

**An Evaluation of**

**Michigan Math Corps**

**ANNUAL EVALUATION REPORT**



**2022-2023**



# 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.

<https://nssc.serveminnesota.org/>

**Authors**

Patrick Kaiser, Director of Education Evaluation, ServeMinnesota

David Parker, Vice President of Research and Development, ServeMinnesota

Table of Contents

[About the National Science & Service Collaborative 2](#_Toc140844914)

[Executive Summary 4](#_Toc140844915)

[Introduction 6](#_Toc140844916)

[Math Corps Overview 6](#_Toc140844917)

[Overview of the Evaluation 7](#_Toc140844918)

[1. What is the scope of the Math Corps program? 8](#_Toc140844919)

[Schools and Tutors 8](#_Toc140844920)

[School Characteristics 9](#_Toc140844921)

[Students Tutored 10](#_Toc140844922)

[2. To what extent was the Math Corps program implemented as intended? 12](#_Toc140844923)

[Coaching Observations 12](#_Toc140844924)

[Tutor Fidelity 12](#_Toc140844925)

[Tutor Caseloads 14](#_Toc140844926)

[Student Dosage 14](#_Toc140844927)

[Lesson Completion 18](#_Toc140844928)

[3. To what extent did participating students improve their math skills? 19](#_Toc140844929)

[Measures of Math Skills 19](#_Toc140844930)

[Student Performance on STAR Math 19](#_Toc140844931)

[Student Performance on Fact Fluency 22](#_Toc140844932)

[Perceptions of Student Performance 22](#_Toc140844933)

[4. How did serving as a tutor impact their skills and knowledge related to education and their future career goals? 24](#_Toc140844934)

[Service Experience 24](#_Toc140844935)

[Skill Development and Future Careers 25](#_Toc140844936)

[References 26](#_Toc140844937)

[Appendix A: Assessment Procedures and Research Base 27](#_Toc140844938)

[Appendix B: Intervention Research Base 28](#_Toc140844939)

# 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 minutes 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 2022-23 school year.

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

Twenty-six Math Corps tutors served a total of 631 students across 23 schools. Black or African American and White were 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 (>95% accuracy) and in accordance with their established evidence base.

On average, students received 59 minutes of tutoring per week across 17 weeks. White students tended to receive both 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 44% of students exceeded their target growth. A greater percentage of non-white students exceeded target growth compared to white students. 75% of students made growth on the Fact Fluency measure.

When asked in a survey about the impact of the program on students, the majority of tutor, Internal Coach, school administrator, and classroom teacher respondents indicated participation in Math Corps had a positive impact on students.

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

92% of tutor respondents to an end-of-year survey from the evaluation team indicated Math Corps had a positive impact on them personally, and 100% of respondents said their service increased their knowledge and skills related to education. Additionally, 82% 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 makes a noteworthy contribution 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 2022-23 program year.

**Table 1. Schools, Coaches, and Tutors**

|  |  |  |
| --- | --- | --- |
| **Schools** | **Coaching Specialists** | **Tutors\*** |
| 23 | 4 | 26 |

*\*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 identity 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 MEC Staff 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. MEC Program Directors and Coordinators provide AmeriCorps 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 MEC Math Corps partner schools based on their school level FRPL percentage. The majority of the students at 86% of participating schools are FRPL eligible indicating most tutors were placed in schools where access to other resources may be at least somewhat limited.

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

*Note: Data not available for one participating school.*

## 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 term commitment. Full-time tutors serve a caseload of 24 or more students while part-time tutors serve a caseload of 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 | 223 |
| Fifth | 247 |
| Sixth | 133 |
| Seventh | 14 |
| Eighth | 14 |
| **Total** | **631** |

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 2019-20, 2020-21, and 2021-22 were significantly impacted by the COVID-19 pandemic and cannot be generalized other program year outcomes.

**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 Black or African American and White were the greatest racial/ethnic groups 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. Most tutors received consistent observation support from both their Coaching Specialist and Internal Coach.

**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% | 91% | 100% | 87% |

*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 (MCDMS). 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** |
| 181 | 95.9% |

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. 13% 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**

Figures 6 also shows the distribution of tutors by their intervention average fidelity, but the data are disaggregated between tutors at schools where less than 75% of students are eligible for the free or reduced-price lunch program and tutors at schools with 75% or more students eligible. The intervention fidelity data is lower at schools with a high percentage of students eligible for the free-reduced priced lunch program, indicating tutors at these schools may need greater support delivering tutoring interventions in this context.

**Figure 6. Distribution of Tutor Fidelity by Percentage of Students Eligible for Free-Reduced Price Lunch**

## 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. All tutors with a caseload goal of 12 students were able to meet this expectation while 62% of tutors with a caseload goal of 24 students met this expectation 80% of the time.

**Table 5. Tutor Caseloads**

|  |  |  |  |
| --- | --- | --- | --- |
| **Minimum Caseload Expectation** | **Number of Tutors** | **Average Total Students Served** **per Tutor** | **Percentage of Tutors Meeting Caseload Expectation**  |
| 12 students | 13 | 19.0 | 100% |
| 24 students | 15 | 29.5 | 62% |

## 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 an average of 17 weeks of tutoring with about an hour of tutoring each week. White students averaged both 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** | **223** | **8,993** | **40.3** | **19.3** | **58.0** |
| White | 86 | 4,635 | 53.9 | 24.0 | 59.6 |
| Non-White | 119 | 4,173 | 35.1 | 17.9 | 56.7 |
| **Grade 5** | **247** | **8,959** | **36.3** | **17.8** | **57.6** |
| White | 85 | 4,165 | 49.0 | 22.2 | 58.3 |
| Non-White | 144 | 4,621 | 32.1 | 16.9 | 57.4 |
| **Grade 6** | **133** | **2,798** | **21.0** | **13.4** | **61.7** |
| White | 48 | 1,267 | 26.4 | 16.8 | 63.0 |
| Non-White | 82 | 1,500 | 18.3 | 11.6 | 60.7 |
| **Grade 7** | **14** | **402** | **28.7** | **15.4** | **62.8** |
| **Grade 8** | **14** | **231** | **16.5** | **9.6** | **51.0** |
| **Total** | **631** | **21,383** | **33.9** | **17.2** | **58.5** |
| White | 221 | 10,171 | 46.0 | 21.7 | 59.7 |
| Non-White | 366 | 10,732 | 29.3 | 15.7 | 57.7 |

*Note: The subtotals do not equal the totals as the totals include students with an Unknown race/ethnicity in the program database. Disaggregated results not included for Grade 7 and Grade 8 due to small sample sizes.*

In additional 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 and “other” were the most common reasons 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 tutor absences.

**Table 7. Tutoring Attendance by Grade and Race**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Student Race** | **Session Attended** | **Tutor Absent** | **Student Absent** | **Assessing Student** | **Tutor Training** | **Other** |
| **Grade 4** | **61%** | **16%** | **7%** | **7%** | **1%** | **9%** |
| White | 67% | 10% | 6% | 7% | 1% | 10% |
| Non-White | 58% | 18% | 7% | 7% | 1% | 9% |
| **Grade 5** | **57%** | **19%** | **7%** | **6%** | **1%** | **10%** |
| White | 60% | 14% | 7% | 7% | 1% | 11% |
| Non-White | 55% | 21% | 7% | 6% | 1% | 10% |
| **Grade 6** | **64%** | **7%** | **12%** | **6%** | **0%** | **11%** |
| White | 65% | 10% | 9% | 6% | 0% | 11% |
| Non-White | 63% | 5% | 14% | 6% | 0% | 12% |
| **Grade 7** | **72%** | **2%** | **7%** | **5%** | **0%** | **14%** |
| **Grade 8** | **65%** | **2%** | **8%** | **5%** | **0%** | **21%** |
| **Total** | **60%** | **15%** | **8%** | **6%** | **1%** | **10%** |
| White | 64% | 11% | 7% | 7% | 1% | 10% |
| Non-White | 59% | 15% | 9% | 6% | 0% | 10% |

*Note: Disaggregated results not included for Grade 7 and Grade 8 due to small sample sizes.*

Table 8 displays the percentage of days tutoring sessions were delivered along with the rate of each missed tutoring session reason disaggregated by site level Free-Reduced Price Lunch rate. Students at sites with a lower percentage of students eligible for Free-Reduced Price Lunch had a greater percentage of sessions delivered. Students at sites with a larger percentage of students eligible for FRPL tended to have more missed sessions due to tutor absences, while students at schools in the lowest FRPL range had more sessions missed for “other” reasons.

**Table 8. Tutoring Attendance by Grade and Site Free-Reduced Price Lunch**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Site FRPL Percent** | **Session Attended** | **Tutor Absent** | **Student Absent** | **Assessing Student** | **Tutor Training** | **Other** |
| **Grade 4** | **61%** | **16%** | **7%** | **7%** | **1%** | **9%** |
| 26-50% | 60% | 2% | 12% | 8% | 0% | 19% |
| 51-75% | 62% | 16% | 6% | 8% | 1% | 8% |
| 76-100% | 58% | 21% | 8% | 5% | 1% | 7% |
| **Grade 5** | **57%** | **19%** | **7%** | **6%** | **1%** | **10%** |
| 26-50% | 60% | 1% | 8% | 7% | 0% | 24% |
| 51-75% | 57% | 19% | 7% | 7% | 1% | 9% |
| 76-100% | 54% | 24% | 7% | 5% | 1% | 9% |
| **Grade 6** | **64%** | **7%** | **12%** | **6%** | **0%** | **11%** |
| 26-50% | 61% | 13% | 10% | 6% | 0% | 9% |
| 51-75% | 59% | 5% | 9% | 5% | 0% | 21% |
| 76-100% | **64%** | **7%** | **12%** | **6%** | **0%** | **11%** |
| **Total** | **60%** | **15%** | **8%** | **6%** | **1%** | **10%** |
| 26-50% | 61% | 8% | 10% | 7% | 0% | 15% |
| 51-75% | 59% | 16% | 7% | 7% | 1% | 10% |
| 76-100% | 59% | 17% | 9% | 5% | 1% | 9% |

*Note: Grade 7 and Grade 8 not included 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 7 displays the distribution of students by their percent tutoring range. 76% of students received tutoring between 41-80% of their scheduled days, indicating a growth opportunity for the program.

**Figure 7. 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 9 displays the average number of lessons students completed in each grade and the average number of weeks students spent on each lesson. Fourth grade students completed the most lessons while eighth grade students completed the fewest lessons. Overall students completed less than half the lessons, indicating a growth area for the program.

**Table 9. Lessons Completed per Student**

|  |  |  |
| --- | --- | --- |
| **Grade** | **Average Lessons Completed** | **Average Weeks per Lesson** |
| Grade 4 | 9.8 | 2.4 |
| Grade 5 | 9.4 | 2.4 |
| Grade 6 | 8.4 | 2.7 |
| Grade 7 | 7.7 | 2.6 |
| Grade 8 | 6.0 | 3.2 |
| **Total** | **9.3** | **2.5** |

# 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 10 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, 44% 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 (Codding et al., 2022; Parker et al., 2019).

**Table 10. 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 | 171 | 1.37 (1.79) | 45.0% |
| Grade 5 | 173 | 1.05 (1.97) | 39.9% |
| Grade 6 | 53 | 1.11 (2.19) | 50.9% |
| Grade 7 | 10 | 0.59 (2.60) | 50.0% |
| Grade 8 | 6 | 1.94 (1.72)  | 83.3% |
| **Total** | **413** | **1.19 (1.94)** | **44.3%** |

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

Figure 8 disaggregates the above student outcome data into non-white and white students in order to better understand program impact across key demographic considerations. Across all three grades and measures, a greater percentage of non-white students exceeded target growth compared to white students. The differences between the two groups ranged from 1 percentage points to 17 percentage points.

Similarly, Figure 9 disaggregates student outcome data by the school level percentage of students eligible for the free-reduced price lunch program. In Grade 6, students at schools with the greater percentage of students eligible for the FRPL program had a greater percentage of students exceeding target growth than students at schools with a lower percentage of students eligible for the FRPL program. For Grade 4 and Grade 5, students at schools in the middle range (50-74% eligible for FRPL) had the greatest percentage of students exceeding target growth.

**Figure 8. Percentage of Students Exceeding Target Growth, By Race**

*Note: Grade 7 and Grade 8 not included due to small sample sizes for disaggregated results.*

**Figure 9. Percentage of Students Exceeding Target Growth, By School Free-Reduced Price Lunch Percentage**

*Note: Grade 7 and Grade 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 10 displays the percentage of students above target growth for the past five years. Grade 5 and Grade 6 had an increase in the percentage of students exceeding target growth compared to the previous year.

**Figure 10. 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. Limited student numbers for Grade 6 in 2020-21 and Grades 7 and 8 in all years.*

## 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 11 displays the average fact fluency score collected before tutoring begins and the final score of the program year. The average student in four of the five grades increased their performance on the fact fluency assessment. Grade 7 students made the most growth with 86% of students increasing their score with an average growth of 7.4 items correct.

**Table 11. Fact Fluency Average Growth**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Grade** | **Number of Students with Two Scores** | **Average Initial Score** | **Average Final Score** | **Average Growth** | **Percent Making Growth** |
| Grade 4 | 123 | 6.7 | 10.7 | 4.0 | 73.2% |
| Grade 5 | 133 | 9.0 | 13.4 | 4.4 | 76.9% |
| Grade 6 | 40 | 12.2 | 15.5 | 3.3 | 75.5% |
| Grade 7 | 6 | 9.1 | 16.6 | 7.4 | 85.7% |
| Grade 8 | 4 | 10.7 | 10.7 | 0.0 | 66.7% |
| **Total** | **306** | **8.5** | **12.6** | **4.1** | **75.2%** |

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

## Perceptions of Student Performance

In the spring of each program year, Math Corps evaluators distribute an online survey to tutors, Internal Coaches, school administrators, and classroom teachers of students participating in Math Corps. The survey asks a wide-range of questions regarding their experience with Math Corps and potential impact of the program.

Figure 11 displays the percentage of respondents who agreed or disagreed that Math Corps had a positive impact on students. Tutors were the most likely to respond that they strongly agree Math Corps had a positive impact on students.

**Figure 11. Survey Results on Student Impact**

*Note: Coaches, administrators, and teachers were asked to agree or disagree with the statement “Participation in Math Corps had a positive impact on students” while tutors were asked “My service had a positive impact on students.*

# 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 12 shows that 91% of tutors would recommend serving as a member of Math Corps, with over half of the respondents indicating they would definitely recommend the program. These results highlight the highly positive experience tutors had serving in the Math Corps, and suggests a positive experience while serving.

The survey also asked tutors if serving in Math Corps had a positive impact on them personally. Figure 13 shows that 92% of tutors agree or strongly agree service had a positive impact on them, demonstrating the positive personal impact of serving.

**Figure 12. Tutor Satisfaction Figure 13. 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 14 shows that 100% 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 15 displays tutor responses related to the likelihood they will pursue a career in education as a result of their service in Math Corps. 55% of respondents answered that they are very likely to pursue a career in education as a result of their service and 27% responded that they are likely to do so. These results indicate Math Corps likely makes a noteworthy contribution to the education career pipeline in the communities where tutors serve.

**Figure 14. Tutor Increased Knowledge and Skills**

**Figure 15. 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., & Klaft, 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** |
| BenchmarkAll Students | Progress CheckActive Students | BenchmarkAll Students | Progress CheckActive Students | BenchmarkAll 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.
* Codding, 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 Taasoobshirazi, Rena Stroud, and James M. Royer. "Combined fluency and cognitive strategies instruction improves mathematics achievement in early elementary school." Contemporary Educational Psychology36, 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,