, for which the percentage of students at the school who are eligible for the federal free and reduced-price lunch (FRPL) program can be a useful indicator. Students from

families with incomes at or below 185 percent of the Federal poverty level are eligible for free or reduced-price meals. Figure 2 shows the distribution of Math Corps schools based on their school level FRPL percentage. 93% of participating schools have less than 50% of students eligible for Free or Reduced Price-Lunch.

Figure 2. Distribution of Schools by Student Eligibility for Free or Reduced Price-Lunch Program



Note: Data not available for 10% of sites.

Students Tutored

Students are identified as good candidates for Math Corps participation through a two-step process. First, teachers or other school staff recommend students for Math Corps based on student performance or previous service. Second, tutors administer a benchmark assessment to recommended students. Students who score below benchmark targets that are linked to future academic success are eligible to receive Math Corps tutoring (see Appendix A for more information on the benchmark targets).

After identifying eligible students, the tutor works with their Internal Coach to select which students will be served, called the tutor’s “caseload”. Coaches set the caseload using a number of factors such as the school’s schedule and other services available to eligible students.

The number of students on a caseload depends on the tutor’s service commitment. Full-time tutors aim to serve 24 or more students at a time while part-time tutors serve 12 students. Interventions can be delivered to two or three students at the same time. Serving more students in groups of three increases the number of students served per tutor. Table 2 displays the number of students served by grade across all schools. Most tutors were placed in elementary schools, leading to fourth and fifth grade having the greatest number of students served.

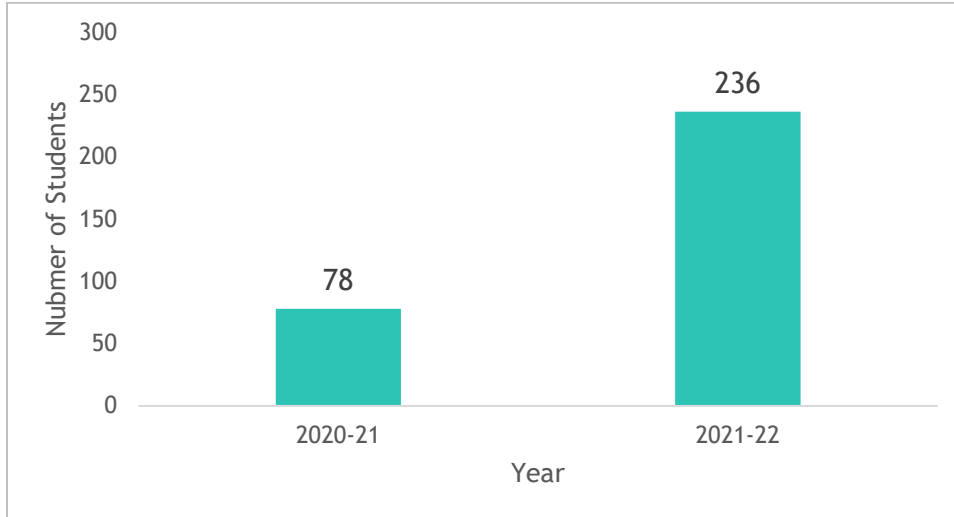
Table 2. Number of Students Tutored

Grade	Number of Students
Fourth	82
Fifth	110
Sixth	16
Seventh	16
Eighth	12
Total	236

The number of students served varies by program year based on many factors including tutor recruitment and retention, the types of tutors serving (i.e. full-time or part-time), whether students are receiving intervention in pairs or groups of three, and the frequency of

students exiting or graduating from the program. Figure 3 displays the number of students who were tutored each year of the program. Note the number of students served in 2020-21 and 2021-22 were significantly impacted by the COVID-19 pandemic.

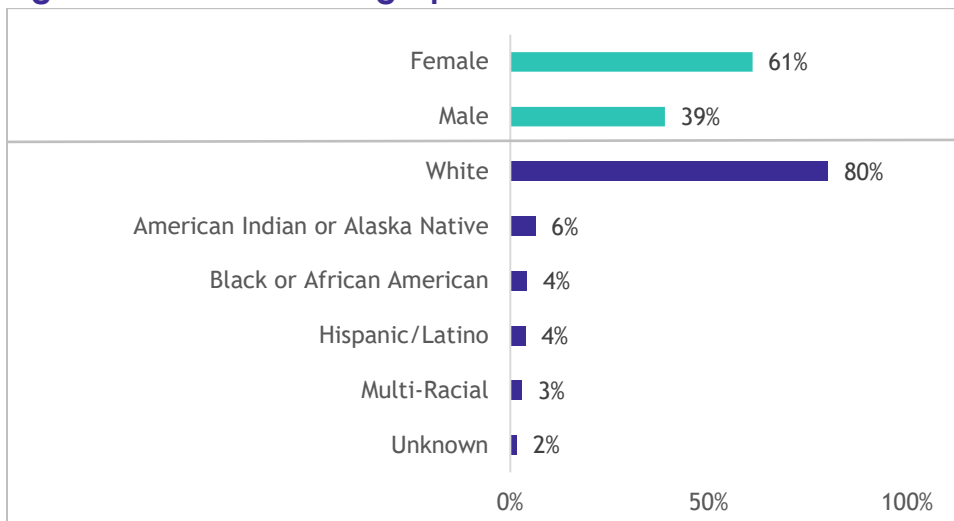
Figure 3. Number of Students Tutored by Year



Math Corps tutors record demographic information of students they tutor, which allows evaluators to disaggregate student outputs and outcomes by important demographics to ensure the program is having an equitable impact.

The information is also used in various reports to describe the students participating in the program. Figure 4 shows White students were the greatest racial/ethnic group participating in the program.

Figure 4. Student Demographics



2. To what extent was the Math Corps program implemented as intended?

Coaching Observations

Ensuring accurate, effective implementation is a core principle of Math Corps. Both types of coaches—Internal Coaches and Coaching Specialists— provide tutors with expert support on math instruction and ensure implementation integrity of Math Corps program elements through ongoing monitoring and observation.

During coaching sessions Math Corps Coaching Specialists and Internal Coaches discuss student selection for service, track student progress for data-based decisions, and observe tutors delivering interventions. The observations allow coaches to build on a tutor’s formal training and to help tutors improve their implementation of the

Math Corps model. Coaches are expected to observe tutors delivering interventions at least every other month to ensure fidelity to the interventions effective instructional processes.

Table 3 displays the percent of Coaching Specialists and Internal Coaches who observed tutors delivering interventions at least one time during the school year. The table also shows the percentage of coaches who met the program’s expectation for observations throughout the school year. All Coaching Specialists and nearly all Internal Coaches met program expectations for observations, demonstrating coaches provided ongoing support to tutors.

Table 3. Intervention Coaching Observations by Coach Role

Coaching Specialist		Internal Coach	
Percent of Tutors Observed at Least Once	Percent of Tutors Observed in Accordance with Expectations*	Percent of Tutors Observed at Least Once	Percent of Tutors Observed in Accordance with Expectations*
100%	100%	100%	93%

*Note: Table includes tutors that served for a minimum of two months.
Coaches are expected to conduct intervention observations at least once every other month.

Tutor Fidelity

During coaching sessions, coaches complete a fidelity checklist for each intervention they observe. The checklist includes the important steps for accurate completion such as introducing the lesson and modeling how to complete problems.

After completing observation coaches enter the number of checklist items that the tutor delivered correctly into the online Math Corps Data Management System. The percent fidelity is then calculated by dividing the number of items delivered correctly by the total number of items.

Table 4 displays the total number of fidelity checks completed and the average intervention fidelity.

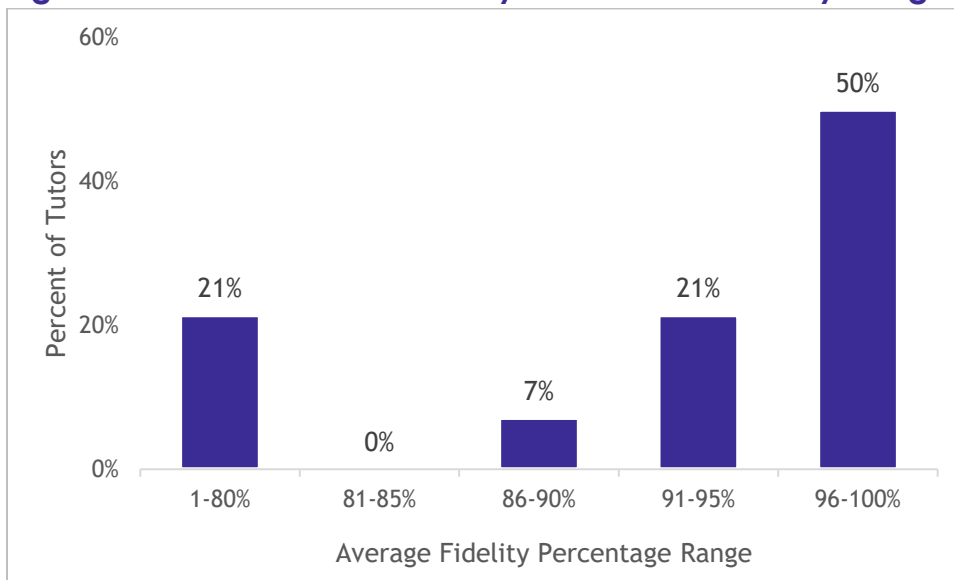
Table 4. Intervention Fidelity

Total Checks Collected	Average Fidelity
94	92.7%

For each tutor, all observations are combined to calculate their overall

intervention fidelity. A tutor's average fidelity can vary throughout the year, with lower scores being more common at the beginning of the year. Figure 5 shows the distribution of tutors by their average fidelity. 28% of tutors had an average fidelity at 90% or less, suggesting a subset of tutors may benefit from additional training and coaching to ensure they accurately implement key program interventions.

Figure 5. Distribution of Tutors by Intervention Fidelity Range



Tutor Caseloads

Tutors work with their coaches to determine which students they will serve based on student eligibility, teacher recommendations, other services offered at the school, and general school priorities for students to serve.

Table 5 shows the average number of students served per tutor based on their minimum caseload expectation. The last

column of the table shows the percentage of tutors who met or exceeded their caseload expectations for at least 80% of the weeks they served in the program. 50% tutors were able to meet the caseload expectation of 12 students, indicating the program may be able to serve more students by encouraging all tutors to have full caseloads.

Table 5. Tutor Caseloads

Minimum Caseload Expectation	Number of Tutors	Average Total Students Served per Tutor	Percentage of Tutors Meeting Caseload Expectation
12 students	14	16.9	50%

Student Dosage

Tutors strive to work with each student on their caseload for 90 minutes per week. Tutoring is delivered in pairs or groups of three students. Tutors record each student’s daily minutes in the online Math Corps Data Management System. Table 6 shows the total number of tutoring sessions and the average

number of sessions, weeks, and minutes per week students received in each grade. The table also disaggregates the data for white and non-white students. Students received a substantial number of tutoring sessions with over an hour of tutoring each week across multiple months. White students tended to receive slightly more tutoring sessions and more minutes of tutoring per week.

Table 6. Tutoring Dosage by Grade and Race

Student Race	Students Tutored	Total Tutoring Sessions	Average Tutoring Sessions per Student	Average Tutoring Weeks per Student	Average Tutoring Minutes per Week per Student
Grade 4	82	3,623	44.2	16.6	62.4
White	65	2,772	42.6	16.3	62.5
Non-White	16	841	52.6	18.4	62.7
Grade 5	110	4,610	41.9	17.7	63.2
White	85	3,684	43.3	18.2	63.8
Non-White	22	854	38.8	16.7	60.1
Grade 6	16	768	48.0	23.6	68.2
White	15	730	48.7	23.7	67.8
Grade 7	16	678	42.4	21.8	64.8
White	15	661	44.1	22.7	64.8
Grade 8	12	498	41.5	23.9	64.2
White	9	397	44.1	24.3	63.0
Total	236	10,177	43.1	18.3	63.5
White	189	8,244	43.6	18.6	63.9
Non-White	43	1,851	43.0	17.7	62.3

Note: The subtotals do not equal the totals as the totals include students with an Unknown race/ethnicity in the program database. Disaggregated results for non-white students not included for Grades 6-8 due to small sample sizes.

In addition to recording the number of tutoring minutes, tutors also record the reason a scheduled tutoring session was not delivered. Tutors are able to indicate if a session was missed for each of the

following reasons: student absence from school, tutor absence from school, tutor receiving training, tutor administering an assessment to the student instead of

delivering an intervention, or other for any reason not provided.

Table 7 displays the percentage of days tutoring sessions were delivered along with the rate of each missed tutoring session reason. The table also disaggregates the data for white and

non-white students. Tutor absences was the most common reason for missed sessions. White students had a greater percentage of sessions delivered than non-white students, with non-white students more likely to miss sessions for student absences and "other" reasons.

Table 7. Tutoring Attendance by Grade and Race

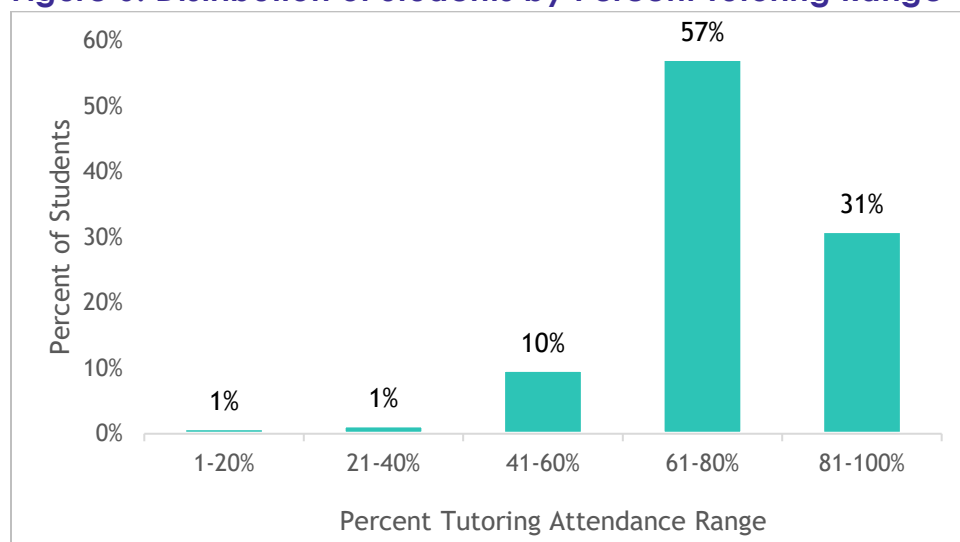
Student Race	Session Attended	Tutor Absent	Student Absent	Assessing Student	Tutor Training	Other
Grade 4	78%	8%	7%	1%	0%	6%
White	78%	8%	6%	1%	0%	6%
Non-White	74%	7%	11%	1%	0%	7%
Grade 5	72%	9%	8%	1%	0%	10%
White	72%	9%	8%	2%	0%	9%
Non-White	70%	10%	7%	1%	0%	12%
Grade 6	76%	8%	7%	3%	0%	6%
White	76%	7%	7%	3%	0%	6%
Grade 7	68%	11%	6%	4%	0%	12%
White	67%	11%	6%	4%	0%	11%
Grade 8	67%	10%	12%	5%	0%	6%
White	68%	9%	11%	5%	0%	6%
Total	74%	9%	8%	2%	0%	8%
White	74%	9%	7%	2%	0%	8%
Non-White	71%	9%	9%	1%	0%	10%

Note: Disaggregated results for non-white students not included for Grades 6-8 due to small sample sizes.

Math Corps tracks tutoring attendance for each student throughout the school year using a 'percent tutoring' metric. A student's percent tutoring is equal to the number of tutoring sessions delivered divided by the number of days tutoring was scheduled to happen (i.e. the metric ignores days there is not school). The program also tracks a tutor's percent tutoring by combining all of their individual student's percent tutoring into a tutor average.

The program strives for each student and tutor to achieve at least 80% tutoring. Tutors falling below this target are provided extra support to improve the frequency of tutoring delivery wherever possible. Figure 6 displays the distribution of students by their percent tutoring range. 57% of students received tutoring between 61-80% of their scheduled days, indicating a growth opportunity for the program.

Figure 6. Distribution of Students by Percent Tutoring Range



Lesson Completion

Math Corps delivers intervention in the form of instructional lessons which vary in number from 20 in eighth grade to 39 in sixth grade. Each lesson focuses on a particular skill (ex. Multiplication Concepts & Strategies) and content builds across the lessons (ex. addition lessons come before multiplication lessons). See Appendix B for more information on the Math Corps lesson research base.

Students are required to demonstrate mastery—defined as 85% correct on a brief informal assessment of lesson content—before advancing to the next

lesson. Progression through the lessons is essential for students to receive instruction in and reach mastery of each concept.

Table 8 displays the average number of lessons students completed in each grade and the average number of weeks students spent on each lesson. Fifth grade students completed the most lessons while sixth grade students completed the least number of lessons. Overall students completed about half the lessons, indicating a growth area for the program.

Table 8. Lessons Completed per Student

Grade	Average Lessons Completed	Average Weeks per Lesson
Grade 4	11.9	2.0
Grade 5	10.5	2.2
Grade 6	15.3	1.5
Grade 7	14.3	1.8
Grade 8	12.7	1.9
Total	11.9	2.0

3. To what extent did participating students improve their math skills?

Measures of Math Skills

As part of the Math Corps program tutors administer STAR Math, a computer adaptive assessment of students' overall math proficiency. Tutors use STAR Math to determine which students are eligible for Math Corps, to monitor student progress, and to inform when students no longer need Math Corps support. Active Math Corps students are assessed every two months (up to five times per year) while prospective and previous Math Corps students are assessed during three seasonal benchmark windows.

Tutors also administer a fact fluency assessment in conjunction with the STAR Math. This one-minute multi-skill probe includes basic addition, subtraction, multiplication, and division math facts. Students who score below the fact fluency benchmark of 30 problems correct per minute receive math fact practice during at least one tutoring session each week. See Appendix A for details on assessment procedures and research base.

Student Performance on STAR Math

Table 9 displays STAR Math assessment data for participating students who received 12 or more weeks of Math Corps tutoring. The average student had a positive weekly growth, indicating an increase in math skills over the course of the program year. Each student's average weekly growth is compared to an individual target growth. Overall, 56% of students exceeded their target growth. These percentages, though relatively modest, may reflect relatively

strong results given the inherently at-risk population of students served by Math Corps. Further, they reflect only within-student growth relative to computer-generated growth targets. Causal comparison studies of Math Corps demonstrate that the program consistently accelerates growth beyond what students experience without the program (Coddington et al., 2022; Parker et al., 2019).

Table 9. STAR Math Average Weekly Growth for Participating Students

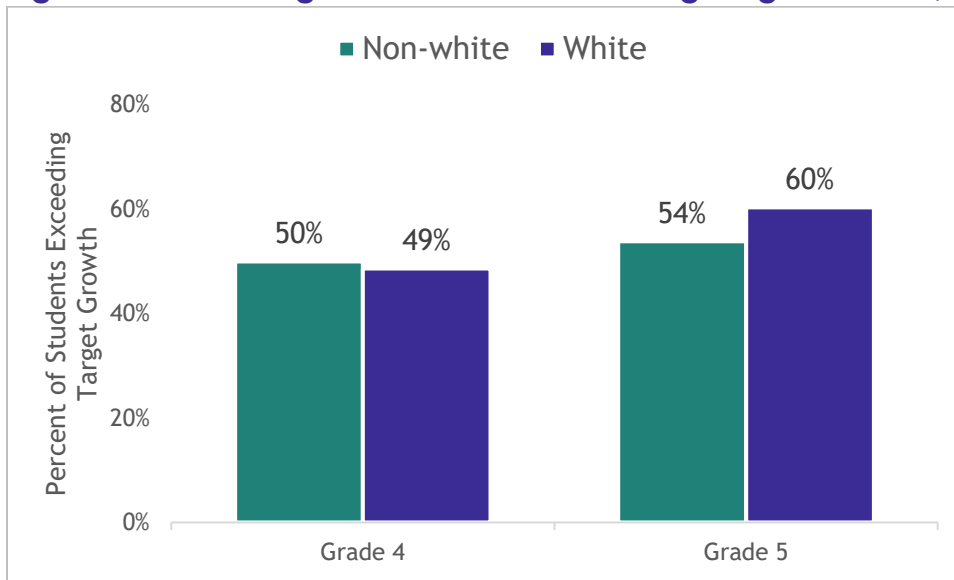
Grade	Number of Students	Average Weekly Growth (Standard Deviation)	Percentage of Students Exceeding Target Growth
Grade 4	47	2.1 (2.7)	48.9%
Grade 5	73	2.0 (2.3)	57.5%
Grade 6	16	1.2 (1.2)	62.5%
Grade 7	13	0.8 (1.7)	53.8%
Grade 8	11	0.8 (1.0)	72.7%
Total	160	1.7 (2.5)	56.3%

Note: Includes students with at least two STAR Math scores and 12 or more weeks of tutoring.

Figure 7 disaggregates the above student outcome data into non-white and white students in order to better understand program impact across key demographic considerations. In Grade 4, white students and non-white students

exceeded target growth at a similar rate. In Grade 5, a greater percentage of white students exceeded target growth compared to non-white students.

Figure 7. Percentage of Students Exceeding Target Growth, By Race

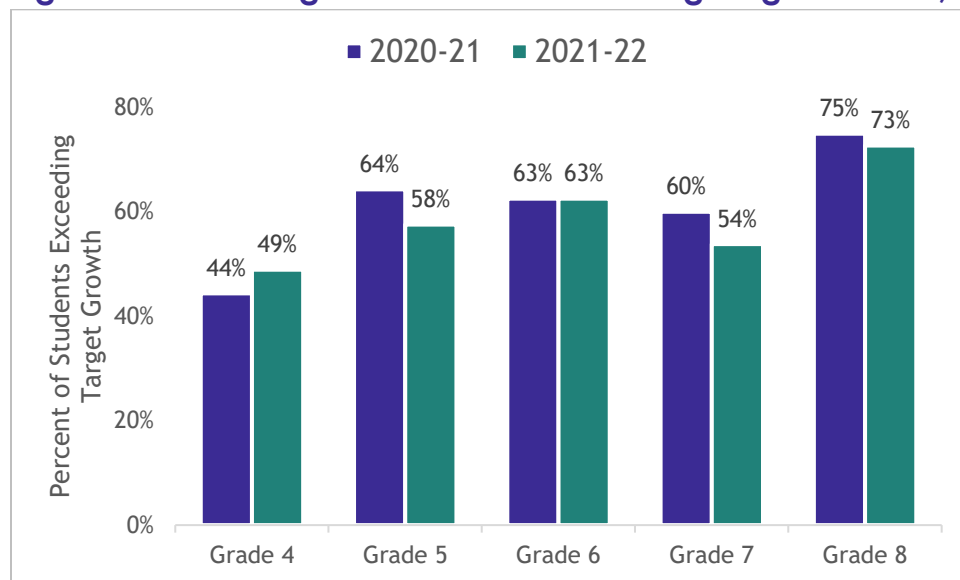


Note: Grades 6-8 not included due to small sample sizes for disaggregated results.

Comparing the percentage of students exceeding target growth across program years is an effective way to track overall program effectiveness and identify potential needs for program improvement. Figure 8 displays the percentage of students above target growth for the past two years. Grade 4

had a substantial increase in the percentage of students exceeding target growth in 2021-22 compared to the previous year. The percentage of students exceeding target growth was equal to or below the percentage from the previous year for the other four grade levels.

Figure 8. Percentage of Students Exceeding Target Growth, by Year



Note: Use caution when comparing outcome data across years as the program was significantly disrupted by the COVID-19 pandemic.

Student Performance on Fact Fluency

As previously stated, tutors administer a one-minute fact fluency assessment to track student progress on basic math fact skills and determine if students should receive fact fluency support during tutoring. Table 10 displays the average fact fluency score collected before tutoring begins and the final

score of the program year. The average student in all grades increased their performance on the fact fluency assessment. Grade 5 students averaged the largest growth while Grade 8 had the greatest percentage of students making growth.

Table 10. Fact Fluency Average Growth

Grade	Number of Students with Two Scores	Average Initial Score	Average Final Score	Average Growth	Percent Making Growth
Grade 4	47	4.4	9.3	4.9	78.7%
Grade 5	71	7.7	13.9	6.2	76.1%
Grade 6	16	15.7	20.9	5.2	75.0%
Grade 7	13	20.3	20.3	0.0	46.2%
Grade 8	11	12.8	18.8	5.7	81.8%
Total	158	8.9	14.1	5.2	74.7%

Note: Includes students with at least two fact fluency scores and 12 or more weeks of tutoring.

Tutor Perception of Student Performance

In the spring of each program year, Math Corps evaluators distribute an online survey to tutors. The survey asks a wide-range of questions regarding their service in Math Corps and potential impact of the program. Figure 9 displays the percentage of tutors who indicated they agreed or strongly agreed that their service in Math Corps had a positive impact on students and increased students' confidence in math. The results from these survey questions

are presented for each of the previous two program years.

The survey results are notably positive with 100% of respondents in both years indicating their service in Math Corps had a positive impact on students and increased students' confidence in math. These results indicate tutors tend to see a clear and consistent positive impact of their work with students.

Figure 9. Tutor Survey Results on Student Impact



4. How did serving as a tutor impact their skills and knowledge related to education and their future career goals?

While supporting student math development is the primary goal for the program, Math Corps also strives to provide tutors with an overall positive experience and prepare them for any future career they might pursue, especially careers in the education field. As previously described, Math Corps evaluators distribute a survey to tutors in the spring of each program year. The survey asks tutors a series of questions on their experience in Math Corps and the impact the program had on them, their students, and their school. Survey results are used to evaluate the program's impact on the tutors themselves.

Service Experience

A common practice in surveys is to ask the respondent if they would

recommend the program to others, as one's willingness or unwillingness to recommend encompasses the overall experience of serving in Math Corps. Figure 10 shows that 100% of tutors would recommend serving as a member of Math Corps, with 82% of the respondents indicating they would definitely recommend the program. These results suggest tutors had a positive experience while serving in Math Corps.

The survey also asked tutors if serving in Math Corps had a positive impact on them personally. Figure 11 shows that 100% of tutors agree or strongly agree service had a positive impact on them, demonstrating the positive personal impact of serving.

Figure 10. Tutor Satisfaction

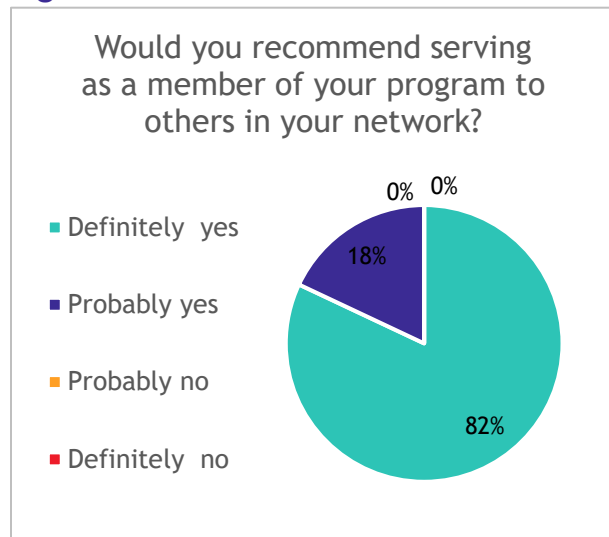
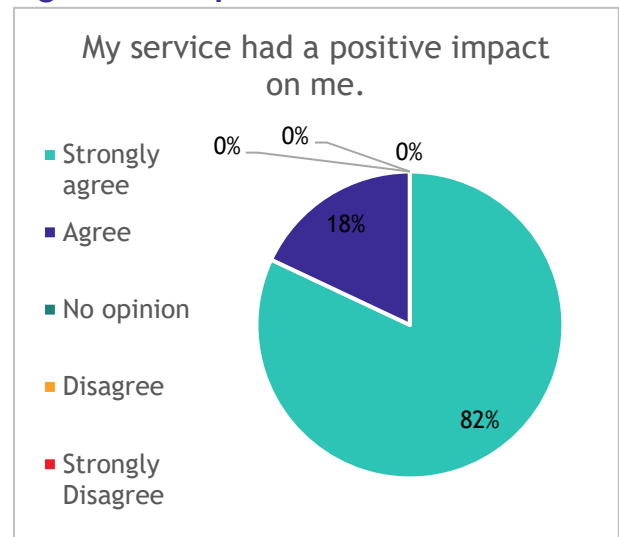


Figure 11. Impact on Tutors



Skill Development and Future Careers

Math Corps strives to support tutor professional development through the training, coaching, service experience, and other professional development support provided by the program. In particular, Math Corps aims to increase the teacher and school staff pipeline in communities through its tutors pursuing careers in education after their service. To evaluate these outcomes in the short term, the spring survey asks tutors to respond to questions related to their increased knowledge and skills as well as any potential plans to pursue a career in education.

Figure 12. Tutor Increased Knowledge and Skills

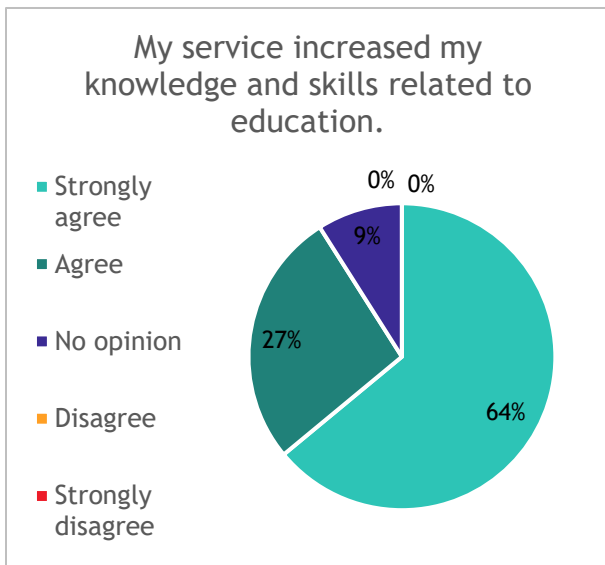
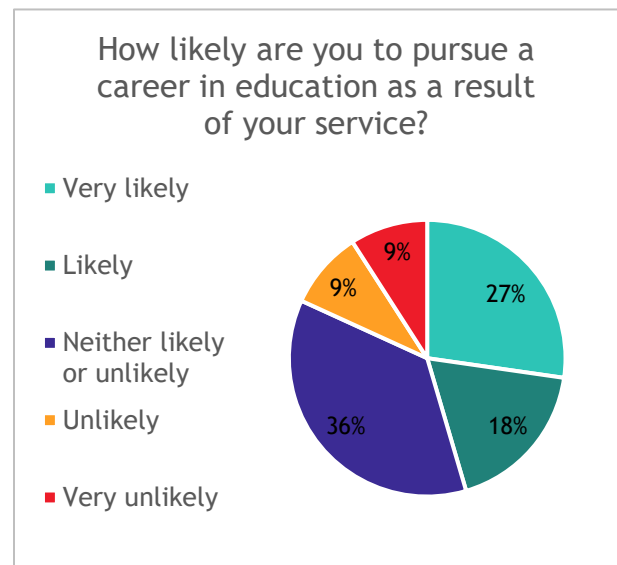


Figure 12 shows that 91% of respondents agree or strongly agree that their service increased their knowledge and skills related to education, demonstrating the program is having a positive impact on tutors in this area. Figure 13 displays tutor responses related to the likelihood they will pursue a career in education as a result of their service in Math Corps. 27% of respondents answered that they are very likely to pursue a career in education as a result of their service and 18% responded that they are likely to do so. These results indicate Math Corps likely contributes to the education career pipeline in the communities where tutors serve.

Figure 13. Tutors Pursuing Careers in Education



References

Burns, K.M., Jimerson, S.R. VanDerHeyden, A. M., & Deno, S.L., (2016). Toward a unified Response-to-Intervention model: Multi-tiered systems of support. In S.R. Jimerson, M.K.

Burns, & A. VanDerHeyden (Eds.), *Handbook of Response to Intervention, 2nd Ed.* (pp. 719-732). New York: Springer.

Codding, R. Nelson, P. M., Parker, D. C., Edmunds, R., & Klafit, J. (2022). Evaluation of a math tutoring program implemented with community support: A systematic replication & extension. *Journal of School Psychology.*

The National Mathematics Advisory Panel. (2008). Reports of the task groups and Subcommittees. Washington, DC: U.S. Department of Education

Parker, D. C., Nelson, P. M., Zaslofsky, A., Foegen, A., Kaiser, P., Kanive, R, & Heistad, D. (2019). Evaluation of a Math Intervention Program Implemented with Community Support. *Journal of Research on Educational Effectiveness.*

Appendix A: Assessment Procedures and Research Base

Math Corps uses two assessments to track student progress throughout the year – STAR Math and Fact Fluency. STAR Math is a computer adaptive assessment of students' overall math proficiency. STAR Math questions adjust in difficulty on how students respond. Tutors use STAR Math to determine which students are eligible for Math Corps, to monitor student progress, and to inform when students no longer need Math Corps support. The publisher for STAR Math provides benchmarks for performance that were derived using diagnostic accuracy analyses to state proficiency as the criterion. Math Corps uses the benchmarks to identify students as on-track for proficiency or below proficiency.

Student progress on math facts is assessed using multi-skill Fact Fluency assessments that include basic addition, subtraction, multiplication, and division math facts. The Fact Fluency assessments are short duration, timed tests; students are given one minute to work through problems. Tutors score the Fact Fluency assessments by determining the total number of problems correct within the one-minute time limit and compare the number correct to the Math Corps benchmark of 30 problems correct in one minute.

STAR Math and Fact Fluency Administration Schedule

September	November	January	March	May
Benchmark All Students	Progress Check Active Students	Benchmark All Students	Progress Check Active Students	Benchmark All Students

Selection of Research for STAR Math Assessment

- Renaissance Learning (2013). STAR Math: Technical manual. Wisconsin Rapids, WI: Author.
- The National Center on Intensive Intervention gave STAR Math the highest possible ratings for technical standards (<https://charts.intensiveintervention.org/chart/academic-screening>).

Selection of Research for Fact Fluency Assessment

- Foegen, A. (2000). Technical adequacy of general outcome measures for middle school mathematics. *Diagnostique*, 25, 175–203.
- Foegen, A., & Deno, S. L. (2001). Identifying growth indicators for low-achieving students in middle school mathematics. *Journal of Special Education*, 35, 4–16.

Appendix B: Intervention Research Base

Math Corps delivers intervention in the form of instructional lessons which vary in number from 20 in eighth grade to 39 in sixth grade. Lessons use one of several intervention components to improve targeted subskills required to work effectively with whole and rational numbers. The first component includes conceptual-based instruction using the Concrete, Representational, Abstract (CRA) approach. The second component focuses on procedural accuracy and includes direct instruction followed by supervised practice with Cover, Copy, and Compare (CCC). The third component uses Cognitive Strategy Instruction (CSI) to support development of the skill for word problem solving.

Intervention components were applied in a sequence for each skill. For example, in 5th grade students first receive CRA to better develop the conceptual basis for adding and subtracting fractions with dissimilar denominators; then receive CCC to become efficient at accurately applying the corresponding computational strategies; and then receive CSI to be able to solve word problems involving fractions with unlike denominators. Students are required to demonstrate mastery—defined as 85% correct on a brief informal assessment of intervention content—before advancing among the intervention components. Students also receive short duration fact fluency practice using Explicit Timing weekly to improve the use and selection of efficient strategies that students already know to encourage automaticity.

For each intervention component sources of empirical evidence for intervention effectiveness are listed below.

Selection of Research in Support of Conceptual-Based Intervention

- Agrawal, J., & Morin, L. L. (2016). Evidence-based practices: Applications of concrete representational abstract framework across math concepts for students with mathematics disabilities. *Learning Disabilities Research & Practice, 31*(1), 34-44.
- Witzel, B. S., Mercer, C. D., & Miller, M. D. (2003). Teaching algebra to students with learning difficulties: An investigation of an explicit instruction model. *Learning Disabilities Research & Practice, 18*(2), 121-131.
- Flores, M. M. (2010). Using the concrete-representational-abstract sequence to teach subtraction with regrouping to students at risk for failure. *Remedial and Special Education, 31*(3), 195-207.
- Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). *Assisting Students Struggling with Mathematics: Response to Intervention (RTI) for Elementary and Middle Schools*. NCEE 2009-4060. What Works Clearinghouse.
- Carbonneau, K. J., Marley, S. C., & Selig, J. P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. *Journal of Educational Psychology, 105*(2), 380.

Selection of Research in Support of Cover, Copy, Compare

- Skinner, C. H., Turco, T. L., Beatty, K. L., & Rasavage, C. (1989). Cover, copy, and compare: A method for increasing multiplication performance. *School Psychology Review*.
- Poncy, B. C., Skinner, C. H., & Jaspers, K. E. (2007). Evaluating and comparing interventions designed to enhance math fact accuracy and fluency: Cover, copy, and compare versus taped problems. *Journal of Behavioral Education*, 16(1), 27-37.
- Coddling, R. S., Eckert, T. L., Fanning, E., Shiyko, M., & Solomon, E. (2007). Comparing mathematics interventions: The effects of cover-copy-compare alone and combined with performance feedback on digits correct and incorrect. *Journal of Behavioral Education*, 16(2), 125-141.
- Skinner, C. H., McLaughlin, T. F., & Logan, P. (1997). Cover, copy, and compare: A self-managed academic intervention effective across skills, students, and settings. *Journal of Behavioral Education*, 7(3), 295-306.
- Stocker Jr, J. D., & Kubina Jr, R. M. (2017). Impact of Cover, Copy, and Compare on fluency outcomes for students with disabilities and math deficits: A review of the literature. *Preventing School Failure: Alternative Education for Children and Youth*, 61(1), 56-68.
- Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). Assisting Students Struggling NCEE 2009with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools. -4060. What Works Clearinghouse.

Selection of Research in Support of Cognitive Strategy Instruction

- Montague, M. (1997). Cognitive strategy instruction in mathematics for students with learning disabilities. *Journal of learning disabilities*, 30(2), 164-177.
- Hutchinson, N. L. (1993). Effects of cognitive strategy instruction on algebra problem solving of adolescents with learning disabilities. *Learning Disability Quarterly*, 16(1), 34-63.
- Montague, M., & Dietz, S. (2009). Evaluating the evidence base for cognitive strategy instruction and mathematical problem solving. *Exceptional Children*, 75(3), 285-302.
- Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools. NCEE 2009-4060. What Works Clearinghouse.
- Carr, Martha, Gita Taasobshirazi, Rena Stroud, and James M. Royer. "Combined fluency and cognitive strategies instruction improves mathematics achievement in early elementary school." *Contemporary Educational Psychology* 36, no. 4 (2011): 323-333.

Selection of Research in Support of Fact Fluency Practice

- Nelson, P. M., Burns, M. K., Kanive, R., & Ysseldyke, J. E. (2013). Comparison of a math fact rehearsal and a mnemonic strategy approach for improving math fact fluency. *Journal of School Psychology, 51*(6), 659-667.
- Nelson, P. M., Parker, D. C., & Zaslofsky, A. (2016). The relative value of growth in math fact skills across late elementary and middle school. *Assessment for Effective Intervention, 41*, 184-192.
- Van Houten, R., & Thomas, C. (1976). The effects of explicit timing on math performance. *Journal of Applied Behavior Analysis,*