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STEM Action Center's AmeriCorps Math Mentors Program: 2022-2023 Evaluation Report

THE UNIVERSITY OF UTAH
UTAH EDUCATION POLICY CENTER

Prepared by the Utah Education Policy Center for the STEM Action Center

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THE UNIVERSITY OF UTAH
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Bridging Research, Policy, and Practice

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Introduction

Evaluation Overview

In 2021-2022, the STEM Action Center launched the AmeriCorps Math Mentors Program (AMMP). The program builds upon the STEM Action Center's successful K-12 Math Personalized Learning Software Program[1] by pairing a mentoring intervention with a math software intervention. Specifically, students involved in the AMMP work with a mentor who offers guidance and encouragement to students as they complete activities in a math learning software program.

Over a four-year period from 2021-2022 (Pilot Year) to 2024-2025 (Year 3), the key aims of the AMMP include:

- increasing the number of students in Utah receiving high-impact tutoring,
- increasing mentors' self-efficacy for providing mathematics tutoring to students and building strong relationships with students,
- increasing students' interest, engagement, confidence, and achievement in mathematics.[2]

During the 2021-2022 pilot year, the Utah Education Policy Center (UEPC) worked closely with the STEM Action Center in dual roles. First, the UEPC's Bridgeworks Team and Research & Evaluation Team served as consultants to ensure that the program was designed in ways that align with evidence-based and practice-informed guidelines for tutoring and mentoring programs. The UEPC's program design work benefitted tremendously from resources developed by and ongoing research conducted by three organizations:

- The National Student Support Accelerator (NSSA)[3] is "devoted to translating promising research about how tutoring can benefit students into action on the ground" by introducing "a framework for thinking about how [high-impact] tutoring programs should be structured to suit their communities and specific tools for building, expanding, improving and funding such programs."

- Saga Education[4] provides resources to support high-impact tutoring, including Saga Coach, an "online training program [that] provides foundational skills for being an effective tutor."

- MENTOR: The National Mentoring Partnership[5] was "created more than 30 years ago to …. build a youth mentoring field and movement, serving as the expert and go-to resource on quality mentoring."

Second, the UEPC's Research and Evaluation Team conducted a preliminary implementation and outcome evaluation of the AmeriCorps Math Mentors Program utilizing data from a review of program artifacts, interviews with mentors, and end-of-year surveys of mentors. UEPC evaluators

[1] https://stem.utah.gov/educators/funding/k-12-math-personalized-learning-software-grant/
[2] https://stem.utah.gov/ammp/
[3] https://studentsupportaccelerator.com/tutoring
[4] https://www.sagaeducation.org/
[5] https://www.mentoring.org/

summarized this work in their 2021-2022 annual evaluation report (Altermatt, Groth, & Rorrer, 2022).[6]

Evaluation Questions

During Year 1 (2022-2023) of the AmeriCorps Math Mentors Program, the UEPC sought to address four evaluation questions:

EQ1. To what degree is the AMMP being implemented with fidelity and in ways that align with evidence-based and practice-informed guidelines?
EQ2. Is participation in the AMMP associated with positive changes in mentors' tutoring and relational self-efficacy?
EQ3. Is participation in the AMMP associated with positive changes in students' mathematics attitudes?
EQ4. Is participation in the AMMP associated with positive changes in students' mathematics achievement?

To address these questions, the UEPC utilized data from five sources: 1. program artifacts, 2. data from a mentor tracking sheet developed and administered by the STEM Action Center and completed by mentors to track tutoring dosage (e.g., # of minutes of tutoring), 3. data from mentor surveys developed by the UEPC and administered by the UEPC to AMMP mentors, 4. data from student surveys developed by the UEPC and administered to students by mentors, and 5. demographic and achievement data collected from participating LEAs and/or from the Utah State Board of Education.[7]

Report Organization

The report is divided into five sections. In the first section, we offer background for the current report by providing a brief review of the research and evaluation literatures that have sought to document changes in student achievement outcomes in mathematics over time and to link changes in student outcomes to tutoring and mentoring interventions and math personalized software use. In the second section, we provide an implementation evaluation of 2022-2023 activities (see EQ1). In the third and fourth sections, we provide an outcome evaluation for 2022-2023 activities, focusing on mentor outcomes (see EQ2) and student outcomes (see EQ3 and EQ4). Finally, in the fifth section, we offer recommendations for ongoing program improvement that could support the STEM Action Center in implementing and expanding the program in years to come to achieve the proposed outcomes.

[6] https://daqy2hvnfszx3.cloudfront.net/wp-content/uploads/sites/2/2022/11/08162511/2022-AMMP-Report-FINAL.pdf
[7] Data Privacy Agreements were established with each of the Local Education Agencies (LEAs) participating in the AmeriCorps Math Mentors Program. In addition, the Utah Education Policy Center (UEPC) has a Master Data Sharing Agreement with the Utah State Board of Education (USBE) for use of education data for evaluation and research purposes. The UEPC adheres to terms of the Master Data Sharing Agreement, including terms of use, confidentiality and non-disclosure, data security, monitoring, and applicable laws. The UEPC also complies with University of Utah Institutional Review Board policies for educational research and evaluation. Though UEPC is housed at the University of Utah, only authorized UEPC staff may access the data, and data are not available throughout the University or to other parties. The views expressed in this report are those of UEPC staff and do not necessarily reflect the views or positions of the USBE or the University of Utah.

Summary of Key Findings

Detailed findings from the UEPC's implementation and outcome evaluation of the 2022-2023 AmeriCorps Math Mentors Program (AMMP) are presented in each subsection of the report as described above. Here, we summarize key findings related to mentor recruitment, pre-service training, in-service training and support, mentor self-efficacy, student self-efficacy, and student achievement:

1. Mentor Recruitment. STEM Action Center personnel recruited and placed 26 mentors in seven LEAs, including three charter schools (The Center for Creativity, Innovation, and Discovery, Promontory School, and Gateway Academy) and four school districts (Garfield, Granite, San Juan, and Weber).
2. Pre-Service Training and In-Service Training and Support. Sixteen mentors attended "kick-off" orientation and training sessions in August and September 2022. All mentors were provided additional pre-service and in-service training opportunities, including access to an online training program (Saga Coach) and a virtual AmeriCorps National Service Training event. Mentors who completed exit surveys ($n = 13$) reported that the "kick-off" orientation and training sessions were high-quality and helpful in improving their knowledge, including about the importance of growth mindsets. At the same time, data from exit surveys, a mentor tracking sheet, and pre/post surveys indicated that mentors would benefit from additional pre-service and in-service training and support opportunities that would allow them to gain additional "just in time" knowledge about how to improve their tutoring and mentoring skills, share their successes, and brainstorm with colleagues, classroom teachers, site supervisors, and STEM Action Center staff about how to approach challenges.
3. Mentor Self-Efficacy. The sample of mentors who completed end-of-year surveys ($n = 17$) reported moderate to high levels of confidence in their ability to tutor and build strong mentoring relationships with students. End-of-year tutoring and mentoring self-efficacy ratings were generally higher than beginning-of-year tutoring and mentoring self-efficacy ratings.
4. Student Self-Efficacy. The sample of students who completed the retrospective pre/post survey ($n = 124$) reported statistically significant increases in their endorsement of attitudes and behaviors that are associated with positive achievement outcomes, in general, and positive math outcomes, in particular (e.g., Korpershoek, Canrinus, Fokkens-Bruinsma, & de Boer, 2020; McLeod, 1994). These include high levels of math self-efficacy, strong perceptions of effort in math, high valuing of math, and strong feelings of belongingness. Effect sizes were large in magnitude compared to effect sizes for other educational interventions (Kraft, 2020) and are potentially important given evidence that math attitudes generally decline from childhood into adolescence (e.g., Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007).
5. Student Achievement. By August 1, 2023, four participating LEAs provided academic and demographic data that were utilized in accordance with data sharing agreements to compare the end-of-year math achievement of students who received tutoring with a comparison group of students who did not receive tutoring. Analyses statistically controlled for student demographic characteristics (e.g., low-income status) and baseline differences in academic achievement. Results of these analyses indicated that involvement in the AMMP was not positively related to Acadience Math or RISE test scores. One explanation for the lack of statistically significant, positive associations between tutoring and student achievement outcomes is that, for many students, tutoring dosage was quite low. Across the four LEAs for

which data were available, mentors recorded 450 minutes or more of tutoring (i.e., the equivalent of 90 minutes per week for five weeks) for only 14 students. All of these students were enrolled in the same LEA.

Based on the evaluation findings, key recommendation to meet AMMP goals for Year 2 (2023-2024) will be to continue to hone recruitment efforts and increase monitoring, training, and support opportunities and processes for mentors to ensure that evidence-based and practice-informed guidelines for "high-impact" tutoring are met. In addition, to improve the ability of the tutoring program to impact student achievement, mentors will need to increase the consistency with which they meet with participating students to ensure the guidelines for "high-dosage" tutoring are met. STEM Action Center personnel are committed to continuous improvement in each of these areas.

Intended Audience

The primary audiences for this report include the STEM Action Center team implementing the AmeriCorps Math Mentors Program, AmeriCorps program personnel, and personnel from schools and districts utilizing the mentoring intervention. Like the Pilot Year report, this report is intended to provide useful information for documenting the characteristics and outcomes of the program in Year 1 (2022-2023) and for identifying key action steps to ensure strong implementation and outcomes for Year 2 (2023-2024) and Year 3 (2024-2025).

1 | Background

Mathematics Learning Loss from 2019 to 2023

There is clear evidence that the Covid-19 pandemic resulted in significant learning losses, especially in mathematics (Lewis & Kuhfeld, 2022) and in districts serving lower-income and students of color (Fahle, Kane, Patterson, Reardon, Staiger, & Stuart, 2023; Kuhfeld, Soland, & Lewis, 2022). Learning losses were historic in magnitude, but also varied widely across districts. Fahle et al. (2023) noted that districts in the top decile of pandemic-related learning losses in math saw an average loss of only .17 grade levels from 2019 to 2022. For districts in the bottom decile, the average loss was .89 grade levels (p. 23).

Using federal reliefs funds as well as state and local resources, school districts across the country have invested in a variety of academic recovery initiatives, including high-dosage tutoring, small-group push-in and pull-out interventions, out-of-school-time programs, and software interventions (Carbonari et al., 2022; Jordan, DiMarco, & Toch, 2022). The long-term efficacy of these interventions in mitigating learning losses remains unknown, and early evidence has been, at best, mixed (Carbonari et al., 2022; Lewis & Kuhfeld, 2022). The latest data from NWEA (released in July 2023) indicates that achievement gains during the 2022-2023 academic year lagged behind pre-pandemic trends such that the average student would require 4.5 months of additional schooling in math to catch up to pre-Covid achievement levels (Lewis & Kuhfeld, 2023). Full recovery, if it occurs, is likely several years away (Lewis & Kuhfeld, 2022, 2023) and this may be achievable only with a sustained, multi-year commitment to deploying and effectively implementing packages of interventions (including high-dosage tutoring, "double-dose" math, and summer programs) that have been shown to have the greatest impact on student achievement (Fahle et al., 2023; Lewis & Kuhfeld, 2023).

Research on the Efficacy of Tutoring Interventions

Recent research suggests that tutoring programs, which involve one-on-one or small-group instructional interventions, can have a significant positive impact on student learning outcomes (see Robinson, Kraft, Loeb, & Schueler, 2021). For example, a 2020 meta-analysis of 96 K-12 tutoring interventions in which students were randomly assigned to treatment or control conditions found consistent and positive effects on student learning outcomes as measured by standardized test scores (Nickow, Oreopoulos, & Quan, 2020).

On average, tutoring programs are estimated to result in an additional three to fifteen months of learning for students (Robinson et al., 2021). Although the precise mechanisms through which tutoring interventions contribute to learning are still being investigated, these interventions are often credited for providing students with additional, focused, and personalized instruction, as well as for introducing students to alternative pedagogical approaches (Nickow et al., 2020).

Among the tutoring programs that have shown positive outcomes for students are several supported by AmeriCorps, including Minnesota Math Corps, which provides math tutoring to struggling students in grades four through eight. End-of-year STAR Math tests showed that participants in Minnesota Math Corps scored 11.2 points higher on average compared to a control group. A higher percentage of participants also passed end-of-year benchmarks (AmeriCorps, 2019; see also Parker, Nelson, Zaslofsky, Kanive, Foegen, Kaiser, & Heisted, 2019). The Minnesota Reading Corps K-3 program, also supported by AmeriCorps, showed significantly higher literacy scores for kindergarten through 3rd grade participants compared to their peers. A randomized control trial study, completed by NORC, showed these positive impacts across at-risk student groups, including dual language learners and students who qualified for free and reduced lunch (NORC.Org, 2014).

Tutoring programs appear to be especially effective when tutors receive adequate training and support, when the number of students paired with each tutor is small, when the dosage is high, when instruction is aligned with classroom learning, and when program implementation is informed by ongoing formative and summative assessments (Nickow et al., 2020; Pellegrini, Neitzel, Lake, & Slavin, 2021). Outcomes also appear stronger when tutors are consistently paired with the same students so that strong mentor-like relationships can be built (Robinson et al., 2021).

Research on the Efficacy of Math Learning Software Interventions

There is growing evidence that technology-enabled instruction (Huebner & Burstein, 2023)[8] – including the use of math learning software -- can also contribute to positive achievement outcomes for students. These positive outcomes include heightened student engagement in the learning process, improved teacher-student interactions, enhanced higher-order problem solving techniques, and increased student math achievement (e.g., Cheung & Slavin, 2013; Hillmayr, Ziernwald, Reinhold, Hofer, & Reiss, 2020; Ma, Adesope, Nesbit, & Liu, 2014; Young, Gorumek, & Hamilton, 2018).

Math learning software appears to be especially effective when student software usage levels are high (e.g., Altermatt, Altermatt, Rorrer, & Moore, 2022; Owens, Rorrer, Ni, Onuma, Pecsok, & Moore, 2020; Su, Rorrer, Owens, Pecsok, Moore, & Ni, 2020) and when educators are provided with sufficient training and support to utilize educational technology with fidelity and to align technology use with other types of instruction (e.g., Altermatt, Rorrer, & Moore, 2022; Altermatt, Rorrer, Altermatt, Doane, & Timmer, 2023b; Sarker, Wu, Cao, Alam, & Li, 2019).

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[8] Technology-enabled instruction is an emerging concept that "encompasses not just whether technology is used in the classroom (technology integration) but also when and how teachers use technology in their instructional practices to improve learning outcomes" (Huebner & Burstein, 2023).

2 | Implementation Evaluation

Overview of Implementation Evaluation

In this section of the report, we provide an implementation evaluation of the AmeriCorps Math Mentors Program (AMMP) for Year 1 (2022-2023). The current report extends evaluation activities performed during the pilot year (2021-2022) and builds upon the work of the UEPC's Bridgeworks Team and Research & Evaluation Team during the pilot year to consult with AMMP staff to ensure that the program was designed in ways that align with evidence-based and practice-informed guidelines for tutoring and mentoring programs (Altermatt, Groth, & Rorrer, 2022). The UEPC's implementation evaluation efforts were guided by one key evaluation question:

> EQ1. To what degree is the AmeriCorps Math Mentors Program being implemented with fidelity and in ways that align with evidence-based and practice-informed guidelines?

To answer EQ2, the UEPC relied on three types of data: 1. program artifacts, 2. data from a mentor tracking sheet developed and administered by STEM Action Center personnel, and 3. data from mentor pre/post surveys developed and administered by the UEPC and completed by mentors. Importantly, interim reports from the mentor tracking sheet and mentor surveys were provided to STEM Action Center personnel throughout the academic year to support continuous improvement.

Summary of Strategic Plan

During the 2021-2022 pilot year, STEM Action Center personnel developed and refined a logic model and strategic plan for the AMMP. As shown in Figure 1, the program sought to recruit 22 AmeriCorps members annually to collectively provide 90 minutes of in-school math mentoring per week to 1,410 students in Grades 4 – 8 in schools or districts in Utah in which fewer than 60% of students are grade-level proficient in math.

Figure 1. Proposed AmeriCorps Math Mentor Program Participants

The AMMP is supported by a team of STEM Action Center personnel with expertise in STEM education, mathematics education, educational technology, youth development, and grants and fiscal management. The STEM Action Center AMMP team is responsible for all aspects of the program, including recruitment, onboarding, training, supervision, and support for mentors and participating school/district personnel.

Alignment with Evidence-Based and Practice-Informed Guidelines

The AmeriCorps Math Mentors Program, as designed, is well-aligned with recommendations for high-impact tutoring released by the National Student Support Accelerator (NSSA) in a recent policy brief (2023; see Figure 2).

Figure 2. Recommendations for high-impact tutoring from the National Student Support Accelerator

- **Tutoring should be embedded in existing schools either during the school day or immediately before or after the school day.** Embedded programs have a significantly higher likelihood of student attendance and reaching the students who need it most. School-based programs equalize access as all students are able to participate without additional cost for the students or transportation requirements. School-based programs do not require students to miss work or other activities outside of the school day.
- **Tutoring sessions should include a minimum of three sessions per week.** For tutoring approaches to be effective, students have to spend a substantial amount of time working with their tutor. While the amount of time per session needed for effectiveness will depend on the program's content area and student age, students should receive a minimum of three sessions per week.
- **Students should work with a consistent tutor who is supported by ongoing oversight and coaching.** The basis of effective tutoring is strong tutor-student relationships. Students should have a consistent tutor who is skilled at relationship-building. Tutors need initial training, oversight, ongoing coaching, and clear lines of accountability in order for the program to be effective.
- **Data should inform tutoring sessions.** Tutors should use data to understand students' strengths and needs, and should build their sessions to focus on the needs. Tutoring programs should use data to assess their effectiveness at improving student learning and should make adjustments based on these data.
- **Materials should be aligned with research and state standards.** The materials that tutors use with their students should be aligned with both state standards and research on teaching and learning and should be engaging for students and easy for tutors to use, given their training and experience. If classrooms are using high-quality materials, tutoring materials should build on those materials; if classroom materials are not high quality, tutoring materials should preference quality and standards-alignment over matching with classroom instruction.

Source: National Student Support Accelerator (March 2023)

For example, the program is designed to provide students with 90 minutes of in-school tutoring per week over several sessions per week, and mentors are encouraged to build strong relationships with students. Resources are in place to provide mentors with pre-service training, and processes are developing to allow both STEM Action Center staff and site supervisors to provide effective in-service training and support to mentors. A tracking sheet has been developed by STEM Action Center staff to monitor tutoring dosage for each participating student and to support mentor accountability. Mentors have opportunities to connect with classroom teachers and to utilize math learning software to understand students' strengths and needs and to support mentors' instruction. The UEPC administers "pulse" and "pre/post" surveys to both students and mentors and shares the findings with STEM Action Center personnel in interim and annual reports. The UEPC explores the effectiveness of the program in improving student learning outcomes with achievement data collected from participating LEAs for both students who receive tutoring and students who do not.

Progress Toward Key Strategic Plan Goals for Implementation

Specific goals for the AmeriCorps Math Mentors Program are outlined in logic model and strategic planning documents developed by STEM Action Center personnel during the pilot year of the program (2021-2022). Information from these documents is provided in the 2021-2022 evaluation report (Altermatt, Groth, & Rorrer, 2022).[9] Table 1 summarizes progress toward key goals related to 1) mentor recruitment and onboarding and 2) mentor training, supervision, and support. Future interim and annual reports will summarize progress toward other goals (e.g., ensuring that ~1,4000 students receive 90 minutes of tutoring in several individual or small group sessions per week with a consistent mentor) as processes continue to develop to effectively monitor and evaluate these goals.

Table 1. Progress toward program goals related to mentor recruitment and onboarding and mentor training, supervision, and support

Domain	Goal	Year 1 Progress
1. Recruitment and onboarding	STEM Action Center personnel will recruit and place 22 mentors	STEM Action Center personnel recruited and placed 26 mentors in seven LEAs, including three charter schools (The Center for Creativity, Innovation, and Discovery, Promontory School for Expeditionary Learning, and Gateway Academy) and four school districts (Garfield County, Granite, San Juan, and Weber). Twenty (20) of these mentors were hired before October 31, 2022. Eleven (11) mentors held half-time positions (900 total hours), and 15 mentors held quarter-time positions (450 total hours). STEM Action Center staff developed a "mentor tracking sheet" that allowed mentors to record their time with students. Mentor utilization of the tracking sheet was mixed in 2022-2023.

[9] https://daqy2hvnfszx3.cloudfront.net/wp-content/uploads/sites/2/2022/11/08162511/2022-AMMP-Report-FINAL.pdf

2. Training, Supervision, and Support	All mentors will complete pre-service training, including a "kick off" orientation session, Saga Coach training[10], and training with a math learning software provider.	Sixteen (16) mentors attended "kick-off" orientation and training sessions in August/Sept 2022. All mentors were offered Saga Coach training and an opportunity to attend a virtual AmeriCorps National Service Training event. Saga Coach training completion rates are unknown. However, a system is now in place in Google Classroom to track completion of each of the three Saga Coach training modules. No mentors attended a training session with a learning software provider; however, mentors were provided with links to online training opportunities. In addition, many mentors engaged with in-person, "hands on" training regarding the math learning software with their site supervisor. Thirteen (13) mentors completed an exit survey following the "kick-off" orientation session. No other exit surveys were completed.
	STEM Action Center will establish monthly training/collaboration sessions for mentors, with an attendance rate of 80% by Year 2.	In December 2022, STEM Action Center personnel established a SLACK channel to facilitate communications with and among mentors. Participation was mixed. Eighteen (18) mentors from across the state attended the in-person AmeriCorps member gathering in Provo, Utah in March 2022.
	Mentors will be assigned non-principal site supervisors and, by Year 2, 75% of mentors will meet with site supervisors weekly.	24 mentors were assigned non-principal site supervisors. The number of mentors who met weekly with site supervisors is unknown.

Successes in Implementation

The AmeriCorps Math Mentors Program had several important successes in 2022-2023 (Year 1) related to implementation. Among the successes related to mentor recruitment and onboarding and mentor training, supervision, and support are the following:

- STEM Action Center personnel recruited, onboarded, and placed 26 mentors in seven LEAs, including three charter schools and four school districts.
- STEM Action Center personnel provided pre-service training to 16 mentors in "kick-off" orientation and training sessions.
- STEM Action Center personnel developed a "mentor tracking sheet" that allowed mentors to record and program staff to monitor the amount of time that mentors spent with individual students or small groups of students and the nature of these interactions.

[10]https://static1.squarespace.com/static/5c44ea9771069967effbe11d/t/61438aabd4faa428d2f17729/1631816363729/Saga+Coach+Scope+%26+Sequence.pdf

- STEM Action Center personnel established a Slack channel to facilitate communications with and among mentors.

Areas for Improvement in Implementation

Several mentors utilized the mentor tracking sheet diligently and were thoroughly engaged with available training, supervision, and support opportunities (e.g., the Slack Channel). However, other mentors struggled to engage with these resources or had limited opportunities to do so given that they were recruited and onboarded relatively late in the academic year. Fidelity to program design, including training and development of mentors, is essential to leveraging the program for improved student success. Notably, STEM Action Center personnel are committed to continuous improvement in recruitment, onboarding, training, supervision, and support.

A key goal for 2022-2023 (Year 2) will be to continue to shore up processes for mentor recruitment and onboarding and mentor training, support, and supervision that will facilitate continued progress toward and a strong evaluation of strategic plan goals related to these and other program elements. Toward this end, STEM Action Center personnel have committed to carefully monitoring the mentor tracking sheet to ensure that mentors are routinely completing all fields (including # of minutes of tutoring at the student level) and that all mentors have access to and are engaging with both pre-service and in-service training, supervision, support, and evaluation opportunities, including by completing training exit surveys. A template for a pre-service training schedule that might be offered to mentors is provided in Appendix A.

3 | Outcome Evaluation for Mentors

Overview of Outcome Evaluation for Mentors

In this section of the report, we provide an evaluation of the impact of the AmeriCorps Math Mentors Program (AMMP) on mentors. The UEPC's implementation evaluation efforts were guided by one key evaluation question:

> EQ2. Is participation in the AMMP associated with positive changes in mentors' tutoring and relational self-efficacy?

To answer EQ2, the UEPC relied on three types of data: 1. data from mentor training exit surveys developed and administered by the UEPC, 2. data from a mentor tracking sheet developed and administered by STEM Action Center personnel, and 3. data from mentor pre/post surveys developed and administered by the UEPC and completed by mentors. Importantly, interim reports from each of these data sources were provided to STEM Action Center personnel throughout the academic year to support continuous improvement.

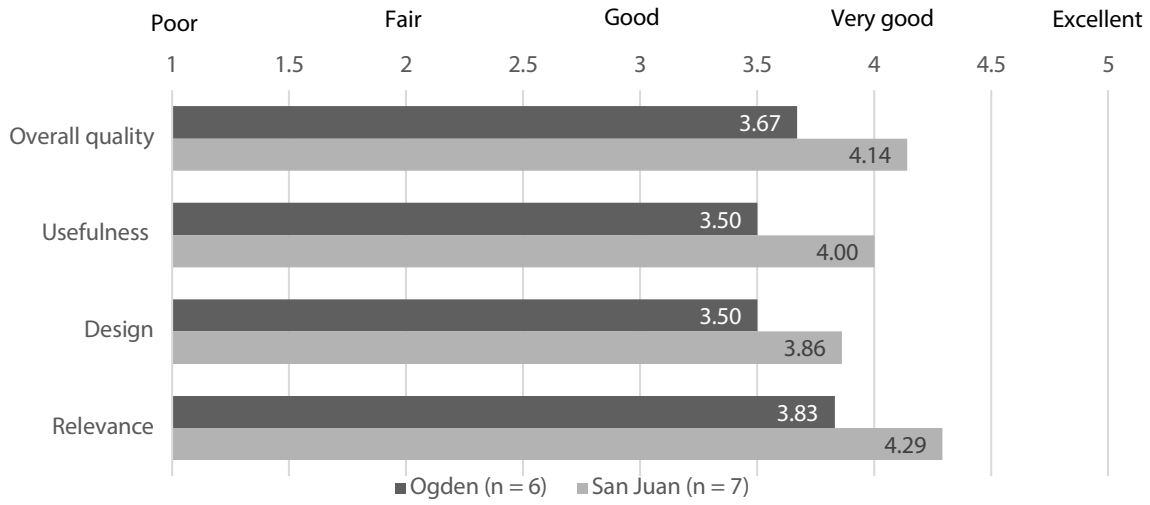
3.1 Evidence from Mentor Training Exit Surveys

On August 9, 2022 and September 12, 2022, the STEM Action Center offered "kick-off" orientation and training sessions for mentors. The first session was held in Ogden, Utah. Seven mentors attended. Six completed a training exit survey. This represents an 86% response rate. The second session was held in San Juan, Utah. Nine mentors attended. Of these, seven completed a training exit survey. This represents a 78% response rate.

Ratings

Survey respondents were asked to provide ratings for four items assessing their perceptions of the quality, usefulness, design, and relevance of the training. Respondents rated all four items on scales that ranged from 1 ("poor") to 5 ("excellent"). Mean ratings are provided in Figure 3.

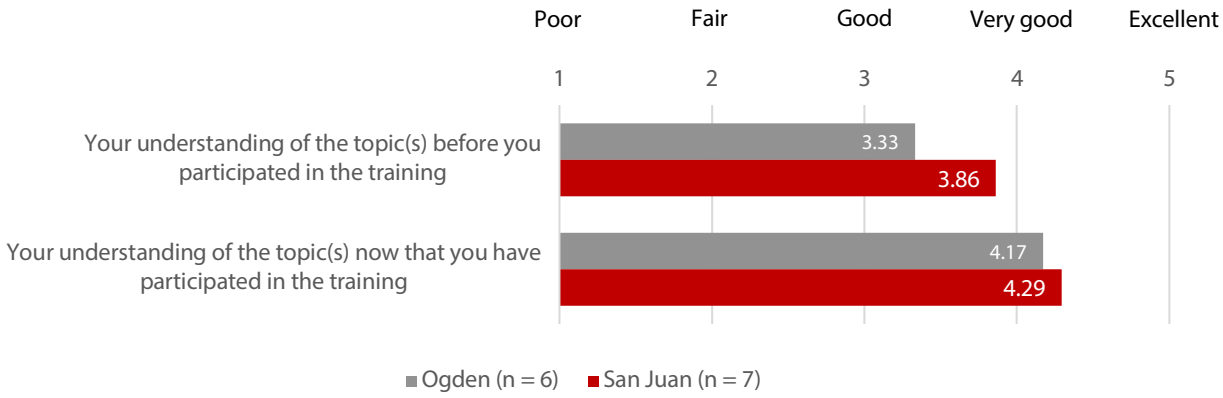
Figure 3. Mean ratings of training session



As shown in Figure 3, respondents' ratings ranged from 3.50 to 4.29 on the five-point scale; that is, above the scale midpoint, between "good" and "excellent." Ratings for the later session (i.e., in September in San Juan) were higher than ratings for the earlier session (i.e., in August in Ogden).

Survey respondents were also asked to provide ratings for two items assessing their understanding of topics before and after participating in the training. Respondents again rated the items on scales that ranged from 1 ("poor") to 5 ("excellent"). Mean ratings are provided in Figure 4. As shown in Figure 4, respondents' ratings of their understanding reflected gains from before training (average ratings = 3.33 and 4.17 for Ogden and San Juan, respectively) to after training (average ratings = 3.86 and 4.29 for Ogden and San Juan, respectively). Results of a dependent *t*-test[11] indicate that these gains are statistically significant, $t(12) = 2.89$, $p < .05$.[12]

Figure 4. Mean ratings of understanding before and after training



Open-ended responses

Survey respondents were also given an opportunity to reflect on their training experiences by answering two open-ended questions tapping their perceptions of valuable aspects of the training and ways in which the training might be improved. Representative verbatim responses are reported here.

What aspect(s) of this training did you find most valuable in supporting the work you will do as a mentor in the AmeriCorps Math Mentors Program?

- "The group work. It allowed me to get to know the other mentors in my field."
- "I thought the specific situations and scenarios provided as examples by speakers and attendees were helpful for understanding the application of concepts."
- "An in-depth training about fixed and growth mindset and how it can help with supporting students. "
- "Learning more about the tracking sheet, and how our time sheets work."
- "The part I found the most help was the mindset parts of the PowerPoint."

[11] A dependent *t*-test, or paired sample *t*-test, is used to determine whether the mean difference between two sets of observations (here, "before" and "after" ratings) is zero.

[12] A statistically significant result is one that is unlikely to occur by chance. When *p* values are less than .05, there is less than a 5% chance of finding a difference this large or larger if the null hypothesis is true. Here, the null hypothesis is that there are no differences in "before" and "after" ratings. When *p* values are greater than .05, this chance is greater than 5% which is traditionally considered unacceptable for rejecting the null hypothesis.

How might this training be improved to better support the work you will do as a mentor in the AmeriCorps Math Mentors Program?

- "I was not so much a fan of the "to know you" games."
- "A little bit faster pace/not as many personal stories."
- "The training was great and a way for it to possibly improve is to integrate similar stuff into future trainings. Because having a growth mindset is a huge support in itself."

Overall, findings from the training exit survey were positive. At the same time, findings from the survey offer insights that may be valuable as AMMP staff plan for training opportunities in Year 2. Specifically, mentors indicated that they found value in training that 1) provided opportunities for mentors to discuss their experiences with other mentors and with program staff, 2) offered specific scenarios and examples to consider or discuss, and 3) was immediately relevant to their work (e.g., by providing opportunities to learn about and reflect on growth mindsets).

3.2 Evidence from Mentor Tracking Sheet

Beginning in September 2022, mentors were asked to track their mentoring sessions by completing a Google Form following each session. On this form, mentors were given an opportunity to record the length and participants for each session and to provide a written description of the session, including successes and challenges. The UEPC summarized key findings from written descriptions and shared these with STEM Action Center at least monthly to support continuous improvement.

Across the academic year, four key findings emerged from the mentor tracking sheet data:

1. As a group, mentors demonstrated a commitment to helping students improve their confidence and skill in mathematics and a willingness to experiment with different strategies to meet students' needs. For example:

    - *"[We] worked with multiplication. [He] didn't want to participate at the beginning, had his head down and wouldn't respond. I got him to participate by letting him quiz me at the start. I would purposely miss ones I knew he has a hard time with so that we reviewed them multiple times. Got him excited and then was able to have him answer the questions."*
    - *"We moved her from groups to one on ones on Wednesday. She was not thriving in groups because of another girl. So today we met one on one and it was night and day difference. She was excited to be here …. Worked on counting backwards from 100, before I have zero participation from her making me think she might not understand the topic. Well today she wanted to do it and did AMAZING. So I feel confident moving to the next intervention with her and feel like these one on ones will be best for her."*

2. As a group, mentors demonstrated a commitment to building strong mentoring relationships with students and an understanding of the importance of these relationships in helping students improve their confidence and skills in mathematics. For example:

    - *"These kids weren't too sure about me. So, we just sat and talked about ourselves for a bit. I talked to them about how I really struggled in math as a child and would have benefited from someone sitting and working with me. They seemed to like hearing about that. We talked about how our brain learns math in so many different ways and how we were excited to unlock how our brain learns it. When they left they felt a little better thankfully."*

- *"We didn't get a ton of math done today, but we did talk with each other and laughed a lot! I felt it was important today to be more of a mentor than a tutor. It helps the kids not think of me as only the person who makes them do math quietly. We talked about different animals, and siblings, and I even explained retirement and how taxes and 401ks help save for it. Not sure if they understood, but I'm glad we can take about real-life stuff too."*

3. Mentors shared a variety of challenges in providing mentoring to students. Sometimes these challenges involved characteristics of the students (e.g., behavior, confidence, or personal issues), and sometimes these challenges involved gaps in mentors' content knowledge.

    - *"Did not go well. They were not on task. [Student] kept giving me wrong answers on purpose to be 'funny.' When I tried asking for how they got the answers [student] would just say "big brain" repeatedly."*
    - *"The session did not go well today. [Students] mostly stared at their screens. If I stood behind them and constantly watched, they did a problem. But they were all procrastinating and [Student 1] was distracting. [Student 2] did pretty well and we worked through a few problems. He worked harder than the others and didn't get very distracted."*
    - *"These guys really need help in confidence building. We talked a lot about … how to say how you need help."*
    - *"[Student 3] this year has been working so hard on focus, some days he is SUPER focused others not so much. I've been informed it's something medical so the days that he is really focused we try to get what we can done, and on other days we do our best and give him some grace. He's a sweet kid, really loves to work standing up, I do provide alternative seating options for all of my kids. But [Student 3] is a good dude, and it's been great working with him."*
    - *"We worked after school until 6pm. Honestly, I haven't done Quadratic Functions in so many years I needed a refresh and [student] took a chance on my tutoring. At some points even he was teaching me whether a linear function was a shrink or stretch."*
    - *"[Student] asked for help and I struggled along with her. It was confusing because we did the math right, but we hadn't quite read the questions properly. Even she had tried solving a different way. We eventually figured it out in the end, we didn't quite have our negatives in the right spot."*

4. Several mentors shared compelling success stories.

    - *"We are working on our i-ready Diagnostic and these two have now completed it. [Student] has shown 15 points of growth which means that all of her domains in the program have shifted up a few grade levels. She was so proud when we did a little data chat comparing the two tests. [Student] also has shown growth of 10 points, this has shifted his domains up a grade level. When we did our data chat he was really proud of himself and got a little emotional. We had a moment to celebrate his success. I'm very proud of them and they are proud of themselves too."*
    - *"[Student 1] asked me for help today when he was stuck!! I was very excited and proud of him. He's still working on his number blocks, but I think he's understanding better. He can do more by himself before I help than he could before. [Student 2] and I also worked together and she stayed on task a little better today without my help. She still gets distracted, but she tries."*
    - *"[Student] is so sweet, she loves coming to my groups. We do alot of review work so I ask her what she would like to work on today and she normally gives me a topic she is struggling on. She LOVES a challenge which is fantastic. She is very helpful with friends when we do group work. Listening to her explain a process and really be a student mentor is so nice. She's great."*

- *"[The student] has a hard time with confidence and has some pretty bad anxiety around school and math. She's been awesome to work with though and I can tell her confidence is growing. She does have a hard time on test days but her teacher, myself, and other support staff have come up with a game plan to help her. She was the only student I had where the teacher asked me to come sit in for parent teacher conferences. So that was nice being able to sit with her mom and talk about what math we have been working on and how much growth we have seen."*

Conclusions

Overall, findings from the mentor tracking sheet speak to a cohort of mentors that are dedicated, thoughtful, and engaged. Findings also indicated that mentors may benefit from weekly training/support opportunities that would allow STEM Action Center staff to clarify expectations for mentors, site supervisors, and classroom teachers and that would allow mentors to a) share their successes, b) brainstorm with colleagues and STEM Action Center staff about how to approach challenges, and c) gain additional knowledge about how to improve their tutoring and mentoring skills. The National Student Support Accelerators (NSSA) offers a number of resources that may be helpful here including recommendations related to structuring effective tutoring sessions. A summary of these recommendations is provided in Appendix B.

3.3 Evidence from Mentor Pre/Post Surveys

Mentors were asked to complete pre- (i.e., beginning-of-yar and post- (i.e., end-of-year) surveys designed to assess their **tutoring self-efficacy** (i.e., to support students in their math learning) and their **relational self-efficacy** (i.e., to build strong relationships with students). Findings from the pre-survey were provided to STEM Action Center personnel in an interim report. Here, we focus on post-survey responses to gauge mentors' self-efficacy at the end of the 2022-2023 academic year. The post-survey was completed by 17 mentors. This represents a 65% response rate. Importantly, apples-to-apples comparisons of pre-survey and post-survey ratings cannot be made as the sample of respondents differed from pre-survey (n = 13) to post-survey (n = 17).[13]

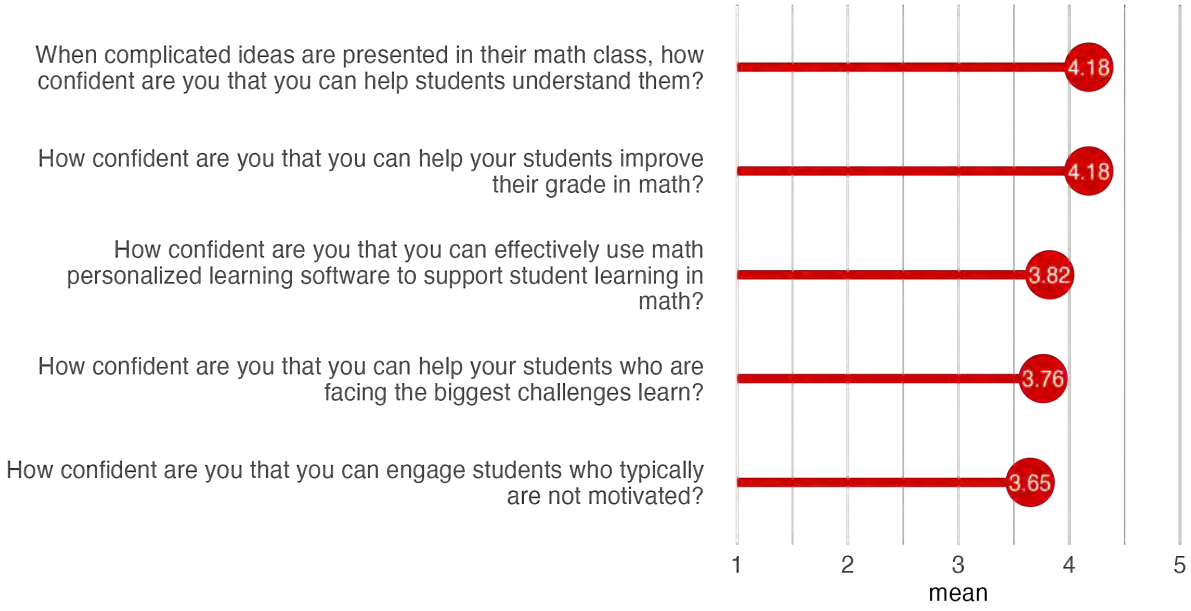
Tutoring Self-Efficacy

Survey respondents were asked to provide ratings for five items assessing their self-efficacy in tutoring students in mathematics. Respondents rated all five items on scales that ranged from 1 ("not confident at all") to 5 ("extremely confident"). Mean self-efficacy ratings are provided in Figure 5.

As shown, mentors' post-survey tutoring self-efficacy ratings ranged from 3.65 to 4.18, indicating that mentors ended the academic year with moderate to high levels of confidence in their ability to effectively tutor students in math. Importantly, pre-survey ratings were also relatively high (here, ratings ranged from 3.38 to 4.00), but pre-survey ratings were always lower than post-survey ratings. At post-survey, mentors were, as a group, especially confident in their ability to explain complicated ideas and help students improve their grades in math. For these items, more than 80% of mentors indicated they were "quite confident" or "extremely confident" in their abilities.

[13] Only five mentors completed both the pre-survey and the post-survey. For this group, ratings were higher on the post-survey than on the pre-survey for all five tutoring self-efficacy items and five of the eight mentoring self-efficacy items. These differences were not statistically significant, likely due, in part, to the small sample size.

Figure 5. Mean ratings on items assessing tutoring self-efficacy



Mentors' reasons for their lower ratings for items tapping confidence in helping students who face challenges and/or who are not typically motivated were captured in their responses to an open-ended item asking them to explain their responses. For example:

- *"I am confident in my ability to teach students math, but I still have room to improve. It is hard for me to help students when outside personal problems such as sleep deprivation and emotional stress impact their ability to learn. I want to be as receptive and helpful as possible when they come to school with challenges like that, but I feel that it is hard to do that while also expecting them to learn new things."*
- *"Students with the "biggest challenges" must trust who they work with, but also have resources outside of schools to get their needs met. It is a complicated situation and is difficult to judge the difference made with students that refuse to engage in work."*
- *"Sometimes it is difficult to help certain students who are not motivated or have a difficult time concentrating on the subject begin taught."*

In additional open-ended items, asking mentors to indicate how AAMP might be improved to increase their confidence in supporting students' math learning, several mentors indicated that the pre-service training and in-service training and support they received were valuable.

- *"I felt like I was prepared as I could be before I started. Nothing helps more that hands on experience."*
- *"The yearly AmeriCorps conference! It opened me up to how much of a difference we make."*
- *"Saga Training! And doing practice in MathSpace to see how the program wants them to solve it. :)"*

At the same time, several mentors noted that additional training and support would have been helpful to boost their tutoring self-efficacy.

- *"I would [have] liked beginning of year in school training to show what my day would kind of look like."*
- *"I feel like I've gained the most experience just by being in the classroom, working with the kids, and seeing*

how their teachers teach various math topics. I find that I prefer to sit with groups while the teacher is teaching a math lesson before I go off to help them individually because I can refer back to what they had learned earlier in class. I have only been able to do this for one grade, but I know that doing so in other grades would help both myself and the students I work with."

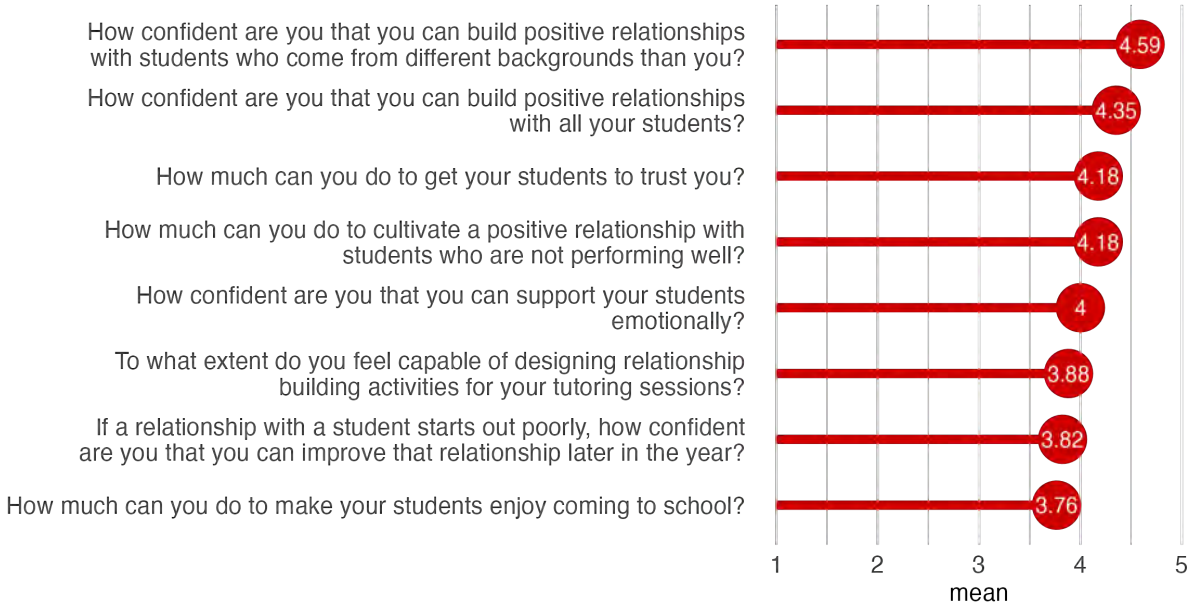
- *"I don't feel I have a great understanding of the issues some of the most difficult students are facing and what research says are the best strategies as a teacher. Further, I don't have insight into what students are dealing with outside the classroom that may affect their behavior and attitude in the classroom."*
- *"I think just trainings in general would have helped."*
- *"Not only math training but to have ideas for children who struggle with learning disabilities, maybe ideas to help teach them."*

Relational Self-Efficacy

Survey respondents were also asked to provide ratings for eight items assessing their self-efficacy in developing strong relationships with students. Respondents rated items on scales that ranged from 1 ("not confident/capable at all" or "almost nothing") to 5 ("extremely confident/capable" or "a great deal"). Mean ratings are provided in Figure 6.

As shown in Figure 6, mentors' post-survey relational self-efficacy ratings ranged from 3.76 to 4.59 on five-point scales indicating that mentors ended the academic year with moderate to high levels of confidence in their ability to build strong relationships with students. Importantly, pre-survey ratings were also relatively high (here, ratings ranged from 3.23 to 4.08), but pre-survey ratings were generally lower than post-survey ratings. At post-survey, mentors were, as a group, especially confident in their ability to build positive relationships with students from different backgrounds. For this item, more than 94% of mentors indicated that they were "quite confident" or "extremely confident" in their abilities.

Figure 6. Mean ratings on items assessing relational self-efficacy



In open-ended responses, mentors commented on the importance of taking the time to build relationships with students. For example:

- *"I took time during the year for extra activities that were fun and allowed me to get to know the kids away from math. So when we did do math it was easy to motivate them and get them excited. Doing those extra things really helped build relationships with my students."*
- *"There were quite a number of students I didn't have good relationships with at the beginning of the year, but now we get along great and I have been able to work with them very well."*

Again, mentors indicated that additional training and support focused on how to build strong relationships with students facing challenges would have been helpful. For example:

- *"[I would like to know more about] how to talk to students about difficult situations they may be having a hard time with. This year I had a lot of kids come to me with problems they were experiencing here at school and at home, and would have to refer them to our counselor. Which I would of always done anyway but knowing what to say so they know I hear them and am here for them would of been helpful. Also knowing what resources I could bring into the school for families in need."*

Conclusions

Overall, findings from the mentor post-survey indicate that mentors ended the academic year feeling moderately to highly confident in their abilities to tutor and build strong relationships with students, with confidence varying considerably by domain. Although strong, direct comparisons of pre-survey and post-survey ratings are not possible as only five mentors completed both the pre-survey and the post-survey, the pattern of findings indicates that mentors, as a group, were more confident at the end of the academic year than at the beginning of the academic year.

Successes in Outcomes for Mentors

The AmeriCorps Math Mentors Program had several important successes in 2022-2023 (Year 1) related to increases in mentors' self-efficacy in tutoring and developing strong relationships with students. For example:

- Mentors who completed training exit surveys reported that the "kick-off" orientation and training sessions were of high-quality and helpful in improving their knowledge, including about the importance of growth mindsets.
- Mentors who completed end-of-year surveys reported moderate to high levels of confidence in their ability to tutor and build strong mentoring relationships with students. End-of-year tutoring and mentoring self-efficacy ratings were generally higher than beginning-of-year tutoring and mentoring self-efficacy ratings.

Areas for Improvement in Outcomes for Mentors

Data from exit surveys, a mentor tracking sheet, and pre/post surveys indicated that mentors would benefit from additional pre-service and in-service training/support opportunities that would allow them to gain additional "just in time" knowledge about how to improve their tutoring and mentoring skills, share their successes, and brainstorm with other mentors, site supervisors, classroom teachers, and STEM Action Center staff about how to approach challenges. Weekly mentor meetings will be especially important in allowing mentors to reflect on their training experiences, program staff to gain ongoing "real time" feedback on perceived training and support needs, and program staff to

identify opportunities for future training and support, including opportunities for mentors to connect more effectively with classroom teachers or site supervisors, understand their responsibilities and limits on their responsibilities for addressing students' personal challenges, and to align tutoring with classroom instruction. Some of these issues are addressed in Saga Coach training modules as outlined in Appendix A. Others may require additional resources, including resources provided by LEAs (e.g., district-level professional learning opportunities) or the National Student Support Accelerator (NSSA).

4 | Outcome Evaluation for Students

Overview of Outcome Evaluation for Students

In this section of the report, we provide an evaluation of the impact of the AmeriCorps Math Mentors Program (AMMP) on students. The UEPC's evaluation was guided by two questions:

> EQ3. Is participation in the AMMP associated with positive changes in students' mathematics attitudes?
> EQ4. Is participation in the AMMP associated with positive changes in students' mathematics achievement?

To answer EQ3 and EQ4, the UEPC relied on three types of data: 1. data from retrospective pre/post surveys developed by the UEPC and administered to students by mentors, 2. data from a mentor tracking sheet developed by the UEPC, administered by the STEM Action Center, and completed by mentors to track tutoring dosage (e.g., # of minutes of tutoring), and 3. student achievement and demographic data provided to the UEPC by participating LEAs and the USBE.

4.1 Attitudinal Outcomes

Students were asked to complete a retrospective pre/post survey designed to assess changes in their math self-efficacy, self-perceptions of effort, valuing of math, and perceptions of belongingness from the beginning of the year (BOY; that is, before their involvement in the AMMP) to the end of the year (EOY; that is, after their involvement in the AMMP). Importantly, interim reports from student surveys were provided to AMMP staff throughout the year to support continuous improvement. From April to May 2023, 124 3rd – 8th grade students completed the survey. Table 2 provides the distribution of respondents by LEA. Two students did not provide information on their LEA.

Table 2. Number of respondents by LEA

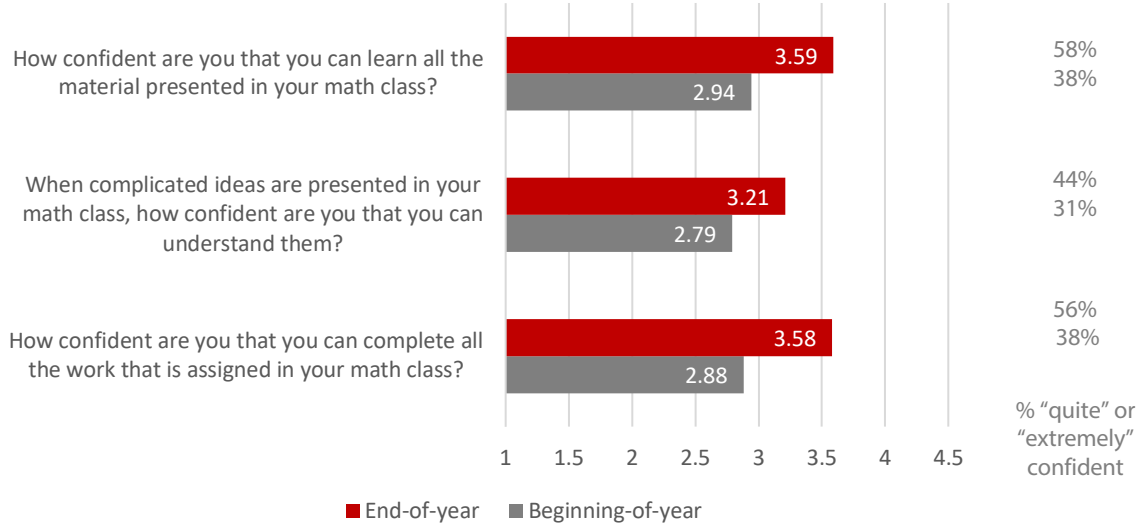
Charter Schools	number
Promontory School of Expeditionary Learning	8
Gateway Preparatory Academy	54
Garfield School District	
Bryce Valley Elementary School	12
Granite School District	
Lincoln Elementary School	8
Roosevelt Continuation School	3
Western Hills Elementary School	--
San Juan School District	
Blanding Elementary School	--
Bluff Elementary School	20
Tse'Bii'Nidzisgai Elementary School	--
Whitehorse High School	--
Weber	
Riverdale Elementary School	17

Math Self-Efficacy

Students were asked to provide ratings for three items assessing their math self-efficacy. Respondents rated all three items on a scale that ranged from 1 ("not confident at all") to 5 ("extremely confident"). Mean self-efficacy ratings are provided in Figure 7.

As shown in Figure 7, students' BOY ratings of their math self-efficacy ranged from 2.88 to 2.94 while their EOY ratings of their math self-efficacy ranged from 3.21 to 3.59. Results of dependent *t*-tests indicated that these were statistically significant gains, *t*s > 3.34, *p*s < .001, reflecting up to a 20-percentage point increase from BOY to EOY in the percentage of students who indicated that they were "quite confident" or "extremely confident" in their ability to do well in math. Effect sizes ranged from *d* = .30 to .54. According to Kraft (2020), these represent "large" effects compared to other educational interventions.[14]

Figure 7. Mean ratings on items assessing math self-efficacy



Note. Sample sizes for these items ranged from 121 to 122.

Self-Perceptions of Effort

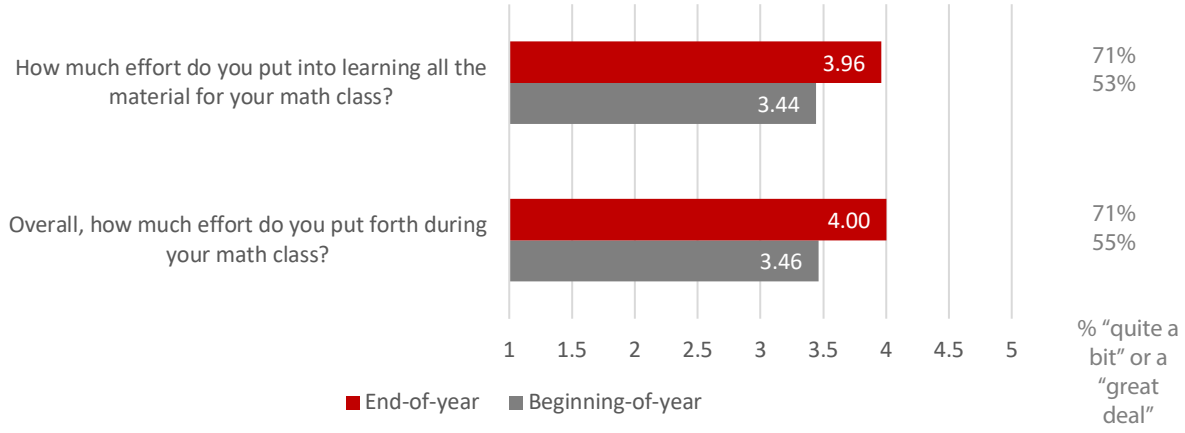
Students were asked to provide ratings for two items assessing their self-perceptions of effort in math. Respondents rated both items on scales that ranged from 1 ("almost no effort") to 5 ("a great deal of effort"). Mean effort ratings are provided in Figure 8.

As shown in Figure 8, students' BOY ratings of effort in math ranged from 3.44 to 3.46, while their EOY ratings of effort in math ranged from 3.96 to 4.00. Results of dependent *t*-tests indicated that these were statistically significant gains, *t*s > 4.85, *p*s < .001, reflecting up to an 18-percentage point

[14] Kraft (2020) proposes that, for educational interventions, an effect size less than 0.05 is small, 0.05 to less than 0.20 is medium, and 0.20 or greater is large. These proposed benchmarks are based on the distribution of 1,942 effect sizes from 747 Randomized Control Trials (RCTs) evaluating education interventions with standardized test outcomes. Caution should be taken in applying these benchmarks – or any other benchmarks – to the current analyses as debate about the most appropriate interpretation of effect sizes is ongoing (see Bakker, Cai, English, Kaiser, Mesa, & Van Dooren, 2019).

increase from BOY to EOY in the percentage of students who agreed with each item. Effect sizes ranged from d = .45 to .47. According to Kraft (2020), these represent "large" effects compared to other educational interventions.

Figure 8. Mean ratings on items assessing self-perceptions of effort

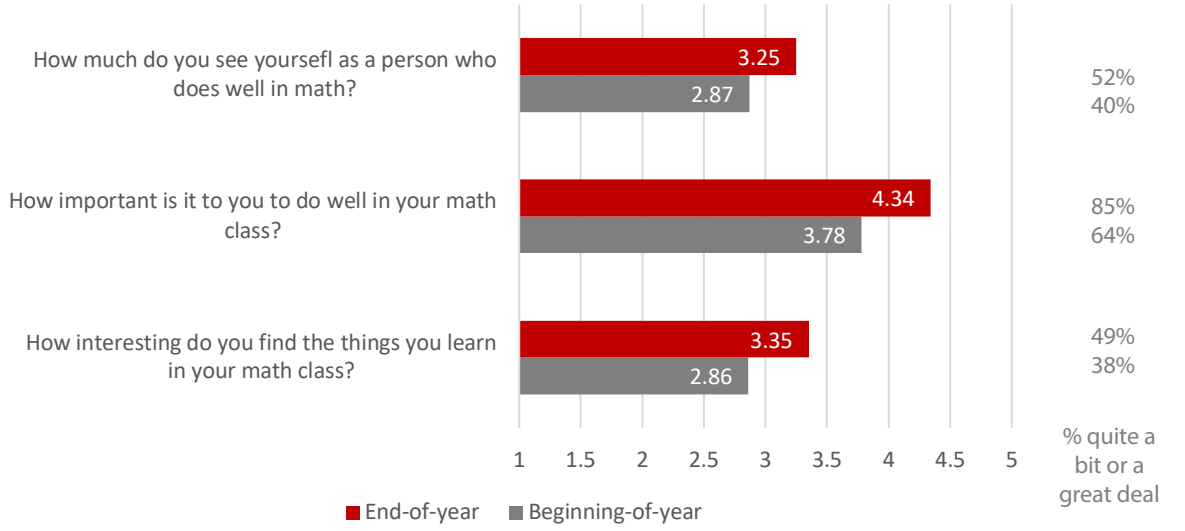


Note. Sample sizes for these items ranged from 119 to 120.

Interest in and Valuing of math

Students were asked to provide ratings for three items assessing their interest in and valuing of math. Respondents rated all three items scales that ranged from 1 (e.g., "not at all") to 5 (e.g., "a great deal"). Mean value ratings are provided in Figure 9.

Figure 9. Mean ratings on items assessing valuing of math



Note. Sample sizes for these items ranged from 117 to 120.

As shown in Figure 9, students' BOY ratings of their math interest in and valuing of math ranged from 2.86 to 3.78 while their EOY ratings of their math self-efficacy ranged from 3.25 to 4.34. Results

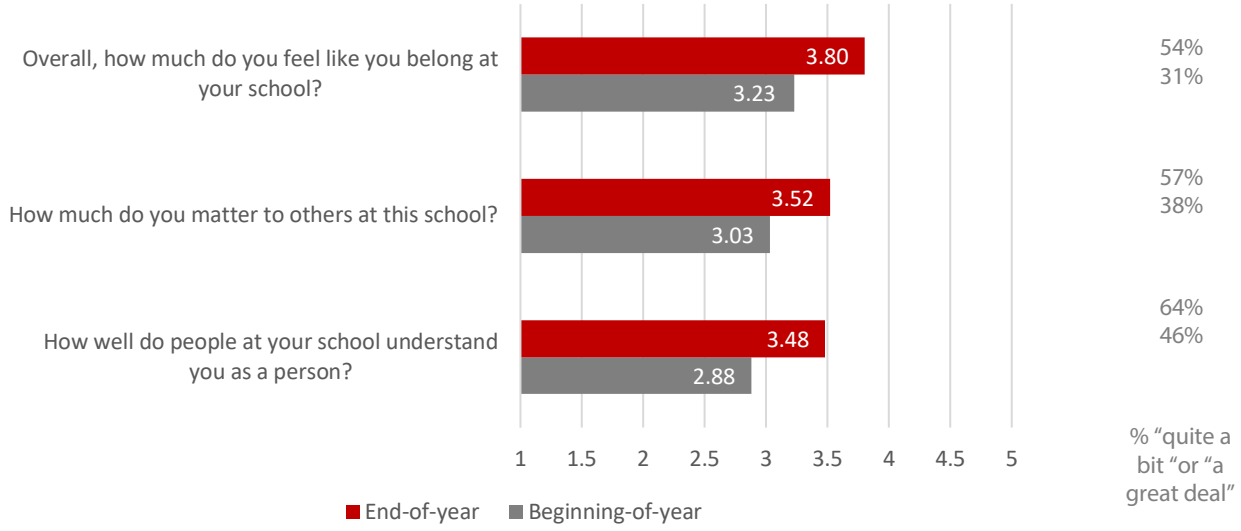
of dependent *t*-tests indicated that these were statistically significant gains, *t*s > 3.16, *p*s < .001, reflecting up to a 21-percentage point increase from BOY to EOY in the percentage of students who agreed with each item. Effect sizes ranged from *d* = .29 to .46. According to Kraft (2020), these represent "large" effects compared to other educational interventions.

Perceptions of Belongingness

Students were asked to provide ratings for three items assessing their perceptions of belongingness. Respondents rated all three items scales that ranged from 1 (e.g., "not at all") to 5 (e.g., "a great deal"). Mean belongingness ratings are provided in Figure 10.

As shown, students' BOY ratings of belongingness ranged from 2.88 to 3.23, while their EOY ratings of their belongingness ranged from 3.48 to 3.80. Results of dependent *t*-tests indicated that these were statistically significant gains, *t*s > 4.00, *p*s < .001, reflecting up to a 23-percentage point increase from BOY to EOY in the percentage of students who agreed with each item. Effect sizes ranged from *d* = .37 to .47. According to Kraft (2020), these represent "large" effects compared to other educational interventions.

Figure 10. Mean ratings on items assessing perceptions of belongingness



Note. Sample sizes for these items ranged from 119 to 120.

Conclusions

Findings from the retrospective pre/post survey indicate that respondents showed statistically significant increases in levels of math self-efficacy, perceptions of effort in math, valuing of math, and feelings of belongingness from beginning-of-year to end-of-year. Effect sizes were large in magnitude compared to effect sizes for other educational interventions (Kraft, 2020). These findings are potentially important given evidence that math attitudes generally decline from childhood into adolescence (e.g., Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007).

The findings should be interpreted cautiously given that no (or few) students at several mentoring sites completed the survey. As a result, it is unclear to what degree findings are generalizable to the population of students who received mentoring as part of the AMMP program. In addition, while retrospective pre/post surveys have many benefits – including reducing survey fatigue for

respondents and allowing evaluators to analyze paired data even when responses are anonymous – this approach, like other self-report methods, is susceptible to social desirability biases and is dependent on students' being able to accurately recall their beginning-of-year attitudes.[15]

4.2 Achievement Outcomes

The UEPC used linear regression analyses to compare end-of-year math achievement outcomes of students who received tutoring through the AmeriCorps Math Mentors Program (AMMP) with students who did not receive tutoring for each of the four participating LEAs who provided academic and demographic data for analysis by August 1, 2023. Specifically, regression analyses were used to predict end-of-year Acadience Math scores and/or RISE math scores across three groups: 1. students who received tutoring above the median level of tutoring for that LEA ("high" levels of tutoring), 2. students who received tutoring below the median level of tutoring for that LEA ("low" levels of tutoring), and 3. students who did not receive tutoring at that LEA (no tutoring).

All analyses controlled for prior math achievement outcomes (as measured by beginning-of-year Acadience Math scores or 2022 RISE math scores) and student demographic characteristics (e.g., race/ethnicity). All contrasts are reported as **effect sizes** – that is, as the standardized mean difference between groups.[16] This approach is consistent with ESSA Tier 3 standards for "Promising Evidence" which requires "a well-designed and implemented correlational study [with] statistical controls."[17]

Summary of Findings

A summary of findings related to students' achievement outcomes is provided in Table 3. In interpreting these findings, it is important to keep in mind that dosage data was frequently unavailable and the median level of tutoring that distinguished "high" and "low" groups ranged from just 60 minutes to 180 minutes, both well below what might be considered "high dosage" tutoring.

Table 3. Summary of Findings Related to Achievement Outcomes

LEA	# of mentors reporting	# of students served	Median # of minutes of tutoring/student	Effect Sizes for Acadience Scores		Effect Sizes for RISE Scores	
				"High" v. None	"Low" v. None	"High" v. None	"Low" v. None
1	1	71	180	.64	.04	-.33	-.03
2	1	27	75	-.39	-.29	.25	.58
3	1	18	60	--	--	-1.20	-.58
4	1	79	60	-1.92***	-1.20	-.69	.05

*** $p < .001$.

[15] https://fyi.extension.wisc.edu/programdevelopment/files/2021/12/RetrospectivePost-then-Pre.pdf

[16] Kraft (2020) proposes that an effect size less than 0.05 is small, 0.05 to less than 0.20 is medium, and 0.20 or greater is large. These proposed benchmarks are based on the distribution of 1,942 effect sizes from 747 Randomized Control Trials (RCTs) evaluating education interventions with standardized test outcomes. Caution should be taken in applying these benchmarks – or any other benchmarks – as debate about the most appropriate interpretation of effect sizes is ongoing (see Bakker, Cai, English, Kaiser, Mesa, & Van Dooren, 2019).

[17] https://ies.ed.gov/ncee/edlabs/regions/midwest/pdf/blogs/RELMW-ESSA-Tiers-Video-Handout-508.pdf

Only one effect size was statistically significant. The negative sign indicates that, with control variables included in the model, students who received relatively high levels of tutoring at this LEA had scores that were lower than a comparison group of students who did not receive tutoring. This result – and all results – should be interpreted cautiously given missing data and small sample sizes. A full set of results was provided to STEM Action Center personnel in an addendum to this report.

Successes in Student Outcomes

The AmeriCorps Math Mentors Program had important successes in 2022-2023 (Year 1) related to student outcomes. Most notably:

- The sample of students who completed the retrospective pre/post survey reported statistically significant increases in their endorsement of attitudes and behaviors associated with positive achievement outcomes (e.g., Korpershoek et al., 2020; McLeod, 1994). These include high levels of math self-efficacy, strong perceptions of effort in math, high valuing of math, and strong feelings of belongingness. Effect sizes were large in magnitude compared to effect sizes for other educational interventions (Kraft, 2020).

Areas for Improvement in Student Outcomes

With the available data, the UEPC failed to find evidence that the AmeriCorps Math Mentors program had a significant, positive impact on student achievement outcomes in the four LEAs for which data were available. These results should be interpreted with caution for at least two reasons. First, many mentors did not complete or were inconsistent in their completion of a tracking sheet designed to document the number of students served by the program and the number of hours of tutoring that each student received. Incomplete records introduce errors into models and result in small sample sizes. Second, very few students appeared to have received "high dosage" tutoring, typically defined as three sessions per week at 30 to 60 minutes per session (Robinson et a., 2021). For example, across the four LEAs that were the focus of analyses, only 14 students received 450 minutes or more of individual or small-group tutoring. This is equivalent to 90 minutes of tutoring per week for five weeks. All these students were enrolled in a single LEA. Based on prior research (see Nickow et al., 2020), it is expected that the effectiveness of the tutoring intervention will improve as per-student dosage increases. STEM Action Center personnel have committed to ensuring that mentors understand the importance of regularly and accurately completing the mentor tracking sheet and to ensuring that mentors have the training and support needed to make appropriate modifications to their caseloads to ensure that participating students receive the intended 90 minutes of tutoring per week.

4 | Recommendations

The UEPC offers the following recommendations for sustaining and strengthening the AmeriCorps Math Mentors Program. Importantly, these recommendations are aligned with the extant literature on design principles for high-dosage, high-impact tutoring programs (e.g., Nickow et al., 2020; Pellegrini et al., 2021; Robinson et al., 2021) that have shown promise in addressing historic and pandemic-related underperformance in math (e.g., Fahle et al., 2023). Recommendations should be evaluated by STEM Action Center personnel in light of local constraints, including constraints associated with recruiting and thoroughly training mentors and establishing strong and informed partnerships with participating schools.

Ensure that all participating students are receiving "high-dosage" tutoring.

There is growing evidence that tutoring can have "impressive effects" on learning among K-12 students (Nickow et al., 2020). However, the effects of tutoring vary considerably by program characteristics. Resources from the National Student Support Accelerator (NSSA) indicate that tutoring appears to be most effective when it is conducted one-on-one or in small groups and when it occurs for at least three sessions per week at 30 to 60 minutes per session (Robinson et al., 2021). Smaller student:tutor ratios – of no more than three students for every tutor – are often recommended, especially when tutors are not experienced classroom teachers or master tutors (NSSA, 2021).[18] Smaller ratios are also recommended when tutoring requires strong content knowledge and when program goals include building strong mentor-like relationships between tutors and students (Robinson et al., 2021).

As currently designed, the AmeriCorps Math Mentors Program can provide mentoring to 1,410 students for 90 minutes per week with a student:mentor ratio across sessions of 4:1 (see Appendix C for details). Although mentor tracking sheet data should be interpreted cautiously in this study given mixed engagement with the tracking sheet across mentors, available evidence indicates that many student participants in the AMMP received far less than the program-prescribed or NSSA-recommended number of hours for high-dosage tutoring. The reasons that students involved in the AMMP may have received lower-than-ideal amounts of individual or small-group tutoring are varied and include the following factors: a) many sessions involved fewer than four students (such that some tutoring "slots" were unfilled), b) some sessions involved whole classes (such that some students had contact with a mentor, but not in the context of individual or small-group tutoring), and c) some mentors did not complete as many hours in the classroom as intended (e.g., because of delays in finding appropriate placements).

Two solutions to this conundrum that have been proposed by STEM Action Center personnel are to a) recruit additional mentors or b) recruit volunteers to assist mentors. Both solutions would allow for smaller student:mentor ratios, potentially without reducing the number of students served at the prescribed dosage. There are reasons to caution against these approaches, however. First, recruiting additional mentors or volunteers may prove difficult. Second, providing adequate training, support, and supervision for additional mentors and/or volunteers is likely to prove challenging, given that only three STEM Action Center staff are assigned to administer the AMMP. An alternative solution might be to work closely with both mentors and site supervisors to *decrease* the number of students served to ensure that all participating students are, indeed, receiving high-dosage tutoring.

[18] https://ies.ed.gov/ncee/edlabs/regions/west/relwestFiles/pdf/4-2-50_Tutoring_Webinar_2_Participant_Slides_508c.pdf

Importantly, prior research shows that after a tutoring program is well-established and demonstrates success with smaller numbers of students, it can successfully be scaled up and still improve student learning outcomes (see Robinson et al., 2021).

Provide on-going training and support opportunities that will ensure that all mentors have the knowledge, skills, and tools they need to engage in "high impact" tutoring.

Prior research indicates that AmeriCorps members and volunteers can be effective mentors, but that, compared to experienced classroom teachers, these types of mentors are likely to need substantial and ongoing training and support to engage in critical features of "high impact" tutoring. These features include a) building sustained and strong relationships with students, b) ensuring that there is a strong alignment between mentoring activities and regular classroom instruction, and c) carefully monitoring student knowledge and skills (Robinson et al., 2021).

The strategic plan developed by STEM Action Center personnel makes clear that both training and support are priorities. For example, by Year 2 (2023-2024), mentors are expected to participate in a pre-service orientation, attend a pre-service training with vendors, complete Saga Coach training modules, participate in weekly check-ins with STEM Action Center staff, engage in 30-minutes per week of in-service training, participate in monthly trainings/collaborations with other mentors, and participate in weekly meetings with site supervisors. As STEM Action Center personnel work to implement and/or strengthen these program elements, it will be important to develop a system for monitoring attendance and gathering feedback on training and support efforts. A draft pre-service training schedule – with links to Exit Surveys – is included in Appendix A. Although the Saga Coach training modules are fully developed, STEM Action Center personnel have indicated a desire to replace SAGA Coach materials with customized training materials by Year 3 (2024-2025). Before doing so, a careful review of relevant data collected from mentor surveys and/or interviews would be prudent to understand if and how the Saga modules are or are not meeting program or mentor needs.

Importantly, the National Student Support Accelerator (NSSA) offers guidance for in-service training and support that STEM Action Center personnel might find useful. Among the important principles for in-service training and support highlighted in this resource are that:

1. Training and support opportunities should focus on specific skills, mindsets, or values that are important for the program. For the AMMP, these might include how to plan for tutoring sessions, how to use math learning software, how to use data to inform instruction, how to provide support to struggling students, and how to overcome potential barriers to communication with site supervisors.
2. Training and support opportunities should incorporate a culture of open communication and feedback. One key strategy for creating this culture includes asking tutors for feedback and explicitly acknowledging when feedback has been taken into account in making a decision.
3. Training and support opportunities should include regular observation and debrief cycles. Two key strategies for engaging in this work include a) observing each tutor working directly with individual or small groups of students and b) providing regular feedback so that mentors get multiple opportunities to learn, reflect, and improve.

Among the resources offered by NSSA are recommendations for structuring tutoring sessions to ensure that a) these sessions have clear objectives that are based on data and informed by

communications with the classroom teacher and b) tutors have the resources they need (e.g., talking points for addressing misconceptions) to maximize the potential for gains in student attitudes (e.g., confidence) and performance. A summary of NSSA recommendations is provided in Appendix B.

Increase consistent participation in data collection to support data-informed improvements.

During the pilot year and Year 1 of the program, UEPC staff worked to develop a variety of tools – including exit surveys, "pulse" surveys, and both traditional and retrospective pre/post surveys – that are designed to collect information from mentors and students regarding their experiences with and perceptions of the impact of the AmeriCorps Math Mentors program. In addition, STEM Action Center personnel worked to develop processes for tracking administrative data (e.g., # of hours of mentoring per student). Exit surveys are designed to be administered after each major training opportunity (e.g., the pre-service orientation, pre-service trainings with vendors, and completion of three sets of Saga Coach modules). "Pulse" surveys are designed to be administered periodically (e.g., as often as once per month) during the academic year. While findings from exit surveys and "pulse" surveys are helpful in making necessary adjustments to program elements and mentor activities in real-time, pre/post surveys, administrative data, and school-provided assessment data can be useful in understanding implementation fidelity and quantifying end-of-year impact (see National Student Support Accelerator, 2021, for more information).

In Year 1, mentor and student responsiveness to surveys was lower than would be ideal. For example, 13 mentors and 185 students completed the pre-survey, 11 mentors and 23 students completed a pulse survey, and 17 mentors and 124 students completed a post-survey. Response rates for mentors were, then, generally 50% or less. Response rates for students are unknown, given that the number of student participants is unknown. Given other demands on mentors, it will be important for STEM Action Center personnel to dedicate time during pre-service training sessions to introduce and discuss with mentors the data collection tools they will be using. It will also be important to be intentional about setting aside time for ongoing training and support for mentors on how to collect, review, and use these data throughout the academic year (Kupersmidt et al., 2018; Robinson & Loeb, 2021; Robinson et al., 2021; Sarker et al., 2019). Weekly check-in meetings may be an optimal time to provide this training and support.

To support program improvement efforts, the UEPC is committed to continuing to provide formative assessment data in a timely manner and usable format while also participating in weekly check-in meetings with STEM Action Center personnel and mentors to offer guidance on how (and why) to use data for continuous improvement.

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Appendix A

STEM Action Center AmeriCorps Math Mentors Program (AAMP)
Pre-Service Training Schedule

Event/Module	Topic	Time (in minutes)	Task	Date (Time)
1. AAMP Kick-Off Meeting	AmeriCorps training and AAMP training	**120**	Join us at [Zoom link]. Complete "exit ticket" [here].	
2. Strong Relationships	What does it mean to be a tutor?	10		
	Your education experiences	10		
	Implicit bias	10		
	Growth mindset	20		
	Tools for tutoring Part 1	5		
	Joy factor	20		
	Right relationships Part 1	15		
	Right relationships Part 2	20		
	TOTAL	**110**	Complete these online modules here. Complete "exit ticket" [here].	
3. High-Impact Tutoring	Tools for tutoring Part 2	5		
	What makes a high-quality tutorial?	25		
	Checks for understanding	15		
	Collaborative learning	10		
	Differentiation and ZPD	15		
	TOTAL	**70**	Complete these online modules here. Complete "exit ticket" [here].	

4. Planning and Using Data	Tools for tutoring – high expectations	5	
	Rigor	15	
	Intentional lesson planning	15	
	Analyzing student work	15	
	High expectations	10	
	TOTAL	**60**	Complete these online modules here. Complete "exit ticket" [here].
5. On-Site Training	On-Site Training	**90**	Meet at school site. Complete "exit ticket" [here].
6. Intro to Math Software	Vendor-provided training	**90**	Join us at [Zoom link]. Complete "exit ticket" [here].
7. AAMP Pre-Service Training Debriefing Meeting	Debriefing and introduction to in-service support	**90**	Join us at [Zoom link]. Complete "exit ticket" [here].

Appendix B

STEM Action Center AmeriCorps Math Mentors Program (AMMP)
Recommendations for Structuring a Tutoring Session

Prior to each tutoring session, be sure to …

- set a clear learning objective for the session that is based on data (e.g., from math software) and informed by communications with the teacher, parent, and/or student.
- write out talking points for explaining key concepts and addressing misconceptions.
- ensure that all necessary materials (examples, practice problems, digital resources, etc.) are ready.

Step 1. Relationship-Building

Take some time to build a strong tutor-student relationship (e.g., check-in about the student's day or have a conversation about the student's interests).

Step 2. Taking Stock

Reflect on the previous session and administer a brief "entrance ticket" that assesses the student's ***mastery of*** and ***confidence in*** either a skill they learned in a previous session or a new skill they will work on in today's session. If necessary, use this time to remediate any unfinished learning that the student will need for today's session.

Step 3. Overview

Provide an overview of today's planned activities. Clearly state the session's learning objective.

Step 4. Mini Lesson & Explicit Modeling

Using one or more examples, explicitly model the step-by-step process that the student will use to master the skill(s) or concept(s) needed to achieve the learning objective for today's session.

Step 5. Independent Practice

Provide sufficient time for students to practice the skill(s) or concept(s) needed to achieve the learning objective for today's session. Practice should allow for multiple "at bats" and be as independent as possible. If the student struggles to master a skill or concept, ***do*** ask guiding questions but ***do not*** provide answers.

Step 6. Formative Assessment

Reflect on today's session and administer a brief "exit ticket" that assesses the student's ***mastery of*** and ***confidence in*** the new skill they worked on today.

Sources. Adapted from materials provided by the National Student Support Accelerator at studentsupportaccelerator.org and informed by Robinson, C. D., Kraft, M.A., Loeb, S., & Schueler, B. E. (2021). Accelerating student learning with high-dosage tutoring. *EdResearch For Recovery: Design Principles Series.* Annenberg Institute at Brown University and Results for America.

Appendix C

If each mentor is able to provide 25 hours of mentoring for each of 32 instructional weeks (i.e., 900 hours ÷ 32 instructional weeks, less three hours per week for training, support, and other non-mentoring activities), each mentor would have to work with 4 students per session as outlined here:

# of students who need mentoring	1,410
# of hours of mentoring per student per week	x 1.5 hours = 2,115 hours/week
# of hours of mentoring per mentor per week	÷ 25 hours = 85 mentors at 1:1 ratio
# of students per mentor during a session	÷ 4 students = 22 mentors at 4:1 ratio

Modifications would need to be made to the program to reduce the student:mentor ratio. Although the ideal student:mentor ratio is still not well-understood (see recent meta-analyses by Nickow et al., 2020, Robinson et al., 2021, and Pellegrini et al., 2021), the National Student Support Accelerator recommends lower student:mentor ratios for less experienced tutors (National Student Support Accelerator, 2021). Given a fixed number of mentors and hours per mentor, the AMMP could reduce the student:mentor ratio to 3:1 by reducing the number students served to 1,100. More mentors serving fewer students would also be required if students were to receive the two to three hours of mentoring per week often recommended by the National Student Support Accelerator.[19] For example, 40 mentors would be needed to mentor 1,000 students for three hours per week if mentors could mentor 25 hours per week.

[19] https://ies.ed.gov/ncee/edlabs/regions/west/relwestFiles/pdf/4-2-50_Tutoring_Webinar_2_Participant_Slides_508c.pdf