



Annual Report for the 2023-24 Evaluation of the STEM Action Center's Professional Learning Grant Program

Prepared by the
Utah Education Policy Center
August 2024



THE UNIVERSITY OF UTAH
COLLEGE OF EDUCATION

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Acknowledgments

The Utah Education Policy Center extends our gratitude to the participating educators and site leaders at participating schools and districts who provided feedback on their experiences in the Professional Learning Grant Program. We would also like to extend special thanks to Kellie Yates from the STEM Action Center for providing invaluable insights about the Professional Development Grant and serving as a liaison between the evaluation team and the STEM Action Center's partner schools and districts.

Suggested Citation: Zemaitis, J., Rorrer, A., Colvin, K., & Timmer, M., & Reynolds, A. L. (2024). *Annual Report for the 2023-24 Evaluation of the STEM Action Center's Professional Learning Grant Program*. Salt Lake City, UT: Utah Education Policy Center.

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Executive Summary

Since 2016, the STEM Action Center's (STEM AC) Professional Learning (PL) Grant program has partnered with the Utah Education Policy Center (UEPC) to evaluate the implementation of grant activities and associated educator outcomes. This year's formative evaluation was designed to provide information to the STEM AC about program progress on implementation and preliminary outcomes for participating educators across sites in year one of a two-year grant award cycle. The following primary evaluation questions (EQ) guided the 2023-2024 evaluation of the STEM AC's Professional Learning Grant program:

Program Implementation

EQ1: To what extent were grant activities implemented as planned and consistent with goals across participating sites (e.g., holding planned sessions, engaging educators initially targeted for participation, making progress towards planned goals)?

Alignment of PL Activities with Program Expectations and Professional Learning Standards

EQ2: How and to what extent were professional learning activities at participating sites aligned with program expectations and professional learning standards?

STEM AC's Role as an Intermediary

EQ3: In what ways and to what extent did STEM AC serve as an intermediary to support the implementation of the Professional Learning Grant program?

- How effective was STEM AC at facilitating collaboration opportunities and supporting the development of communities of practice among program leadership across participating sites to support implementation?

Educator Outcomes

EQ4: To what extent did educators identify as STEM educators, feel competent in their own STEM-related knowledge and skills, feel confident in their STEM instructional skills, and engage in STEM planning and integration activities (i.e., the educator outcomes of interest for the STEM AC PL Grant Program)?

- To what extent did educators perceive outcomes change following their participation in grant activities?
- To what extent did changes in educators' perceived outcomes differ based on the extent and nature of engagement in grant activities?

These questions were answered using data from multiple sources, including surveys and focus groups with participating educators, surveys and interviews with site leaders, and program data.

Key Findings

The following key findings summarize the 2023-24 evaluation results and highlight program implementation and the outcomes of participating educators across sites during the 2023-24 academic year.

- **Key Finding #1:** Sites made considerable progress in implementing PL activities that align with PL standards and grant expectations

- **Key Finding #2:** Site leaders valued the grant management and continuous improvement support provided by the STEM Action Center, highlighting the responsiveness of the Grant Manager, funding support, and access to resources.
- **Key Finding #3:** Participating educators reported meaningful increases in their STEM teaching self-efficacy, STEM planning and instructional practices, and STEM identity and interest after engaging in grant-supported STEM PL.
- **Key Finding #4:** Relatively higher ratings among educators related to the quality of PL implementation were associated with increases in the target outcomes, particularly concerning their STEM planning and instructional practices and the extent to which educators perceived their PL activities to adhere to adult learning principles and features of effective learning design.
- **Key Finding #5:** Higher levels of educator engagement in PL facilitation were associated with modest increases in educator outcomes, particularly about their STEM planning and instructional practices.

Considerations for 2024-2025 Academic Year

Based on these key findings, the UEPC identified program considerations to inform the program's implementation during the 2024-25 AY. These considerations offer clear, actionable steps that program staff and participating sites can consider for program improvement, quality implementation, and maximal impact.

- **Consideration #1:** Strategically align PL activities with school, district, and educator needs.
- **Consideration #2:** Enhance resource availability, communication, and relevance.
- **Consideration #3:** Support educators' regular and active engagement in PL activities, including facilitation, focusing on implementing their learnings in practice, and promoting professional learning communities (PLCs) that allow educators to collaborate, share best practices, and reflect on their learning.
- **Consideration #4:** Support site leaders in aligning their PL activities with key implementation factors, particularly adherence to adult learning principles and elements of effective learning design.

Introduction

Professional Learning Grant Program Overview

The STEM Action Center's (STEM AC) STEM Professional Learning Grant program was established in 2014 by the Utah State Legislature's passage of H.B. 150. Since then, STEM AC has awarded funds to schools, districts, and educational organizations throughout Utah to support STEM-focused professional learning (PL) opportunities. To honor local educational needs for STEM Education, the grant focuses on PL initiatives that target the development of educators' content knowledge expertise and their instructional practices in science, technology, and computer science, engineering, or mathematics (STEM) content areas. STEM is the central focus of the grant at participating sites (i.e., schools, districts, LEAS, or other educational organizations), with some sites focusing exclusively on supporting PL related to a single STEM content area and others supporting PL that integrates these subjects with other non-STEM content areas (e.g., Social Studies, English Language Arts). Overall, the PL grant supports professional learning experiences by strengthening STEM-content knowledge and instructional practices, engaging in mentoring and coaching experiences, and engaging in professional learning communities (PLCs). Historically, participating sites have received funding to support professional learning initiatives for one to three years. The current grant cycle will fund projects for two years, starting in July 2023 and ending in June 2025.

The Utah Education Policy Center (UEPC) has served as the external evaluator for STEM AC's programs since 2016. The evaluation continues to support the actionable insights about program implementation and impact and promote continuous improvement. This year's evaluation activities provide formative feedback to the STEM Action Center about this year's (Year 1 of the 2023-2025) program progress, implementation, and initial STEM AC program outcomes. This report starts with background information, including information about the current grant cycle, relevant literature, and Utah's professional learning standards that framed the current evaluation of the grant program. The following section outlines the evaluation questions that guided this year's evaluation and the data collection and analysis methods employed during this inquiry. The findings are then presented by each evaluation question and address program implementation, the alignment of PL activities with program expectations and professional learning standards, the role of STEM AC as an intermediary, and preliminary findings about how participation in grant-supported STEM PL activities affected educators' STEM identity & interest, STEM teaching self-efficacy, and STEM planning & instructional practices. The report then concludes with an overview of the key findings and considerations for the future.

Background

The Current Grant Cycle, 2023-2025

The current two-year cycle of the STEM AC's PL Grant program supports Utah schools, districts/LEAs, and agencies in meeting their local STEM PL needs. During the 2023-24 academic year, the PL Grant program supported 34 sites (i.e., schools, districts, LEAS, or other educational organizations) that implemented various STEM PL activities to support STEM education in formal settings (e.g., classrooms) and informal settings (e.g., after-school STEM opportunities and educational programs in zoos). Examples of these activities include hybrid courses that focus on building educators' knowledge of Science with Engineering Education (SEEd) standards, multiple training sessions

related to STEM phenomenon, number talks, building thinking classrooms, and data and reflection sessions. In addition to the implemented program activities, the STEM AC grant program manager hosted monthly webinar sessions between September and April for site leaders. The webinars are intended to support site leaders with their reporting and evaluations as part of the grant requirement while supporting community building and cross-site collaboration. Specifically, the grant program manager used the considerations for improvement from the 2022-2023 evaluations as the framework for the monthly webinar topics.

Relevant Literature

STEM education remains a key priority for educational improvement efforts, particularly because of its contributions to increased global competitiveness, economic development, and societal improvement (Carnevale et al., 2011; Xie et al., 2015; Zhou et al., 2023). The National Science Board (2024) reported that nearly 24% of the U.S. civilian workforce held jobs in STEM as of 2021 and that current estimates from the Bureau of Labor Statistics expect this sector to grow faster than non-STEM occupations over the coming decade. Strengthening STEM education is critical to preparing students for post-secondary education and the workforce. Yet, Rotermund and Burke (2021) noted in the Science and Engineering Indicators report from the National Science Board (that while students in the U.S. perform better than students in other OECD (Organization for Economic Co-operation and Development) nations in science and computer and information literacy, they don't fare as well in mathematics.

STEM education continues to evolve. One of the changes that has occurred is a move away from siloed content to STEM integration in a rigorous, authentic, and connected way to real-world experiences that promote holistic learning (Rosengrant et al., 2019). To realize these changes in STEM education, there is a need to prepare better STEM teachers, many of whom lack STEM-specific degrees, coursework, or a deep understanding of content knowledge and skills (Hossain & Robinson, 2012; Jensen et al., 2016). Notably, prior research demonstrates that educators' subject-matter-related knowledge for teaching STEM subjects is positively associated with increases in associated student outcomes (Hill et al., 2005; Hudson et al., 2015). As the need to improve STEM education in K12 rises, professional learning is a valuable tool for supporting educators in preparing students for success in post-secondary endeavors and the workforce to build educators' content knowledge and incorporate content-focused pedagogical training (Hasim et al., 2022; Lynch et al., 2019; Zhou et al., 2023).

Research suggests that specific aspects of a PL design are essential to promote intended participant learning outcomes. Rorrer, Groth, and Colvin (2024) assert that professional learning should be sustained and ongoing, engage practitioners in reflective practice, and address a problem of practice to honor adult learning needs for transformational learning. Furthermore, PL opportunities must create authentic learning experiences, provide educators with easy access to hands-on learning materials, enhance educators' knowledge of STEM careers, and address factors such as teacher attitudes, coherence with work practices, and active learning (Darling-Hammond et al., 2017; Desimone, 2009; Gardner et al., 2019; Haug & Mork, 2021; Loucks-Horsley et al., 2009; Thiele & Bogdon, 2022).

Offering this type of PL may be challenging for some schools or districts as they may face limited funding, availability, or time challenges (Haug & Mork, 2021; Lavalley, 2018; Yettick et al., 2014). Online opportunities have expanded to support greater access to professional learning opportunities. This

expansion of PL has supported the ability to reach rural educators and the COVID-19 pandemic (Brown et al., 2021; Durr et al., 2020). A recent systematic review of several studies of online professional development programs highlighted the need for PL experiences that accommodate individual learning styles, foster engagement, focus on pedagogical content knowledge, embed practical activities, provide specific learner supports, and are flexible and goal-oriented, contributing to positive outcomes among participants (Bragg et al., 2021). Moreover, consistent with research on in-person PL, online PL similarly benefits from including hands-on features, extended duration, and cycles of feedback and reflection (Herbert et al., 2016).

The lingering impact of the COVID-19 pandemic has continued to draw attention to concerns for teacher retention and mobility (Zamarro et al., 2021). Enhancing STEM teachers' self-efficacy is also an important issue for STEM education, as it impacts educators' job satisfaction and retention (Kasalak & Dağyar, 2020). Recent evidence (Durr et al., 2020) suggests that engaging educators in STEM PL contributes to increases in educators' teaching self-efficacy and their enjoyment and valuing of PL opportunities going forward. Additional studies show the role of professional learning communities and practical application in building educators' STEM teaching self-efficacy (Gardner et al., 2019; Kelley et al., 2020). Teacher self-efficacy also plays a critical role in building STEM teacher leadership (Quaisley et al., 2023). Lai and Cheung (2015) found that teacher leaders demonstrated stronger teaching skills, resulting in better student outcomes.

Utah Professional Learning Standards

In addition to the insights provided by literature related to STEM professional learning, the Utah State Board of Education (USBE) has also established standards for high-quality professional learning that grant-funded activities must comply with in design and implementation. These standards provide important guidance for designing and structuring high-quality PL activities and insight into key features of PL implementation that indicate effective practices. Specifically, USBE defines professional learning “as comprehensive, sustained, and evidence-based approach to improving teachers’ and principals’ effectiveness in raising student achievement” (USBE, 2023). In alignment with this definition, USBE has established eight research-based PL standards that these activities are expected to attend to, which include:

- **Learning Communities.** Professional learning occurs within learning communities committed to continuous improvement, individual and collective responsibility, and goal alignment.
- **Skillful Leaders.** Professional learning requires skillful leaders who develop capacity, advocate, and create support systems for professional learning.
- **Resources.** Professional learning requires prioritizing, monitoring, and coordinating resources for educator learning to advance student learning.
- **Outcomes.** Professional learning aligns with performance standards for teachers and school administrators; and performance standards for students as described in the Utah Core standards.
- **Learning Design.** Professional learning integrates theories, research, and models of human learning to achieve its intended outcomes.
- **Implementation.** Professional learning applies research on improving practice and sustains support for implementation of professional learning for long-term change.
- **Data.** Professional learning uses a variety of sources and types of student, educator, and system data to plan, assess, and evaluate professional learning.

- **Technology.** Professional learning both incorporates the use of technology in the design, implementation, and evaluation of high quality professional learning practices and includes targeted professional learning on the use of technology devices to enhance the teaching and learning environment and the integration of technology in content delivery. (USBE, 2023, p.1)

Methods

Evaluation Questions

The following evaluation questions (EQs) guided the 2023-2024 evaluation of the STEM Action Center's Professional Learning Grant program. Following these questions, we provide an overview of the data collection and analysis procedures used in this evaluation.

Program Implementation

- EQ1:** To what extent were grant activities implemented as planned and consistent with goals across participating sites (e.g., holding planned sessions, engaging educators initially targeted for participation, making progress towards planned goals)?
- EQ2:** How and to what extent were professional learning activities at participating sites aligned with program expectations and professional learning standards?
- EQ3:** In what ways and to what extent did STEM AC serve as an intermediary to support the implementation of the Professional Learning Grant program?
 - How effective was STEM AC at facilitating collaboration opportunities and supporting the development of communities of practice among program leadership across participating sites to support implementation?

Educator Outcomes

- EQ4:** To what extent did educators identify as STEM educators, feel competent in their own STEM-related knowledge and skills, feel confident in their STEM instructional skills, and engage in STEM planning and integration activities (i.e., the educator outcomes of interest for the STEM AC PL Grant Program)?
 - To what extent did educators perceive outcomes change following their participation in grant activities?
 - To what extent did changes in educators' perceived outcomes differ based on the extent and nature of engagement in grant activities?

Data and Methods

The evaluation used qualitative and quantitative data to inform our understanding of how sites implemented STEM-focused PL activities and their initial outcomes. More specifically, data collection focused on gathering detailed information from site leadership about program implementation and progress, refining previously administered educator surveys to clarify understandings of key outcomes, and collecting qualitative data from a representative sample of sites to provide more nuanced information about the implementation and outcomes of the 2023-24 grant-supported PL activities. Appendix A provides a map of data sources for each EQ.

Practically Meaningful Differences: Interpreting the Findings of this Report

Estimates can reach statistical significance without being a meaningful difference within context. Therefore, for this report, we also highlight *practically meaningful differences* – in other words, substantive changes or differences within the context of the STEM AC PL program in terms of Likert scale points. Differences greater than 0.25 scale points are flagged as practically meaningful, with those that fall between 0.25 to 0.50 points being described as modest, 0.50 to 1.0 as moderate, and greater than or equal to 1.0 as large.¹

Site Leader Implementation Surveys

Purpose & Process. Site leaders at programs participating in STEM AC's PL Grant Program completed the Site Leader Implementation survey in the middle and end of the 2023-24 academic year (i.e., December 2023 and May 2024). The survey included five sections, which are described below. While the first section was only asked in December 2023, the remaining four sections were asked at both time points to monitor progress and implementation across the academic year.

1. **Types of STEM Professional Learning Activities.** The survey asked site leaders to share specific information about their PL activities during the 23-24 AY. This included the PL content area, participant interactions, PL facilitators, frequency and length of PL experience, and types of PL activities (e.g., PLCs, in-person workshops, virtual workshops, coaching activities).
2. **Program Progress.** This section asked site leaders to reflect on their goals for their STEM PL grant activities and participating educators by providing progress updates for the reporting period and including key successes and challenges experienced.
3. **Structure and Functioning of STEM PL.** The survey asked site leaders to provide details about the structure and functioning of grant-supported STEM-related professional learning activities at their site. This included a set of seven factors associated with quality PL, which included adherence to adult learning principles, respectful and effective communication, effective data use, focus on professional growth and learning, effective learning design, supportive learning culture, and shared visions and responsibilities.¹
4. **Supporting a Community of Practice for STEM PL.** This section asked site leaders to report on how they and those participating in grant-related activities at their school, district, or agency supported establishing a community of practice through collaboration and interactions related to grant-supported STEM professional learning activities throughout the reporting period. This included two sets of questions about (1) collaborative practices and (2) the nature and frequency of participant interactions with resources and individuals.
5. **STEM AC as an Intermediary Organization.** This section asked site leaders to report on how the STEM AC fulfilled its role as an intermediary organization in supporting the implementation of grant activities at their school, district, or agency during the reporting period.

Sample. Site leaders served in a variety of roles at their schools, districts, or agencies. About a third (32%) were subject or content area specialists (e.g., Math, Science and STEM Specialists). Others were

¹ These scales were constructed using items from UEPC's Collaborative Self-Assessment (CSA) and other previously administered items for the STEM PL Grant program, which were refined based on the results of factor analyses, crosswalks with Utah's PL Standards and program-specific expectations for grant programs, and discussions with the Grant Manager to ensure adequate coverage of the key implementation features of interest.

curriculum facilitators (19%), district-level administrators (19%), instructional coaches (15%) or school administrators (15%). Of the 34 participating programs, 29 site leaders completed the Fall 2023 survey (85% response rate), and 27 completed the Spring 2024 survey (79% response rate). The sample of respondents included site leaders from 32 of the 34 sites (94%) who responded to at least one of these surveys.

Analysis. Descriptive statistics were used to analyze responses to the Site Leader Implementation survey. When items were part of a scale, the reliability of that scale was computed (see Appendix B) and item ratings were averaged to arrive at a scale score for each responding site during each period. These were then averaged to produce composite measures across sites for the two time points (i.e., Fall 2023 and Spring 2024). Statistical tests were then used to compare average ratings across time points and to compare the difference between site leader and educator ratings.

Educator Survey

Purpose & Process. The end-of-year educator survey was administered between late April and early May 2024 to gather information about participants' engagement in specific types of PL activities, their perspectives on the structure and functioning of the activities offered at their site, their interactions with individuals and resources as a part of PL activities, and their perceptions of the impacts of these activities on the target educator outcomes (outlined below). At the start of the survey, the list of grant-supported activities offered at their site this academic year was provided to orient educators to the specific PL activities they may have participated in and should consider when completing the survey. The survey took approximately 15 minutes for educators to complete, and no compensation was offered for participation. This survey was organized into the five sections that follow.

1. **Type of STEM PL Activities They Participated in Over the Course of the 2023-24 Academic Year.** Participants were asked to share information about the grade level and content area focus of the PL activities they participated in and the approximate frequency and amount of time they spent engaging in specific activities.
2. **PL Structure and Functioning of STEM PL.** This section asked participants to rate the PL activities they participated in in relation to the seven factors associated with quality PL (i.e., adherence to adult learning principles, respectful and effective communication, effective data use, focus on professional growth and learning, effective learning design, supportive learning culture, and shared visions and responsibilities).
3. **Supporting a Community of Practice for STEM PL.** This section asked educators to share information about their collaborative practices and the nature and frequency of their interaction with individuals and resources throughout the year.
4. **Educator Outcomes.** This section was unique to the educator survey and focused on three areas: (1) STEM teaching self-efficacy and confidence; (2) STEM identity and interest; and (3) STEM planning and instruction. For each area, educators were asked to rate the extent to which they agreed with statements now and at the start of this academic year. When providing these ratings, educators were asked to keep in mind the STEM concepts and instructional practices the grant-related PL activities they participated in focused on and their impact on these target outcomes.

Sample. Site leaders provided contact information for 2,940 educators who participated in at least one of the grant-supported PL opportunities. The sample represents 33 of the 34 PL sites. Of those

sites that shared participating educator lists, the number of educator contacts ranged from 12 to 641. A total of 944 educators responded to the survey (response rate of 32%). Although the majority of these respondents were general education classroom teachers ($N=634$, 86%), some were instructional coaches ($N=49$, 7%), STEM subject/content area specialists ($N=15$, 2%), and the remaining 5% were special education educators ($N=11$), curriculum facilitators ($N=7$), school administrators ($N=4$), district support staff ($N=3$), or other educators (e.g., media specialist, reading specialists, informal educators, after-school teachers). Of those who provided information about the grade levels they taught or supported, most educators (75%) taught or supported primary grades (Pre-K through 6th grade) ($N=701$), 19% worked with secondary grades (grades 7 through 12) ($N=176$), and 7% with both ($N=62$).

Data Analysis. Descriptive statistics were used to analyze responses to the Educator survey. When items were part of a scale, the reliability of that scale was computed (see Appendix B) and item ratings were averaged to arrive at a scale score for each responding educator at the start and end of the year. Statistical tests were used to compare average ratings across time points. Additional details about how data from each section of the survey was analyzed are as follows:

1. **Type of STEM PL Activities They Participated.** These results were used to investigate differences in educator outcomes based on the nature and extent of participation in grant activities, such as assessing the association between the number of hours educators spent participating in PL activities and their outcomes.
2. **PL Structure and Functioning of STEM PL.** The average ratings of these components were computed and the association between these ratings and reported changes in educator outcomes were assessed.
3. **Supporting a Community of Practice for STEM PL.** The average ratings of these components were also computed to assess their association with reported changes in educator outcomes.
4. **Educator Outcomes.** Change in participant outcomes was measured by subtracting the end-of-year ratings from the start-of-year ratings for each outcome measure. These differences in ratings were used in analyses to test the association between educator outcomes and scales related to the structure and functioning of STEM PL, as well as educator reports of involvement in facilitation.

Open-Ended Survey Responses, Focus Groups, & Interviews

Purpose & Process. Open-ended survey responses were gathered during the Site Leader Implementation Surveys and the EOY Educator Survey. Respondents detailed key successes and obstacles in implementing grant activities, resources used, participant interactions, and STEM AC's support in building educator capacity. During the Spring 2024 survey, site leaders also provided suggestions for further STEM AC support. The EOY Educator Survey administered in Qualtrics collected data on the most meaningful aspects of grant-related PL activities and also suggestions for improvement.

Additional qualitative data from select program site focus groups, identified through the Fall 2023 Site Leader Implementation Survey, provided nuanced participant experiences. Site leaders participated in 30-45-minute virtual interviews discussing grant activity progress, goals, STEM AC interactions, and the overall impact. Educators from these sites also joined virtual focus groups to share their experiences and the influence of their participation on engagement and outcomes.

Sample. In Fall 2023 and Spring 2024, site leader survey response rates were 85% and 79%, respectively, with all respondents providing open-ended feedback on their progress. Approximately half of the site leaders gave open-ended responses in Fall 2023, increasing to three-fourths in Spring 2024. For the educator survey, about 800 out of 1,149 respondents (70%) shared their responses to what were meaningful aspects of their PL experiences, 400 (35%) gave improvement suggestions, and 190 (16%) provided additional information on their interactions with resources. Among the 20 selected sites for focus group interviews, 11 participated in educator focus groups (55% of those targeted for participation and 32% of all sites). In contrast, only two site leaders (10% of those targeted and 6% of all sites) participated in interviews, limiting the representativeness of the site leader interviews. Appendix E compares the select sample to the total population, noting a slight underrepresentation in sites focusing on Technology and Computer Science (9% in the sample vs. 24% across all participating programs) and overrepresentation in sites that included a focus on Special Education-in their STEM PL activities (45% in the sample vs. 29% across all participating programs). When interpreting the findings from these select sites, it is important to note that, overall, only about a third of participating sites had educators participate in the focus groups, and the findings derived from the participant focus groups and site leader interviews may not represent the experiences of all participating educators.

Data Analysis. Transcripts from each focus group and interview and the open-ended responses to the site leader and educator surveys were analyzed using inductive coding procedures (Saldaña, 2016) to address the evaluation questions. After the data were coded, themes were generated by the coding team, who had met throughout the analysis process to maintain shared understandings of the codes and reach consensus around the final themes identified in the data.

Program Data

Purpose & Process. The program manager shared each participating site's objectives on their grant applications with the evaluation team. These objectives were used for the Site Leader Implementation Surveys to monitor progress towards the stated objectives. These were also referenced while analyzing site leaders' qualitative data to better understand the purpose and intent of the participants' PL activities.

Site leaders shared lists of participating educators and a calendar of their professional learning activities for the 2023-24 year with the evaluation team. Although information regarding educator participation in PL activities was requested per STEM AC's expectations for shared information to assess educator outcomes, insufficient information about educator background and engagement was received to be used for the analysis. A copy of this template can be found in Appendix F.

Site leaders were also asked to provide information about the activities that were planned and implemented throughout the 2023-24 AY, their goals, the number of educators they hoped to engage in each activity, how participants were expected to reflect and follow up after the learning opportunity, the number of educators who participated, and how the session went overall. In addition to the Grant Manager using this calendar information for their own informational and monitoring purposes, the evaluation team used the number of educators who were expected to participate in each activity and the number who did so to estimate the implementation effectiveness of the program activities overall. A copy of the calendar template can also be found in Appendix F.

Sample. All but one program provided calendars and educator lists with contact information to the evaluation team. However, most sites did not provide sufficient information about educator backgrounds or their participation in grant activities, despite efforts to support site leaders in providing this information (i.e., making an instructional video about how to enter this data into the template and holding individual meetings with site leaders to support these efforts). For example, as of the final deadline for submission, only about 70% of sites had provided at least some background information about their educators, and only a few (<10%) of sites provided information about participant attendance.

Data Analysis. The intention was to use educator attendance data to determine the duration of participant engagement in PL activities (i.e., number of months) as well as the number and proportion of activities at their site that they engaged in. However, the challenges noted above related to the completeness of this data and differences across programs about the extent of involvement required during each PL activity touchpoint (e.g., one-hour meeting versus participation in a multi-day intensive PL workshop) made it difficult to compare this data across sites and use it for analysis as planned. In the absence of information from sites, additional items were added to the educator survey to gather estimates of the amount of time educators spent engaging in specific types of activities during their PL experiences to make up for this limitation in the information that could be discerned from this data source.

Findings

Program Implementation

Findings from the review and analysis of program data (i.e., goals and reported attendance records), site leader reflections about the purpose and goals of the PL activities at their sites, and participating educators' reflections on why they participated in PL activities were analyzed to determine the extent to which grant activities implemented as planned and were consistent with the goals and activities planned across participating sites. Specifically, this section first provides an overview of the STEM professional learning focus and goals across participating sites, the extent to which sites reported making progress towards their goals, the extent to which site leaders reported engaging educators as planned and what motivated educator participation in grant-supported STEM PL activities during the 2023-24 school year.

Professional learning focused on a variety of STEM and non-STEM content areas.

The STEM AC grant does not stipulate which STEM area must be the focus. The 2023-24 grantee goals targeted various STEM and non-STEM content areas. See Table 1. Site leader responses to the Fall 2023 Implementation Survey suggested that the majority of the 29 reporting sites (79%) targeted math content professional learning as a part of their grant-supported activities, and just over half of the sites included a focus on science (55%), furthermore, just under a third of participating sites focused on integrating STEM with non-STEM subjects. The most common content areas for integration were English Language Arts and Social Studies, with 28% and 14% of sites reporting that these subject areas were included in the focus of their STEM PL activities. Only about a third of sites reported that their STEM PL activities included Special Education, and about a fourth reported a focus on Career and Technical Education.

Table 1. Subject or Content Area Focus of Reporting Sites

Focus of PL Activities	Count	% of Reporting Sites (N=29) ²
STEM Subject	29	100%
Mathematics	23	79%
Science	16	55%
Engineering	7	24%
Technology and Computer Science	7	24%
Non-STEM Subject	9	31%
English Language Arts (ELA)	8	28%
Social Studies	4	14%
Foreign Languages	2	7%
Fine Arts	2	7%
Physical Education (PE)	1	3%
Other (i.e., Any Language Arts)	1	3%
Other Focus Areas		
Special Education	10	34%
Career and Technical Education (CTE)	7	24%

Source: UEPC Fall 2023 Site Leader Implementation Survey

² Since some sites reported focusing their PL activities on multiple content or focus areas and were counted multiple times, these percentages will not total to 100.

Professional Learning activities were designed to strengthen STEM content knowledge, instructional strategies, and improve student engagement.

Many grant-funded PL activities across sites sought to increase educators' STEM content knowledge and STEM planning and instructional practices. Reviewing the grantee's program goals, implementation survey responses, and site leader interviews highlighted a desire to increase student engagement and discourse across their school and/or district. Specifically, site leaders mentioned that the PL opportunities offered at their sites were intended to support critical thinking, increase student talk, and re-center learning activities on student actions and experiences such that they – not the teachers – would do most of the “lifting” during instruction. Some site leaders named the impact COVID-19 had on education and their desire to get students talking and interacting with each other in the classroom again.

The selected excerpts from the grant applications and site leaders below represent the desire to enhance instructional practices that promote deeper student engagement and understanding of STEM education. An emphasis on fostering effective discourse strategies was named to engage students cognitively in rigorous STEM education. Additionally, site leaders often discussed how PL activities were intended to build educators' content knowledge and strengthen their instructional planning and practices, two of the three primary outcomes of interest for this year's evaluation.

Excerpts from select program goals on grant applications:

- *Provide instructional support and resources for educators for targeted systematic implementation of number sense routines and discourse in mathematics and science.*
- *Our school would like to help educators improve their use of accurate and clear STEM language and vocabulary.*
- *Teachers have a desire to grow their practice in use of effective questioning strategies and discourse moves that promote cognitive engagement.*
- *Participants will work to increase the use of research-based discourse strategies that promote active and equitable student engagement in STEM classrooms such as the uptake of student ideas or contributions. To help teachers improve discourse strategies ... participants will deepen their knowledge of: Stem Vocabulary, Student Critical Thinking & Perseverance, and Increasing Student Talk in the Classroom by attending Teach FX, Gizmos, Derivita, or book study webinar and/or training where they'll discuss methods and strategies.*
- *Secondary science teachers will increase the percentage of average student discourse in their classroom by ten percent or have an average classroom ratio of teacher talk, 30%, to student discourse, 70%, focused on science concepts by the end of the school year.*

Site Leader Quotes:

- *We're just trying to put an emphasis on teacher practice and how to encourage more student discourse and push more of the thinking load for the mathematics back to the students, rather than it just be a modeling exercise for the teacher.*
- *I want students to have a really good experience with mathematics. I want them to understand mathematics as being something that's creative and useful and connected and makes sense as opposed to this set of rules and procedures that is just a checkbox for their graduation and for whatever, if they're going on in schooling, to get them into the next checkbox. And then also to help*

students and teachers believe in the capability of all students and provide all students access to rigorous mathematical experiences.

Site leaders reported at least some progress on the majority (92%) of their goals, completing or nearly completing more than half in this first year of implementation.

Site leaders reported on their goal progress twice throughout the 2023-24 academic year. Once at the end of fall 2023 and again at the end of spring 2024. Of the 34 participating programs, 32 site leaders provided this information at least once during the reporting periods. Sites reported on a total of 95 goals, three of which were new and 92 of which were initially set during the grant application process. Each reporting site set between one and six goals for their PL activities over the two-year grant cycle, with two-thirds working towards two and four goals over the 2023-24 academic year.

The most recent report highlights progress for each goal, which was considered in the summary of these findings. In 2024, only the most recent progress rating was used if a site leader reported on the same goal in fall 2023 and spring 2024. As shown in Table 2, approximately 42% of the goals sites reported on were completed throughout the 2023-24 AY, and a considerable proportion were nearly completed or had some progress (41%). However, some sites did report having to abandon some goals (7%) due to challenges or shifts in priorities (e.g., reduced staffing, lack of buy-in from school administration, requests from educators to spend more time on other PL topics) and some sites also reported that they had yet to start or had made little progress and a small proportion of their goals (9%).

Table 2. Reported Progress Towards Program Goals During the 2023-24 AY

Progress Towards Goals	Goals	
	Count	Percent
Stopped	6	6%
Have not started	2	2%
Started, but little progress	6	6%
Some progress	26	38%
Nearly completed	9	9%
Complete	36	38%

Source: UEPC Fall 2023 & Spring 2024 Site Leader Implementation Surveys

Note: N = 32 program sites.

Despite the considerable progress made across sites this year, some site leaders discussed competing demands led to implementation challenges. Furthermore, the results suggest that these competing challenges and priorities occurred at the district-, school-, and individual educator levels. The following illustrative excerpts from site leaders describe some of the different ways other goals, activities, or interests were prioritized over STEM PL activities:

- *The biggest challenges in our LEA are related to competing interests. ELA takes the lion's share of planning and professional learning time. In addition, it seems like it is the only discipline that is monitored by the state, district, or administrators. I think the best strategy to support our efforts would be to put STEM disciplines on the leadership radar. To overcome the barriers, we have worked with individual principals in our LEAs to provide just what that schools need. (Site Leader, Spring Survey)*

- *We could not hold sessions with teachers this year. They were simply too overwhelmed with the new Math curriculum selected by the district. (Site Leader, Spring Survey)*
- *The primary challenge I face is that I'm dealing with [more than two dozen] elementary schools with principals and coaches who each have varying degrees of understanding and buy-in, which impacts support for the shifts we are trying to make with math instruction. (Site Leader, Spring Survey)*
- *[M]any elementary teachers don't dedicate enough time to teaching content areas outside of ELA. I also recently had the epiphany that many teachers feel STEM is another thing on their plate, so don't change their mindset because it must be rejected from their expectation list due to overwhelm! But if we started to focus on STEM in another way, more in terms of instructional implementations terms instead of program/framework terms, STEM wouldn't seem so overwhelming coming as another program/framework that needs implementation. (Site Leader, Spring Survey)*

Sites successfully engaged nearly two-thirds of the educators targeted for participation in this year's PL activities.

A review of the available program data as of early April 2024 revealed that sites successfully engaged just under two-thirds of the target group of educators they hoped to during their PL activities. Site leaders submitted their final activity calendars for the 2023-24 AY by early April 2024, listing all planned professional learning activities and participant estimates. Of the 34 programs, 30 (88%) provided these calendars, listing 483 activities. While 82% (398 activities) included participant estimates, only 30% (144 activities) included participant counts. The data from these 144 activities showed that 62% of the anticipated educators participated in the grant activities.

Participants were interested in learning new instructional strategies, accessing instructional resources, and valued compensation.

Participants discussed different rationales for engaging in a grant-support PL. Some were required to participate, while other sites had an opt-in/optional model. Participants could select PL opportunities aligned with their professional needs and interests at sites where participation was optional. Educators in focus groups reported wanting to learn new instructional strategies, support greater student discourse, and develop skills to promote deep critical thinking. Another common motivation for educator participation was the expectation of receiving access to new classroom materials, ready-to-use resources, and lesson plans to support their instructional practices. For some, financial compensation was an important driver for participation. Related to this, other educators mentioned the importance of receiving funds to cover substitutes so they could attend professional learning during the day and how this logistical support enabled their participation. The following quotes characterize how educators described what made them interested in participating in the STEM PL at their site:

- *The whole foundation was, "Let's get the kids talking to each other." Because we come out of COVID and it's hard to get them to even talk to each other. And the Number Talks help them participate in a way that was... You didn't have to know all the answers, everybody could. So I really liked that idea of getting the kids involved and getting them to talk to each other and get relationships. (Educator, Focus Group Interview)*
- *With it being my first year, I'm constantly trying to get that feedback and get as much information as I can just to make sure my students are having good experiences and getting all the information they need from me. (Educator, Focus Group)*

- *I participated in the SEEd Flex courses. And they were extremely helpful. It was really helpful to be able to get a lesson plan, and then the supplies needed to teach that lesson in my classroom. So, those were all really great this year. (Educator, Focus Group Interview)*
- *And so [the facilitator] provided some actual trilobite fossils we had with, I am assuming with the grant money, but she provided some colored pictures that the students could use to sort and arrange and match a living creature to a fossil that looked similar. And so doing that was really helpful for the students to have it in color, all prepared. That helped me to have her prepare some of those materials and share them with me and bring them to me to be able to help the students with that. And then we looked at the assessment data afterward, and she helped me look at how I could grade that on a proficiency-based scale of how well did the students understand what we were doing. (Educator, Focus Group Interview)*
- *One of the most important things I think is that along with [our facilitator] planning this professional development, she also made sure that we all had the supplies we needed to do it. So she started off with just giving us all these, what they're called white books... (Educator, Focus Group Interview)*

Alignment of PL Activities with Program Expectations and Professional Learning Standards

This section presents findings on the alignment between PL activities implemented across participating sites and the PL Grant program expectations and PL standards. It opens with an overview of the measures used to assess alignment. Next, it describes key findings related to these measures and their suggestions for implementation during the 2023-24 AY. The findings are further elaborated with the qualitative data from educator focus group interviews and open-ended survey responses to the fall 2023 and spring 2024 Implementation Surveys.

Site leaders and educators generally agreed that the PL activities implemented this year aligned with program expectations and standards.

To assess the extent to which participating programs were in alignment with these guidelines, the evaluation team reviewed and refined previously administered evaluation instruments to construct new scales that represented key implementation features and activities of high-quality STEM professional learning activities. The scales used to assess this alignment, internal reliability measures, and example items are shown in Table 3 on the following page.

Table 3. UEPC Scales for Assessing Implementation Alignment with PL Standards and Expectations

Factor	# of Items	Reliability Est. (Cronbach's α) ³	Example Items ⁴
Supportive Learning Cultures	9	0.93	➤ Actively promoted routine feedback - both seeking and receiving. ➤ Honored professional expertise and experience.
Effective Learning Design	9	0.90	➤ Allocated sufficient time for collaboration. ➤ Effectively leveraged technology to expand educator access to professional learning opportunities.
Shared Visions & Responsibilities	3	0.80	➤ Professional learning facilitators and participants shared a vision for STEM professional learning that focused on improving student learning.
Respectful & Effective Communication	3	0.86	➤ Participants' interactions reflected mutual trust and respect.
Focus on Professional Growth and Learning	3	0.83	➤ Participants were provided with sufficiently scaffolded opportunities to apply their learning to practice.
Effective Data Use	3	0.86	➤ Participants collaboratively examined data and analyzed student work to enhance STEM-related teaching and learning.
Adherence to Adult Learning Principles	9	0.94	➤ Gave participants the chance to inform the construction of its content. ➤ Allocated sufficient time for participants to practice new skills between meetings.

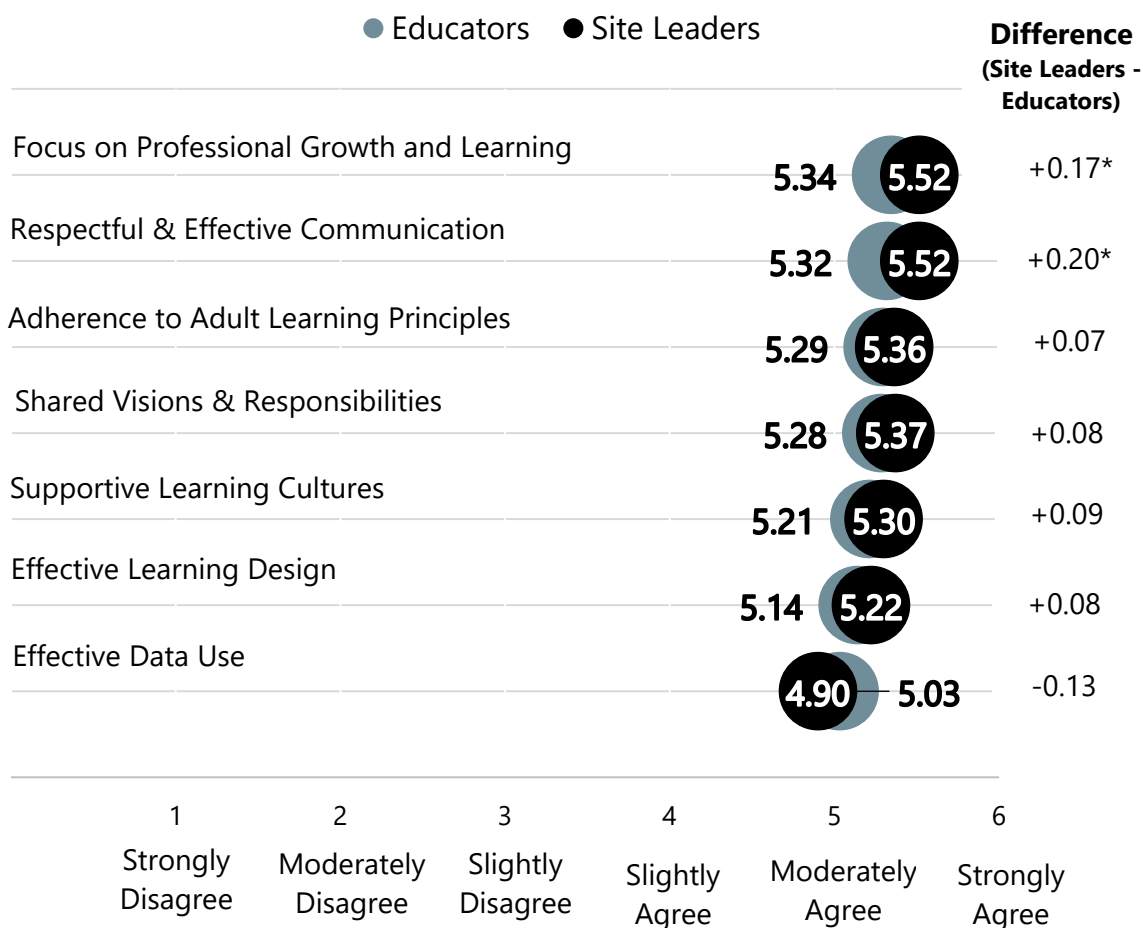
Source: UEPC 2023-24 EOY Educator Survey

Site leaders rated the alignment of PL activities with key areas with no meaningful differences across the Fall 2023 and Spring 2024 UEPC Implementation Surveys ($N = 29$ and 27 , respectively). Similarly, the 2023-24 EOY Educator Survey asked participants about alignment with these areas ($N = 776$ to $N = 872$ across items). Average ratings of the dimensions of PL activities from site leaders and educators and the differences in ratings between groups are shown in Figure 2. Although the differences in mean ratings between educators and site leaders were statistically significant for both focus on professional growth and learning and respectful and effective communication, the differences are not large enough to be considered practically meaningful. For educators and site leaders, mean ratings for effective data use were notably lower than the other dimensions of PL implementation.

³ Based on between 700 and 797 educator responses.

⁴ A complete list of the items on these scales can be found in Appendix B.

Figure 1. Differences in Average Site Leader and Educator Ratings Across Dimensions of PL Implementation



*Statistically significant difference at $p < .05$.

Sources: UEPC 2023-24 EOY Educator Survey, UEPC Fall 2023 & Spring 2024 Site Leader Implementation Surveys

Educators highlighted the importance of effective PL design and structure, particularly the value they found in the modeling/observational activities, collaboration opportunities, and regular engagement in PL activities throughout the year.

The themes from the qualitative analysis provided additional insights into key design features and structures of the STEM PL activities implemented across sites during the 2023-24 AY. Specifically, the following sections provide additional details about how educators valued modeling/observational activities, collaboration opportunities, and regular engagement in PL activities throughout the year.

Educators particularly valued the modeling and observational opportunities during their STEM PL experiences.

During the focus group sessions, educators noted the value of observing mastery teaching (*i.e.*, high-quality and high-impact teaching) in action. These observational modeling activities provided

experiential PL to support a greater conceptual understanding of how practitioners could apply their new learning in the classroom. Participants identified their colleagues as valuable assets to the PL experience(s), providing new insights, knowledge, and shared expertise. The following quotes provide examples of how educators described the value of key features and structures of the PL activities they participated in:

- *I think the most beneficial for me is when we watched the professional development person ... go into one of our classrooms. We all came in there and watched her demonstrate for us. We had a really good idea of what it needed to look like. (Educator, Focus Group)*
- *Our class sessions were highly impactful models of good teaching. Each session [the facilitator] modeled how to get students to understand and talk about basic math concepts. I grew as a teacher because [the facilitator] helped us reflect on our successes and struggles, learn from other teachers' experiences, and participate in Number Talks as if we were the students. My personal math sense increased. This has helped me be a better teacher for my students. (Classroom Educator, Educator Survey)*
- *[Our PL activity] was not a kindergarten through third-grade band. It was actually, "This is our grade level. This is our exact standards we're teaching." And it was also taught by teachers that had done it before. And that helped a lot. Rather than just reading about it, we were able to pick their brains and see what had worked for them in that particular lesson. (Educator, Focus Group Interview)*

Participants highlighted the value of collaboration during their STEM PL experiences.

Responses to the EOY Educator Survey showed that 80% of PL participants moderately to strongly agreed their professional learning activities had sufficient collaboration time. Concerning how collaboration activities occurred, over half of educators (61%) reported participating in professional learning communities (PLCs), 35% engaged in structured coaching cycles, and 17% participated in video-based peer reflection. Participants indicated that collaboration positively impacted their learning and content development. Participants found it beneficial to work collectively on PL activities and curricula and to form a community of teachers addressing common goals or problems. Specifically, participants appreciated sharing ideas, best practices, and experiences. The following quotes illustrate how collaboration supported PL activities:

- *Working as a collaborative team to learn new methods of visible thinking. (Instructional Coach, Educator Survey)*
- *Collaborating with other teachers across the district about STEM learning activities has helped me feel more supported and validated in my teaching and desire to improve my practice. (Classroom Educator, Educator Survey)*
- *The discussions and interactions with other teachers in the same content, even across multiple grade levels and subjects. They took us in pairs of two, so we had someone from our school to collaborate with and that was very meaningful. Learning as professionals in a safe, learning environment. (Classroom Educator, Educator Survey)*
- *The leaders are amazing but they are not the only people who control the safety of the environment. Every person in the interaction does. This year has been amazing for me but it hasn't always been in years past. (Classroom Educator, Educator Survey)*

- *I feel the most impactful part was creating a shared language of feedback for our team. This really helped our team be able to provide and receive feedback in a more effective way and overall improve our programing. (STEM Specialist, Educator Survey)*
- *And that collaboration and discussion among those four grade-level teachers became even more valuable because we all had to put our heads together and say, "Okay, what is this? How do we do it? Is it in the book yes or no? And if it wasn't, what do we do about it?" (Educator, Focus Group)*

Educators described the importance of reflection in their STEM PL and professional growth.

The professional learning participants in the focus groups and the EOY Educator Survey shared how reflective practices contributed to the overall impact of their professional learning experiences and supported their learning and growth as STEM educators. This often occurred during structured times during PL activities (or asynchronously via Canvas), while others shared how they reflected on the impact of implementing the new knowledge, resources, or content they gathered while participating in one (or several) STEM AC-supported PL opportunities. The following quotes provide examples how educators described the role of reflection in their PL experiences:

- *I don't really enjoy sitting there and typing up about my reflection, but it actually is helpful to me to do that. Sometimes as I'm reflecting, I'll realize things that I hadn't put together before. ... It was just a good practice for me to have that as one of the assignments (Educator, Focus Group)*
- *Those reflections [the PL Facilitator] has us do have been really, really helpful for me. So I set a personal goal last month to do more wait times. And since [TeachFX] tracks how many wait times we do, I was able to really actually see did I improve or not. And I found that specifically after students respond, I needed to work on waiting for that. And then the next time I recorded, I did work on that and it helped increase how much my kids were participating. So that's something very specific that the reflection helped me do. (Educator, Focus Group)*
- *And through the reflective process of our Canvas course, we've seen or heard teachers see that immediate impact. And then when we have our monthly sessions, they're able to come and collaborate and discuss how they've gotten that success in their classrooms, but also discuss some problem areas that they have in specific rooms so that they're able to problem solve together on that specific framework. (Site Leader, Interview)*

Educators reported that ongoing engagement in PL activities throughout the year was instrumental to their success.

Over half (55%) of EOY Educator Survey respondents reported spending 20 hours or more engaging in various PL activities (PLCs, workshops, virtual sessions, coaching, TeachFX, video reflections, and assessment development) during the 2023-24 AY. The majority of respondents reported gathering data during lessons (86%), reflecting on it (82%), and modifying their strategies (90%) at least once per month. Qualitative findings suggest that educators participating in multi-series or monthly PL experiences engaged in deeper learning and instructional transformation. Participants valued ongoing reflection, refinement, and feedback, with monthly sessions keeping content and learning at the forefront. After applying new knowledge, follow-up sessions provided a space to share successes and seek support for challenges. The following quotes exemplify how educators described the value of regular engagement in PL activities:

- *I just found that by doing those monthly things, it did make me more acutely aware of, "Oh, this is what I specifically want to work on this month." Gave me a guide as to where to go with it. (Educator, Focus Group Interview)*
- *Some of [the participating teachers] had totally revamped their practice completely. They burned their classroom to the ground and started over. They wouldn't have done that if we didn't have... every month we met, and we talked about a different aspect, and they tried something else, then they come back and report on that and talk about it in a reflection. (Site Leader, Focus Group)*
- *So it builds in a support system with us and with others that are learning that way. And so we try to do a lot. It's not a one and done, it's over time. So it's multiple, four sessions, five sessions. Some of them are seven sessions, some of them were once a month. So we really were trying to create a community that values what we value so that they can take it into their classrooms. (Site Leader, Interview)*

Time and competing demands emerged as a potential challenge for a subset of participants.

Over 80% of respondents on the UEPC 2023-24 EOY Educator Survey moderately or strongly agreed that there was sufficient time for collaboration during their PL experiences ($N = 699$, 80%) and to practice their learnings between sessions ($N = 673$, 82%). However, time-related challenges emerged as a theme in the qualitative analysis of educators' comments and open-ended survey responses. Specifically, these reports revealed concerns regarding the duration of the professional development sessions, limited time to implement new content and resources from the PL in practice or competing demands that made it difficult to integrate new learning effectively. The following quotes exemplify how educators described challenges related to time:

- *I wish I had more time for implementation. I had SO many other (non-related) teaching responsibilities this year, that I felt I couldn't dedicate as much time as I wanted to trying new ideas. (Classroom Educator, Educator Survey)*
- *I felt like the one development I took was extremely well facilitated. If anything, we ran out of time most of the time. We didn't have enough time to delve into some of the things that we would've liked to delve into, like the problems. So maybe have a little more time. But with how much materials we had, I think it was actually respectful for them to not take more time, so I don't know if there's a good solution to that. (Educator, Focus Group Interview)*
- *The challenge has been time. Teachers are so heavily dictated in their instructional minutes and curriculum. This rigid time allocation prevents the integration of STEM-related activities. We adjusted the instructional minutes for math to reflect the implementation of number sense outside of the use of the curriculum to clarify that there is more to teach than just the curriculum lesson. (Site Leader, Spring Implementation Survey)*
- *The biggest challenges in our LEA are related to competing interests. ELA takes the lion's share of planning and professional learning time. In addition, it seems like it is the only discipline that is monitored by the state, district, or administrators. I think the best strategy to support our efforts would be to put STEM disciplines on the leadership radar. To overcome the barriers, we have worked with individual principals in our LEAs to provide just what that schools need. (Site Leader, Spring, Implementation Survey)*
- *I think increased spacing between classes would have been beneficial. (Classroom Educator, Educator Survey)*

STEM AC’s Role as an Intermediary

The Grant Program Manager introduced monthly webinars for site leaders to support grant programs. These webinars covered grant management, program goals, and available support from STEM AC and offered opportunities for reflection, connection, and improvement. Each webinar session focused on one or more of the following recommendations or future program possibilities that the Grant Manager developed in collaboration with the evaluation team based on key successes and challenges identified during the prior PL Grant funding cycle:

- develop shared understandings of high-quality STEM education, instruction, and assessment,
- increase engagement and collaboration among educators and administrators at participating schools and districts with STEM AC and those at other grant programs that are focusing on similar initiatives,
- encourage voluntary participation in STEM PL activities,
- involve educators in the design and facilitation of these activities,
- balance the establishment of dedicated time for educators to regularly engage in STEM PL with flexibility in the scheduling of these activities,
- cultivate supportive and mutually beneficial professional relationships among educators.
- highlight instructional strategies to differentiate instruction and promote the development of student STEM identity, and
- provide coaching supports and resources that scaffold educators’ application of their learnings and the implementation of new STEM instructional practices.

Specifically, site leaders shared what they were already doing in alignment with these recommendations, resources that supported success in this regard, and their reflections about actionable steps they might take to improve on these things during future implementation.

Evaluation of STEM AC's support for grant implementation and improvement was assessed through Fall 2023 and Spring 2024 Implementation Surveys, focusing on their role as grant managers and support for continuous improvement and fostering a community of practice. Data from Fall 2023 indicated that both scales had reliability estimates above 0.90. Table 4 shows the number of items on each rating scale, reliability estimates, and example items. Educator surveys and focus groups provided additional insights into these supports.

Table 4. Scales for Assessing STEM AC's Role as an Intermediary

Scale	# of Items	Reliability Est. (Cronbach’s α) ⁵	Example Items
Grant Management	6	0.90	➤ Established clear program quality standards ➤ Provided direct management support & assistance to grantees
Supporting Continuous Improvement	7	0.94	➤ Provided grantees with useful materials and resources to improve program implementation ➤ Provided opportunities for grantees to identify actionable steps for improving the implementation of their programs

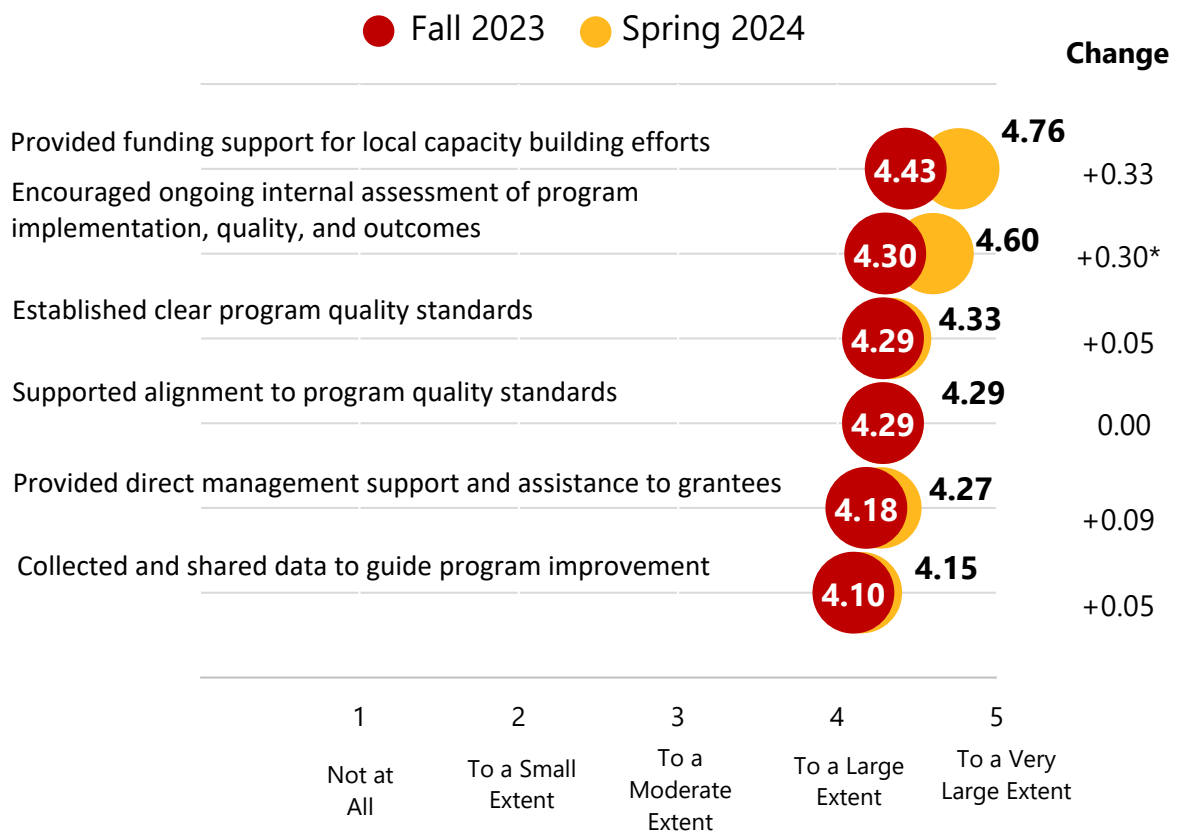
Source: UEPC Fall 2023 Site Leader Implementation Survey

⁵ Based on 27 site leaders’ ratings on the Fall 2023 Implementation Survey.

Site leaders indicated that STEM AC was successful in supporting programs as a grant manager and as a partner in supporting continuous improvement and communities of practice.

As shown in Figure 2, on average site leaders reported that STEM AC fulfilled their roles and responsibilities as grant managers to a large or very large extent. Across the year, site leaders' average ratings increased on most items in the scale, with the extent of agreement increasing modestly, but significantly, for the item related to STEM AC's efforts, encouraging ongoing internal assessment of program implementation, quality, and outcomes across participating sites.

Figure 2. Reported Changes in Average Rating of STEM AC's Role Managing Grant Programs

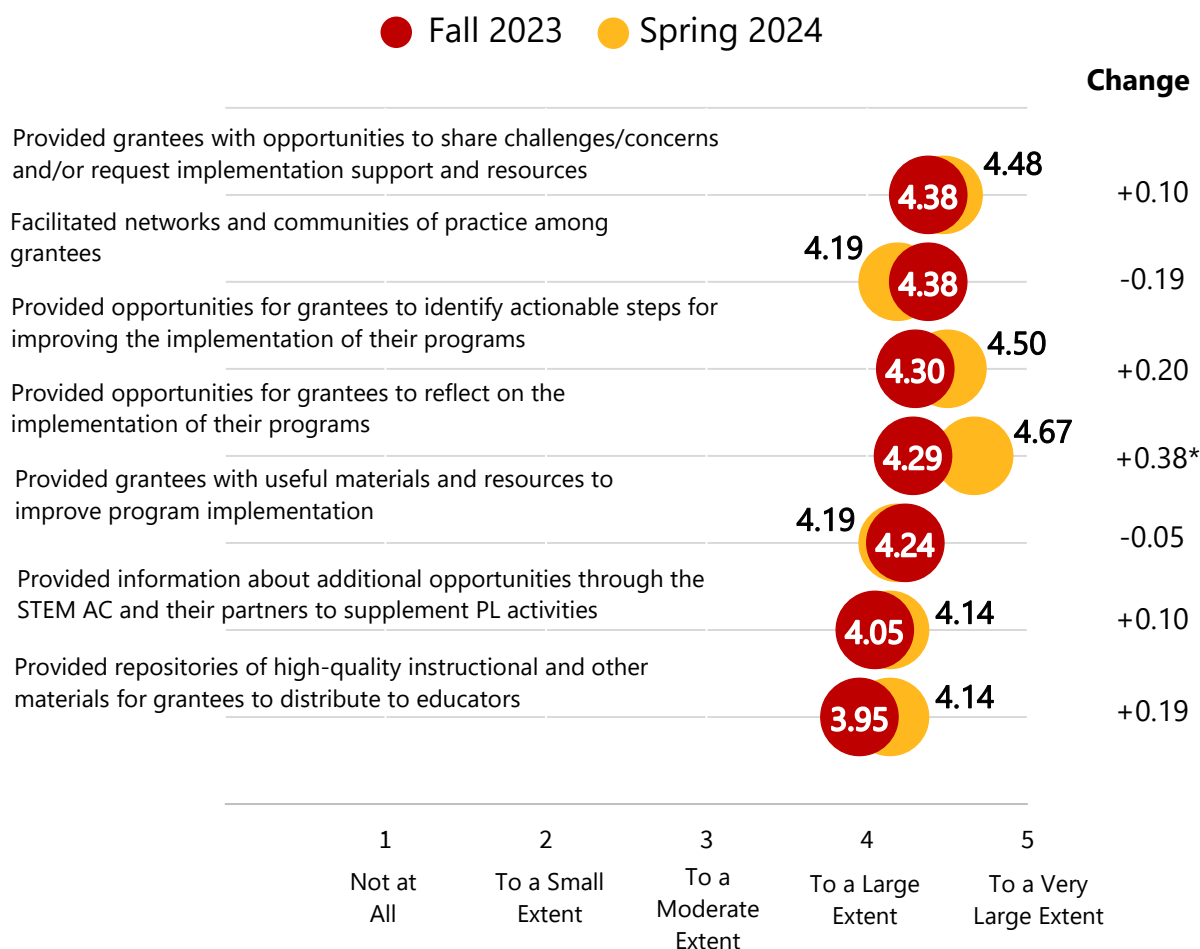


*Statistically significant difference at $p < .05$.

Source: UEPC Fall 2023 & Spring 2024 Site Leader Implementation Surveys

Results from the Fall 2023 and Spring 2024 Implementation Surveys revealed that site leaders agreed to a large extent that STEM AC supported continuous improvement in various ways with little change between the beginning and end of the year (see Figure 3 on the next page). An exception was the extent to which STEM AC offered opportunities for grantees to reflect on the implementation of their programs, which increased by 0.38 points on the five-point scale – a statistically significant and practically meaningful change of modest size.

Figure 3. Reported Changes in Average Ratings of STEM AC's Role Supporting Continuous Improvement



* Statistically significant difference at $p < .05$.

Source: UEPC Fall 2023 & Spring 2024 Site Leader Implementation Surveys

Site leaders appreciated regular and responsive interactions with the Grant Manager to support implementation.

On the Site Leader Implementation surveys, several site leaders said they appreciated the regular virtual webinar sessions with the Grant Manager to discuss progress on their professional learning grant and collaborate with leaders from other participating programs. Site leaders also mentioned the consistent availability of the Grant Manager to answer any questions or provide support if they could not participate in the live sessions. The following quotes provide examples of how site leaders described how STEM AC supported implementation through regular, responsive interactions:

- *I couldn't make most of the monthly meetings because they often overlapped with our professional learning cohort dates or other mandatory work meetings, but I appreciated that they were available to view after the fact. I also appreciate that [the Grant Manager] is quick to respond to any questions I have.* (Site Leader, Spring Implementation Survey)

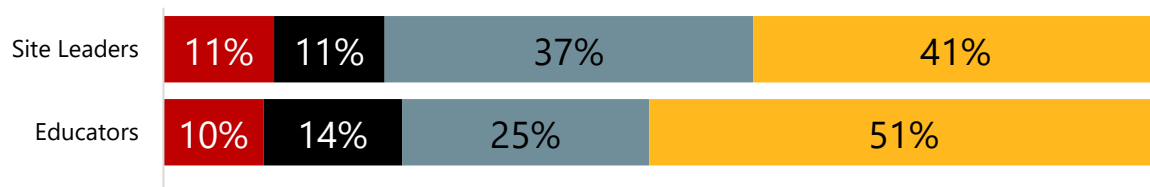
- *The STEM AC is constantly available for support and is helpful in ensuring the grants are used in ways that are beneficial to us. (Site Leader, Spring Implementation Survey)*
- *We are immensely grateful for the invaluable support of the STEM Action Center. Without their assistance, we would not be able to effectively promote STEM education in our 63 schools. Their contributions have been instrumental in fostering innovation, empowering teachers, and enriching the learning experiences of our students. (Site Leader, Spring Implementation Survey)*
- *The STEM Action Center continues to refine its practices year after year and support students, teachers, administrators, and schools / districts all across the state! Thank you for your continued commitment to excellence! (Site Leader, Spring Implementation Survey)*
- *The STEM AC is very responsive to needs, willing to work with grantees, and supportive. I often have questions and feel very comfortable asking. I know that my questions will be answered in a timely manner and that all possible support will be offered. This partnership is outstanding and I appreciate EVERYTHING the STEM AC does. They provide a plethora of opportunities for the teachers in my district. (Site Leader, Fall Implementation Survey)*

The STEM Action Center provided participants with access to important implementation support resources.

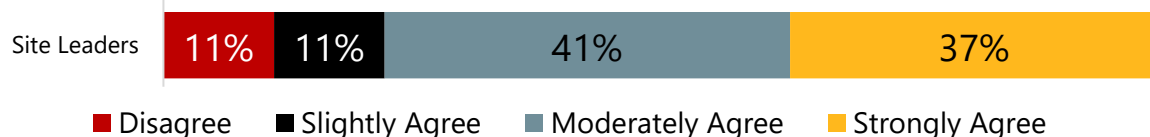
Beyond STEM AC being a primary funding stream for many PL opportunities, site leaders and PL participants noted the value of the support from STEM AC employees and/or instructional supports and resources available through the grant program. For example, the STEM AC's Resource Library (https://stem.utah.gov/directory-resource_lib/), a repository of virtual instructional resources aligned with Utah curriculum and standards. As shown in Figure 4, both site leaders and participating educators overwhelmingly agreed that materials provided by the STEM AC to support STEM PL were shared with participants. Furthermore, site leaders also generally agreed that they regularly shared these materials with other leaders at their school, district, or agency throughout the 2023-24 AY.

Figure 4. Site Leader and the Educator Agreement about Distribution of STEM AC Materials

Materials Provided by STEM AC Regularly Shared with Participants



Materials Provided by STEM AC Regularly Shared Other Leadership at Site

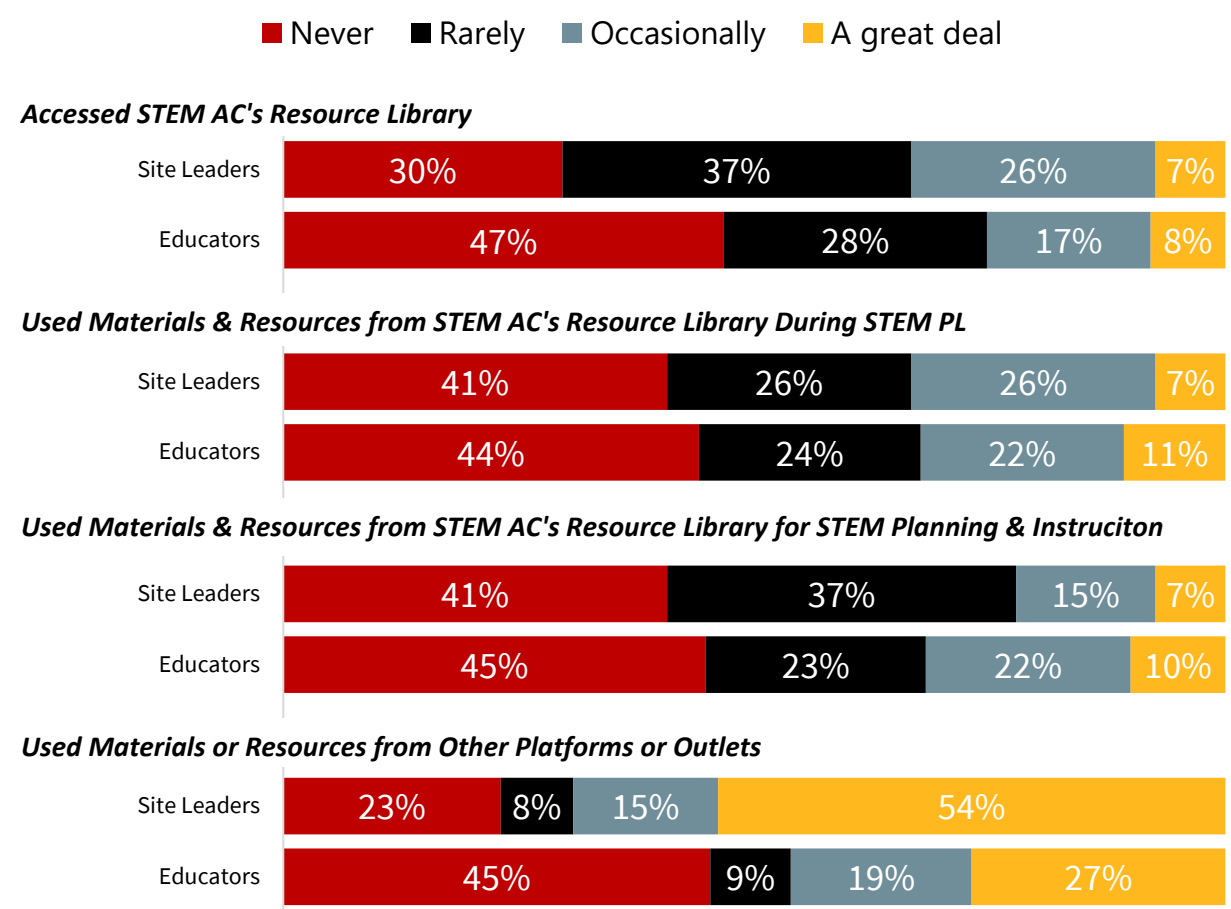


Sources: UEPC Spring 2024 Site Leader Implementation Survey, UEPC 2023-24 EOY Educator Survey

Despite reports of the dissemination of STEM AC resources across sites, site leaders and educators report infrequent use of the STEM Resource Library, a key resource the Grant Program Manager highlighted in webinars and shared with site leaders via email this year. As Figure 5 shows, nearly half

(47%) of educators reported not accessing the STEM Resource Library this academic year. Although 70% of site leaders have accessed it, their usage during STEM planning and instruction is on par with that of educators. Additionally, 54% of site leaders and 27% of educators reported frequently using resources from other platforms. These findings suggest a need to investigate why the STEM Resource Library is underutilized (e.g., challenges related to time or competing priorities) and how its accessibility or alignment with educators' needs can be improved.

Figure 5. Site Leader and Educators' Reported Frequency of Specific Material & Resource Use as Part of STEM PL



- *I utilize the STEM AC resource library to help me with science resources and consumable materials for all of my science units. I am sure there is much more that I am not remembering right now. (Classroom Educator, Educator Survey)*
- *I used Mystery Science, SEEd [Utah Science with Engineering Education] storylines, and Gizmos. I'm not sure how to access STEM AC Resource Library. (Classroom Educator, Educator Survey)*
- *It would be helpful to have a bit more of an overview of the library of resources - we didn't use them much because we just weren't aware they were there until part-way through our grant year. Doing that at the beginning would be great! (Other Coach/Specialist: District Science Specialist, Educator Survey)*
- *All of the resources helped me have a better understanding of the techniques that I can use to improve how I structure and teach my lessons. I continually look-back on the resources to catch new details to incorporate and use the mobile app to monitor how the new techniques are received in the classroom in practice. (Educator Role Not Specified, Educator Survey)*
- *We were all given a lot of manipulatives. One of those was a vertical board with packs of erasers and markers for students of three. Then, we had little sticks that put them in random groups of three. (Educator, Focus Group)*

Educator Outcomes

This section outlines key findings about the three educator outcomes as measured by the 2023-24 End-of-Year (EOY) Educator Survey and focus group sessions. First, results related to educators' self-reported changes in their (1) STEM Identity & Interest, (2) STEM Planning and Instructional Practices, and (3) STEM Teaching Self-Efficacy will be presented along with additional information about these measures. Then, an item-level results summary is presented for each of the educator outcome scales, along with as themes from qualitative analyses to offer a more nuanced picture of how participation may have been associated with these outcomes. This section concludes with a summary of findings from analyses that investigated the impact of PL design features on educators' reported outcomes, including the number of hours educators engaged in PL activities throughout the year, their perceptions of alignment between PL activities program expectations and PL standards, and whether they facilitated PL activities at their site or not.

Participating educators reported significant gains across all three outcomes of interest.

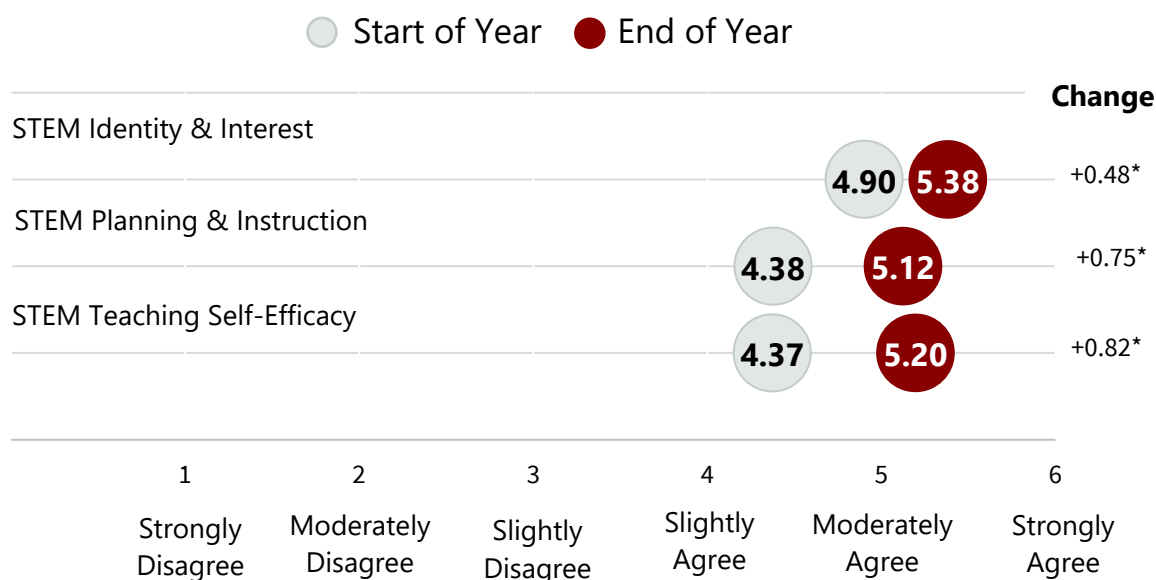
The UEPC 2023-24 EOY Educator Survey included three sections that asked respondents to indicate the extent to which they agreed with statements to measure their (1) STEM Identity & Interest (i.e., enjoyment of STEM and sense of community/belonging among other STEM educators), (2) STEM Planning and Instructional Practices (i.e., how effective educators feel about their ability to the planning and instruction of STEM lessons), and (3) STEM Teaching Self-Efficacy (i.e., educators' sense of confidence teaching STEM content and perception of the sufficiency of their STEM content knowledge to support successful instruction). Table 5 shows the number of items on each of these rating scales, reliability estimates based on educators' ratings of their knowledge at the end of the 2023-24 AY (see Appendix B for measures of reliability for ratings at the start of the AY), and some example items.

Table 5. Scales for Assessing Educator Outcomes

Outcome	# of Items	Reliability Est. (Cronbach's α) ⁶	Example Item(s)
STEM Identity and Interest	5	0.909	➤ I enjoy the subject matter of STEM. ➤ I feel part of a community of teachers who teach or integrate STEM content.
STEM Planning and Instruction	9	0.956	➤ I can plan STEM lessons based on each student's learning level. ➤ I can help students apply their STEM knowledge to real-world situations.
STEM Teaching Self-Efficacy	10	0.958	➤ I have an in-depth understanding of the STEM concepts I teach. ➤ I am confident in my ability to teach or integrate STEM concepts into my instruction effectively.

Source: UEPC 2023-24 EOY Educator Survey

As shown in Figure 6, average ratings across these three scales at the start and end of the year indicated overall agreement with the items representing these outcomes. The results also showed modest to moderate average growth statistically for all three outcomes as educators participated in PL activities over the 2023-24 academic year. These increases were moderate for educators' reported STEM teaching self-efficacy (average of +0.82 points before and after on the 6-point scale) and STEM planning and instructional practices (+0.75 points). Increases in educators' STEM identity & interest were also significant but modest (+0.48 points) according to how we defined practically meaningful differences in the context of this report.

Figure 6. Average Reported Changes Across Educator Outcomes

*Statistically significant difference at $p < .05$ based on paired samples t-tests.

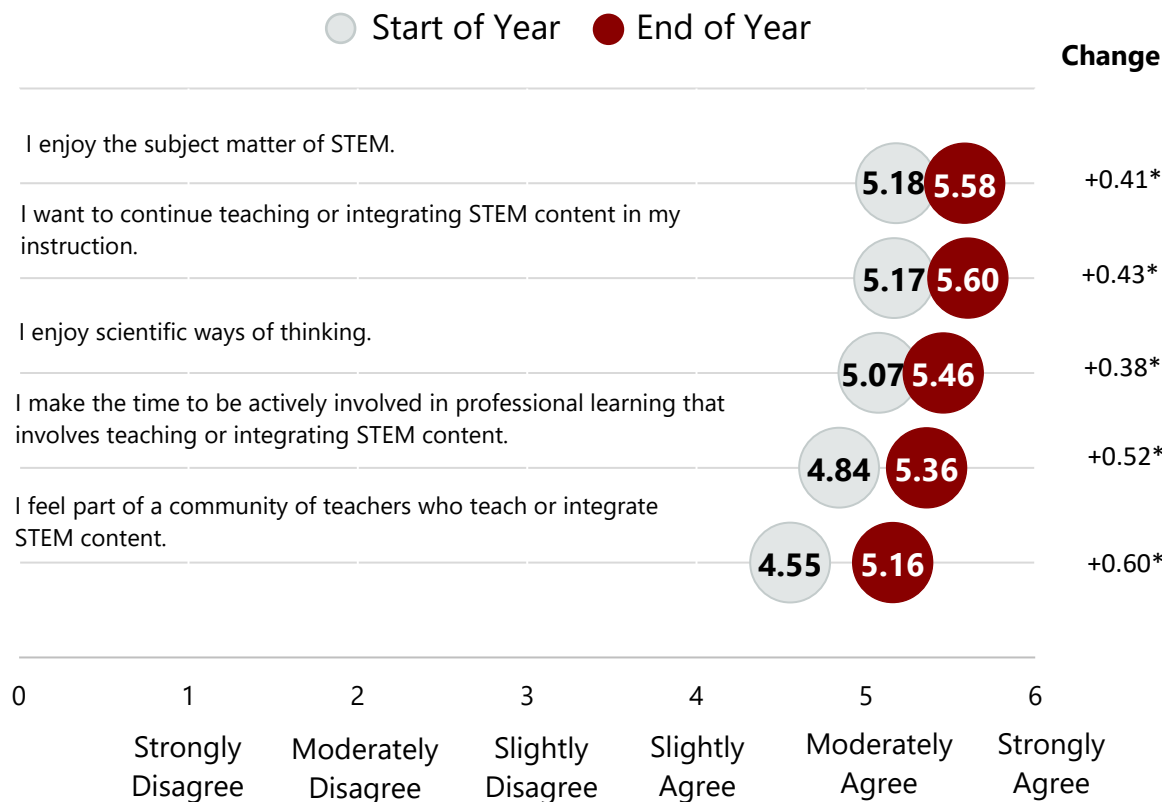
Source: UEPC 2023-24 EOY Educator Survey

⁶ Based on between 640 and 668 educator ratings for their knowledge at the end of the 2023-24 AY.

Educators’ self-ratings of their sense of community with other STEM educators meaningfully grew.

Figure 7 presents the average ratings for five items assessing educators' STEM interest and identity. Educators generally agreed with all items at both time points, with ratings increasing modestly to moderately (+0.41 to +0.60 scale points on average) over the year. Although the item related to the sense of community was rated significantly lower than the others at both time points, it also increased the most during the year (+0.60), suggesting that grant-supported PL enhanced educators' sense of community. The top-rated items suggest that educators enjoyed STEM content and were keen to continue incorporating it into their teaching.

Figure 7. Reported Changes in STEM Identity & Interest



*Statistically significant difference at $p < .05$ based on paired samples t-tests.

Source: UEPC 2023-24 EOY Educator Survey

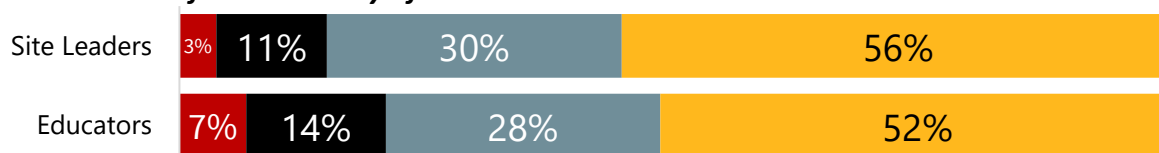
PL activities cultivated excitement for STEM education and instruction and educators expanded their STEM communities of practice.

As shown in Figure 8, responses to the EOY UEPC Educator Survey suggested that more than 90% of educators agreed that participation in the STEM PL activities at their site made them feel like part of a community of STEM educators (93%) and expanded their STEM professional community/network (93%). Furthermore, more than half of respondents indicated strong agreement, 52% and 51%,

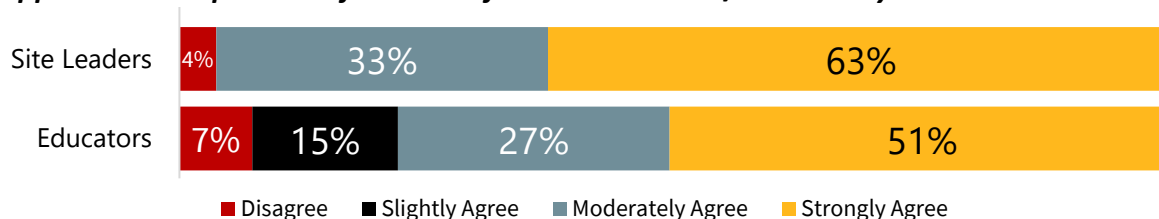
respectively. Similarly, on the spring 2024 Implementation Survey, 96% of site leaders agreed that participating in the STEM AC PL Grant program supported the expansion of their school, district, or agency's STEM professional community/network.

Figure 8. Perceptions of Impact on Community Building and Networking Among Participating STEM Educators

Feel Like Part of a Community of STEM Educators



Supported the Expansion of STEM Professional Network/Community



Sources: UEPC Spring 2024 Site Leader Implementation Survey, UEPC 2023-24 EOY Educator Survey

Additionally, the educators who participated in the grant-related PL experience shared in both focus group interviews and the UEPC EOY Educator Survey that their participation in STEM PL activities was instrumental in helping them establish STEM education communities of practice (CoP). For some practitioners, this occurred via learning opportunities with their grade-level teams. For others, these emerged through opportunities to work with individuals they usually do not collaborate with within their school or different schools/districts.

Specifically, the CoPs served as a tool for educators to work collaboratively to strengthen their STEM pedagogical skills and content knowledge. Several participants shared in the focus group interviews and the open-ended responses on the EOY Educator Survey that they appreciated the time spent developing lesson plans and assessments (or assignments) during the sessions. Specifically, participants appreciated the time spent on their content or grade-level standards to understand better what is expected of students for standard mastery. Participants also appreciated the activities during the sessions, such as role-playing (e.g., playing the role of a “student”) to learn how their students should experience classroom instruction, how they can promote student collaboration, and how to improve content engagement. The following excerpts illustrate how participants described the role of STEM communities of practice in their PL experiences:

- *And it did give me a community of teachers beyond my school community that I could turn to and that I could ask questions and that I could turn to be able to participate in.* (Educator, Focus Group Interview)
- *The most meaningful thing I have gotten out of it is that I am far better at engaging my students in collaborative (rather than individual) learning than I was before these activities. I am excited to feel*

confident in my ability to get students talking with their peers and learning together. (Classroom Educator, Educator Survey)

- *And so for the second collaboration cycle, I felt brave and wanted to try to do more of an engaging hands-on activity with the difficult student group, hoping that that would enable them to be more successful and to pay better attention in what we were doing and just have things go better with that group. And what ended up happening was there were some successes. (Educator, Focus Group)*

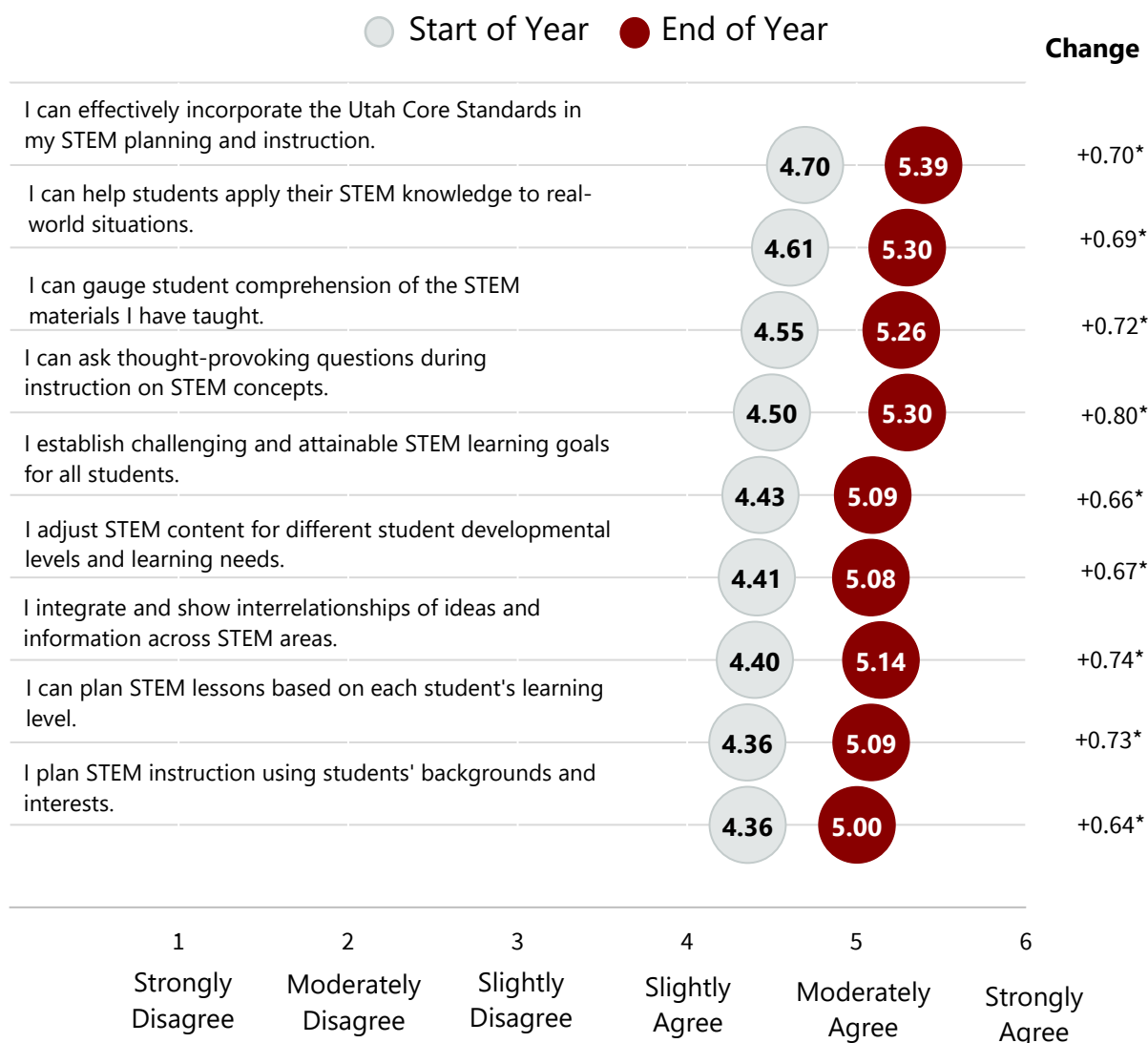
Furthermore, many educators reported being more enthusiastic, confident, and effective teachers after their participation. As a result, participants reported being more motivated and willing to learn new concepts (growth mindset) and implement what was learned. The following quotes provide insight into instances when teachers expressed increased enthusiasm or interest on account of participation in STEM PL:

- *Getting more ideas and ways to promote student learning and thinking. I love it. (Classroom Educator, Educator Survey)*
- *I have really enjoyed trying to integrate more math tasks into my daily math routines and am excited to continue learning and growing in this area. (Classroom Educator, Educator Survey)*
- *I think sometimes it's easy as a math teacher to be like, "Everybody hates my subject because it's boring." And I feel like learning from this experience, different ways of engaging students in math class, I think has made me feel like math can be exciting, math can be engaging, math can be more fun than maybe I previously thought. So I think it's increased my positive feelings towards teaching math. (Educator, Focus Group Interview)*
- *I actually wanted to quit before last year. And [our site leader] gave us this book and it energized me more to think differently. And then I am way more energized to stay in the profession than I have been ever. I actually left the profession for a while and then came back. So I think on a personal level, it made us more engaged and happy to teach math. I feel happier teaching math now. (Educator, Focus Group Interview)*
- *Many teachers in the Building Thinking Classrooms cohort are asking to keep going! They love the strategies they have tried, and many are now ready to do a much deeper implementation next year. (Site Leader, Spring 2024 Implementation Survey)*

Participation in PL activities impacted educators' STEM planning and instructional practices in various ways, particularly in their reported ability to ask thought-provoking questions during STEM instruction.

As shown in Figure 9, the highest rated items at both time points reflected educators' ability to effectively incorporate Utah Core Standards in their STEM planning and instruction. The average ratings for STEM Planning and Instruction items fell between "slight" and "moderate" agreement at the start of the year and between moderate and strong agreement at the end of the year. All changes in ratings across items were statistically significant ($p < .01$) and moderate in nature, meaning that these increases were between 0.5 and 1 point in magnitude on the six-point scale. Participants reported the greatest increase in their ability to ask thought-provoking questions during instruction on STEM concepts (+0.80 points on the five-point scale).

Figure 9. Reported Changes in STEM Planning and Instruction



*Statistically significant difference at $p < .05$ based on paired samples t-tests.

Source: UEPC 2023-24 EOY Educator Survey

Instructional resources focused on the practical implementation of educators' learnings and supported educators' STEM instructional planning and pedagogical skill development.

Although this was not the case at all sites, many participating educators appreciated receiving new resources during the STEM PL activities, particularly those they could use in their classroom immediately. Several educators who participated in grant-supported PL opportunities cited receiving instructional resources and hands-on materials they could directly apply to their instruction. Furthermore, participants appreciated it when PL activities provided them with instructional resources that were accessible and did not have to be purchased to implement their newly learning instructional strategies, as well as the usefulness of resources specific to grade levels or content areas. Multiple educators described the value of scaffolded implementation of their learnings as a part of a

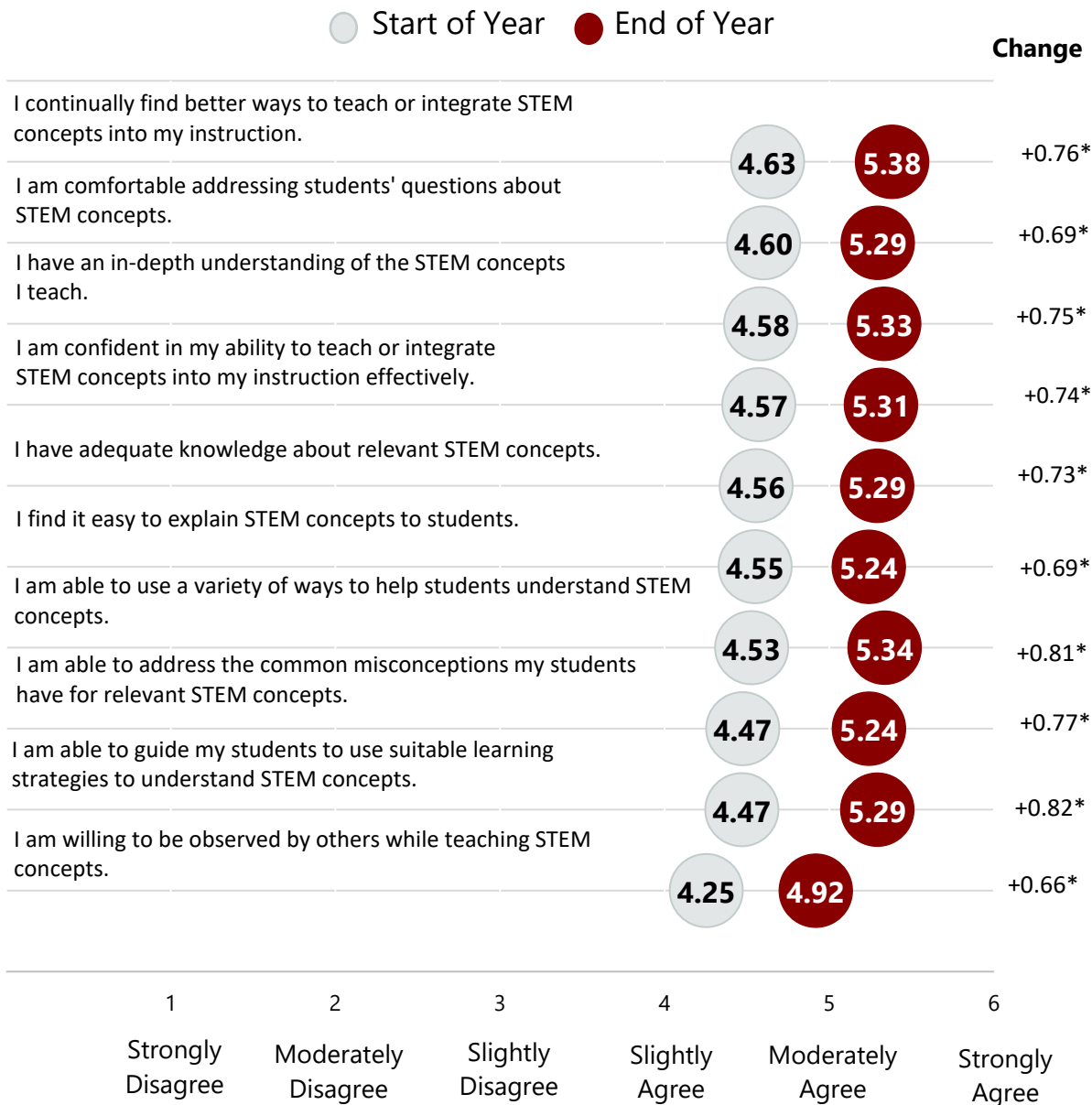
community of practice and how this allowed them to develop their pedagogical skills. The following quotes from participants highlight some of the ways PL experiences supported STEM planning and instruction via resources support and a focus on the practical applications of their learnings:

- *I loved the courses that I took where a presenter taught me how to teach a well-constructed lesson with fun activities to go along with it. Having most all of the manipulatives ready to go for each lesson was very helpful, because it encouraged me not to put off the lesson that needed to be taught at a certain time. The books that were given to me helped integrate my lessons into other areas were beautiful and so enjoyed by my students. (Classroom Educator, Educator Survey)*
- *Providing resources for teachers to easily implement the strategies and practices has been a key component of our success. (Site Leader, Fall Survey)*
- *One of the resources that they introduced that I really love is Picture Perfect. And at those SEEd Flex Courses, they give you access to that for your grade level. And then, they also give you the picture books to use for the lesson. And I think those lessons are so great for integration, like some others have mentioned, with reading and writing. (Educator, Focus Group)*
- *I think we also, for the math collaboration day, [our facilitator] help[s] us to pull all the resources together so we don't need to look around, just that gather the resources, really save our time. (Educator, Focus Group)*
- *Ongoing PD with Feedback Loops: Regular professional development sessions where teachers created lessons, received feedback, made adjustments, and then applied these lessons contributed significantly. This iterative process ensured continuous improvement and refinement of their teaching practices. (Site Leader, Spring Survey)*

Participation in PL activities positively impacted educators' perception of their STEM teaching self-efficacy.

As shown in Figure 10, participating educators reported they slightly or moderately agreed with statements about their perceived STEM teaching self-efficacy at the beginning of the 23-24 AY. Over the year, educator self-ratings increased moderately (i.e., +0.66 to 0.82 points on average on the six-point scale), in many cases moving from “slight” and “moderate” agreement to “moderate” and “strong” agreement overall. Concerning relative differences in responses between items, the findings indicated that they remained less willing to be observed by others while teaching STEM concepts.

Figure 10. Reported Changes in STEM Teaching Self-Efficacy



* Statistically significant difference at $p < .05$ based on paired samples t-tests.

Source: UEPC 2023-24 EOY Educator Survey

The tools, strategies, and communities of practice established during PL experiences supported the development of educators' knowledge of STEM content and confidence implementing more engaging STEM instruction.

Educator focus groups and responses to the UEPC EOY Educator Survey suggested that engagement in PL activities, particularly CoPs, helped them develop their STEM content knowledge and confidence. Specifically, some educators described gaining a better understanding of content standards or new ways students could think about and learn content. Others described how

participating and learning new strategies made them feel better able to wield effective instructional approaches to promote deeper student engagement and thinking. Some new teachers (or those new to specific grade levels or content areas) also cited how the PL opportunities (e.g., coaching) provided quality support to help them feel less overwhelmed and gave them tools and strategies to feel more successful in their roles. The following quotes exemplify educator comments on how PL activities increased their STEM instructional confidence:

- *For me, I feel like I've never understood how to effectively implement the math practices of the standards. This training has taught me how to implement those practices, not just teach to the standards of mathematics.* (Educator, Focus Group Interview)
- *I think that one of the most meaningful was when our standards were restated in a doable sentence. I felt like I could teach it instead of feeling overwhelmed.* (Classroom Educator, Educator Survey)
- *Using the Teach FX and the Ambitious Science Teaching methods have significantly impacted my teaching. I had made goals to increase cognitive engagement and improve my questioning and dialogue with students. Both of these areas have had significant improvements which are reflected in student learning achievements.* (Classroom Educator, Educator Survey)
- *Rather than surfacing the one way that is expected for a kid to learn, [participating educators] can see five ways that kids thought about it [the content] really quickly.* (Site Leader, Focus Group)

Educators perceived positive changes in student engagement and achievement as a result of applying their PL learnings.

Participants reported that their PL experiences positively influenced their students. As educators applied new instructional strategies and resources in their classrooms, they reported increased student engagement and deeper thinking. Educators noted increased student interest and enjoyment, particularly in math, and observed improved understanding and learning achievements. The following quotes illustrate how educators described the perceived impact of their PL experiences and related successes regarding student behavior:

- *The STEM professional learning helped my students learn on a deeper level.* (Classroom Educator, Educator Survey)
- *And I think it's showing up in our classrooms as well. Our kids are feeling more confident. And they are getting exposed to a variety of ideas, because we are going to... We go to a conference and present, but we also are attending classes and getting other ideas and networking that way. So, it has given us not just an opportunity to share with our district, but to share with a larger audience, and then to also bring that back to our own classrooms.* (Educator, Focus Group Interview)
- *In terms of the STEM, my students have mental longevity now that they didn't really have before and they have the ability to explain how they got their answer. And for me, as their teacher, it's nice to have that added piece because they might say something and I'm, "What? No, that has nothing to do with it." But really when they can explain their thinking and how they got there, I'm like, "Oh, I see your connections, I see how you got there and I see why you thought it was that."* (Educator, Focus Group Interview)
- *Rather than surfacing the one way that is expected for a kid to learn, [participating educators] can see five ways that kids thought about it [the content] really quickly. And then the kids find value and*

confidence in their own thinking because they all get to the same point eventually. It's validating that they don't have to learn a set of steps. (Site Leader, Focus Group)

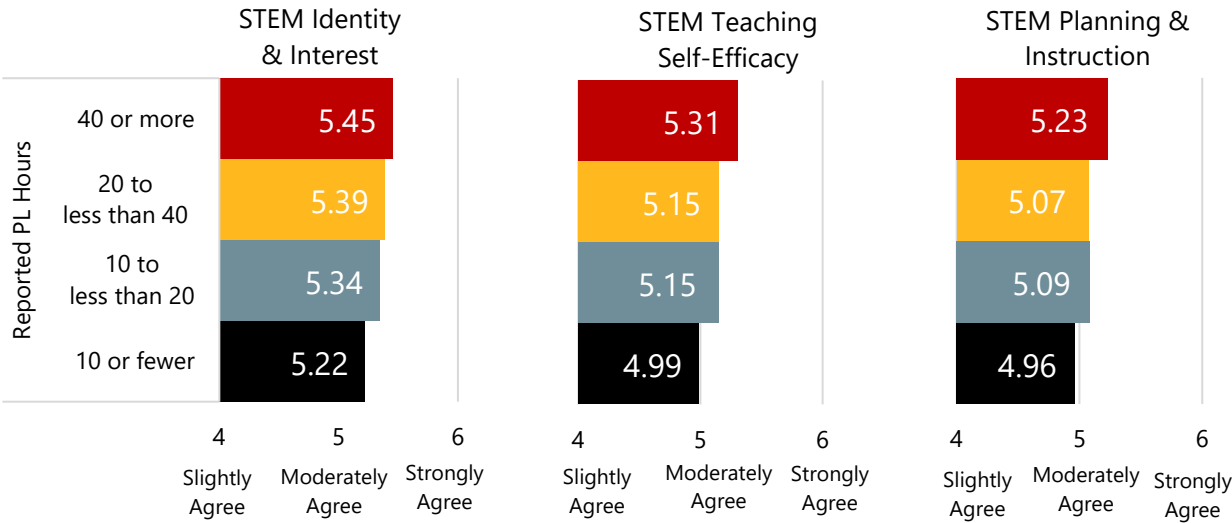
Several notable factors impacted participants' outcomes.

The following sections highlight factors associated with educator outcomes as measured by the 2023-24 EOY Educator Survey. The first section below discusses how time spent on PL activities is associated with educator outcomes. The following section explores how educators' ratings of PL activity implementation were related to their outcomes. Analyses assessing differences by site geographic location (e.g., on or off the Wasatch Front) are not reported here as none were significant.

Greater engagement in STEM PL activities is associated with increases in STEM outcomes for educators, particularly for STEM planning and instruction.

There were meaningful differences between the time educators reported participating in PL activities (<=10 hours, 10-20 hours, 20-40 hours, >=40 hours) and their self-reported outcomes. Reported hours in PL activities included participation in PLCs, in-person or virtual sessions, coaching activities, TeachFX activities, video-based peer- or self-reflection, and/or assessment creation. Descriptive trends show higher self-ratings across outcomes with greater time engaged in STEM PL. After accounting for educators' initial ratings on these measures, the educators who reported spending 40 hours or more on PL activities this year consistently had significantly higher average ratings at the end of the year for all three outcomes when compared to those who reported spending fewer than ten hours overall.

Figure 11. Average Educator Outcome Ratings by Hours of Engagement in PL Activities



Source: UEPC 2023-24 EOY Educator Survey

Educator reports of experiencing higher-quality PL implementation were associated with higher mean scores across all three educator outcomes.

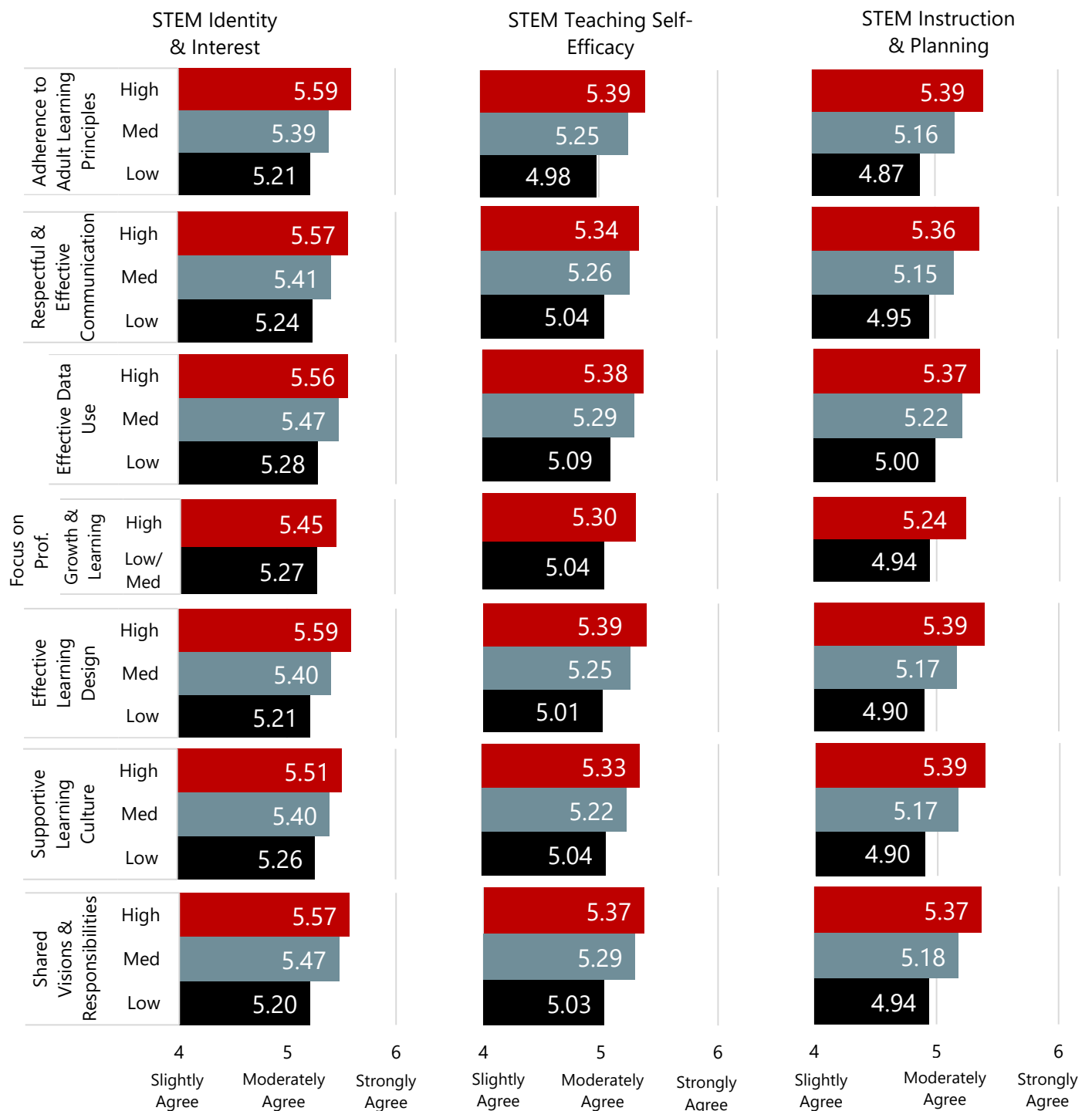
The UEPC EOY Educator Survey asked participants to rate their PL experiences across a set of seven factors associated with quality PL that included adherence to adult learning principles, respectful and effective communication, effective data use, focus on professional growth and learning, effective

learning design, supportive learning culture, and shared visions and responsibilities. Educators' ratings of these dimensions were divided into three evenly sized groups reflecting the relative differences between each group, which we refer to as low, medium, and high. Given the particularly low variability in educator ratings of professional growth and learning, there are only two groups for this PL factor. Multiple regression models were used to estimate the association between the level of PL implementation and the three educator outcomes while controlling for educators' start-of-the-year self-ratings on each outcome and unobserved differences associated with each site (e.g., site-fixed effects).

As seen in Figure 12, results illustrate that greater levels of PL implementation are reliably associated with higher self-ratings across each of the three educator outcomes. In all cases, educators in the medium and high groups for each dimension of PL implementation had significantly ($p < .05$) higher outcomes than those in the low group, and increases were monotonic from the low to the high group in all cases. By our definition, the differences in estimates for the outcomes between the, low and medium groups were quite small, whereas the differences between the low and high groups were meaningful and modest to moderate in size. Furthermore, when comparing differences in outcomes between the low and high groups, the largest differences were observed for instruction and planning (on average, 0.41 points higher), and the smallest differences were observed for interest and identity (on average, 0.31 points higher). Adherence to adult learning principles and effective learning design were associated with the largest differences between the low and the high groups across outcomes, with the largest associations for educator instruction and planning. In contrast, a supportive learning culture that focused on professional growth and learning showed the smallest difference between group outcomes.

These findings suggest that educators' experiences of higher-quality PL implementation are meaningfully related to higher self-ratings across outcomes, particularly for their instruction and planning, even after accounting for initial self-ratings and variability across grant sites.

Figure 12. Average Ratings on Educator Outcomes for Groups Rating PL Implementation Factors Relatively High, Medium or Low



Note: The low or low/medium-low groups serve as the reference group across dimensions of PL. All differences between the lowest and medium/highest groups are statistically significant ($p < .05$), though not all are significant.

Source: UEPC 2023-24 EOY Educator Survey

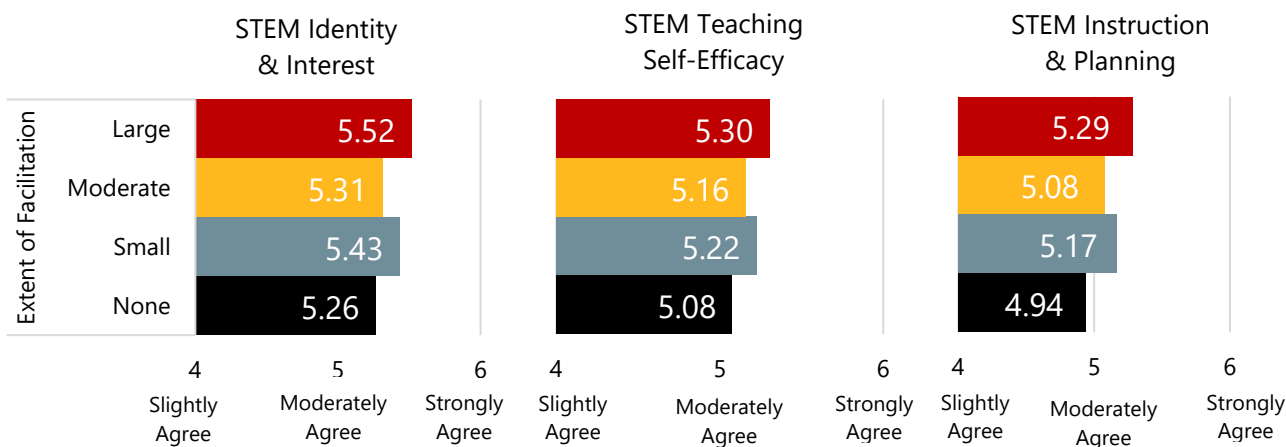
Those educators who reported participating in the facilitation of PL to a large extent had meaningfully higher average scores across the educator outcomes, particularly for instruction and planning.

The educator survey asked participants about the extent of their involvement in facilitating STEM PL sessions during the year. Educators (N = 875) described their participation in facilitating PL as either none (17.3%), to a small extent (21.0%), to a moderate extent (35.3%), or a large extent (26.4%). Multiple regression models were used to estimate the association between the levels of facilitation and each of the three educator outcomes while controlling for educators’ start-of-the-year self-ratings on each outcome and unobserved differences associated with each site (e.g., site-fixed effects).

On average, educator participation in facilitating PL at any level was associated with increased outcomes. However, the extent of participation seems to matter, with educators who facilitated PL to a large extent having meaningfully higher scores across all three outcomes than those who did not facilitate PL, particularly for educators’ instruction and planning.

These findings suggest that greater educator engagement in facilitating STEM PL may support outcomes.

Figure 13. Average Ratings on Educator Outcomes for Groups of Educators Reporting Various Levels of Involvement in PL Activity Facilitation



Source: UEPC 2023-24 EOY Educator Survey

Conclusions

During the 2023-24 academic year, 34 sites in Utah received funding from the STEM AC's Professional Learning Grant Program to support STEM professional learning opportunities. The main goals were to enhance educators' STEM knowledge and improve their teaching practices to increase student engagement. Educators participated in learning new strategies, obtaining resources, and receiving compensation, aligning their individual goals with the broader program goals.

Reports from site leaders indicated that over half of the program goals were achieved or nearly achieved in the first year, with progress made on almost all goals. Both site leaders and educators confirmed that implementing PL activities met program expectations and standards. Educators emphasized the importance of effective PL design, including modeling, observation, collaboration, and consistent engagement throughout the year. Although most participants reported having sufficient time for collaboration and implementation of their learnings, a subset of educators still noted challenges regarding the duration of PL activities, time to implement new strategies and resources in practice, or competing demands that made it difficult to integrate new learning effectively.

Site leaders and educators generally view STEM AC as a grant manager and partner, supporting grant management activities and continuous improvement through cultivating a community of practice. Site leaders and educators specifically mentioned appreciating the financial support offered through the grant program and the access to implementation resources provided by STEM AC. Additionally, several site leaders mentioned appreciating the regular and flexible interactions with the Grant Manager and the general responsiveness to their needs.

Analysis of educators' ratings of their current and previous STEM identity and interest, STEM planning and instructional practices, and STEM teaching self-efficacy indicated statistically significant gains across these three key outcomes during the 2023-24 academic year. Furthermore, participant reports suggested that engagement in grant-supported activities helped educators establish and expand their STEM communities of practice and bolstered their excitement for STEM education. PL activities also positively impacted educators' instructional practices. Many educators described perceived changes in their students' interest in STEM content and depth of thinking due to their participation. Furthermore, educators described valuing how PL activities maintained a focus on practical implementation and provided them with access to ready-to-use instructional materials, both of which were viewed as instrumental to their success.

Analyses that considered key implementation factors and their impacts on educator outcomes found that educators' experiences of higher quality PL implementation were meaningfully related to higher self-ratings across outcomes, particularly for their instruction and planning, even after accounting for initial self-ratings and variability across grant sites. Additionally, results indicated that greater educator engagement in facilitating STEM PL may support outcomes.

Considerations

The following considerations aim to build on the STEM AC PL Grant program and address growth opportunities identified during the 2023-24 evaluation. These considerations are intended to support program improvement and promote impactful practices across participating sites to support STEM PL activities and STEM education broadly.

Consideration #1: Strategically align PL activities with school, district, and educator needs.

At sites experiencing challenges with implementation, consider developing new ways PL goals or activities can be better aligned with school and district strategic goals, as well as educators' own learning needs. Although programs have made considerable progress towards their goals this year, program data suggested that about a third of the educators targeted for PL activities did not participate. Also, some site leaders noted that competing demands hindered PL implementation. It is important to ensure that STEM PL activities are viewed as something other than an additional task or initiative for educators in participating programs to add to their already busy schedules. By aligning PL with broader priorities and personalizing it to educators' needs, PL can be more relevant and less burdensome. Furthermore, expanding the incorporation of adult learning principles in all program experiences, including the PL webinars with site leaders, would help ensure grant-supported STEM PL activities are practical, hands-on, reflective, and grounded in educators' professional practice. At sites experiencing challenges gaining traction, leadership might consider new ways to collaborate with administrators at their schools, LEAs, or educational agencies to align PL activities with strategic goals or determine if other supports are necessary to encourage educators to prioritize their STEM PL.

Consideration #2: Enhance resource availability, communication, and relevance.

It is important to ensure all participants are aware of and have access to the STEM resource library and other available resources and instructional supports through the STEM Action Center and their partners. Although the Grant Manager has taken steps to increase awareness of the STEM Resource Library (i.e., sharing during recorded webinars and emails) and the majority of site leaders moderately or strongly agreed that they regularly shared the materials and resources provided by STEM AC with participating educators and other leaders at their school, district, or agency, there is still room for improvement in the dissemination of these materials.

Specifically, although the vast majority of participating educators agreed that their site leaders regularly shared information and resources from the STEM AC with them, less than half of these same educators reported accessing the STEM AC's Resource Library, using these materials during their PL activities, or applying them in practice. Site leaders reported slightly more usage, but it would be beneficial to determine how to improve accessibility and use of the existing materials available through STEM AC or how best to tailor the available materials to the needs of participating educators. As a part of this process, it is important to ensure that the resources provided include a variety of hands-on materials and resources that educators can immediately use in their instruction. While some educators have valued receiving classroom resources and supplies, other participants reported not receiving any instructional materials. This highlights the need to consistently include practical resources in all PL activities. PL facilitators across sites might collectively reflect on better identifying and increasing access to more targeted, hands-on, and ready-to-use instructional materials and resources in PL sessions. Similarly, there may be opportunities to expand how STEM AC directly

shares materials and resources across sites or how they support and cultivate communication and idea sharing across sites to support these collective efforts more systematically.

Consideration #3: Support educators' regular and active engagement in PL activities, including facilitation, focusing on implementing their learnings in practice, and promoting professional learning communities (PLCs) that allow educators to collaborate, share best practices, and reflect on their learning.

Findings showed that the amount of time educators reported engaging in PL activities and the extent to which they facilitated PL activities were associated with improved outcomes. Furthermore, educators perceived regular engagement in PL activities, particularly those that focused on implementing their learning in practice and included collaboration with others, to be instrumental to their successes. These results suggest that it would be beneficial for site leaders and PL facilitators across participating programs to find ways to get educators involved in the design and facilitation of PL activities. Programs might also consider how to design PL activities and resources to intentionally scaffold the application of educators' learnings to their practice and develop PL communities that allow educators to collaborate, share best practices, and reflect on their learning. Establishing additional PLCs within and across sites and a dedicated platform for site leaders to share resources and lessons learned on how best to facilitate sustained collaboration could continue to expand and build upon the communities of practice emerging within participating sites.

Although many site leaders and educators highlighted the value of collaboration during their STEM PL experiences, educators could support each other better and improve instructional practices by increasing the frequency and depth of PLC interactions. Specifically, although the results suggest that participating sites have provided sufficient time for collaborative activities, some educators still indicated that more structured and frequent collaboration could benefit their professional growth. To support continuous improvement, site leaders might consider ways to structure activities that allow educators to sustain their engagement throughout the year and more regularly solicit participant feedback about pacing to ensure educators have sufficient time to engage in PL activities meaningfully. Additionally, the establishment of additional PLCs within and across sites, as well as the establishment of a dedicated platform for site leaders to share resources and lessons learned related to how best to facilitate sustained collaboration, could continue to expand and build upon the communities of practice emerging within participating sites.

Consideration #4: Support site leaders in aligning their PL activities with key implementation factors, particularly adherence to adult learning principles and elements of effective learning design.

Findings indicated that relatively higher ratings among educators related to the quality of PL implementation were associated with modest to moderate increases in target outcomes, particularly in relation to their STEM planning and instructional practices and the extent to which educators perceived their PL activities to adhere to adult learning principles and features of effective learning design. Specifically, a review of the lowest rated items on these two key implementation factors (see Appendix G) suggests that sites may be able to give participants more changes to inform the construction of the PL content and ensure that structures or processes were in place to allow participants to choose when, where, and with whom to collaborate.

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Appendices

Appendix A. Map of Data Sources Used to Answer Each Evaluation Question

Table 6. Evaluation Questions and Data Sources

Evaluation Questions	Data Collection Methods				
	Site Leaders			Participating Educators	
	Fall & Spring Surveys	Webinar Surveys ⁷	Interviews	End-of-Year Survey	Focus Groups
Program Implementation					
EQ1. To what extent were grant activities implemented as planned and consistent with goals across participating sites (e.g., holding planned sessions, engaging educators initially targeted for participation, making progress towards planned goals)?	✓		✓		
Alignment of PL Activities with Program Expectations & PL Standards					
EQ2: How and to what extent were professional learning activities at participating sites aligned with program expectations and professional learning standards?	✓			✓	✓
STEM AC's Role as an Intermediary					
EQ3. In what ways and to what extent did STEM AC serve as an intermediary to support the implementation of the Professional Learning Grant program? How effective was STEM AC at facilitating collaboration opportunities and supporting the development of communities of practice among program leadership across participating sites to support implementation?	✓		✓		

⁷ Note: The site leader webinar surveys were administered to site leaders after each monthly webinar. These were designed to gather participants' perspectives on session quality, relevance, and usefulness. Additionally, the survey sought to understand how the webinars supported program implementation, promoted community building, effectively shared useful materials and resources and met its intended objectives. The objectives for each of these sessions can be found in Appendix C. The survey findings were compiled into memos shared with the program manager to support program improvement and continuous improvement. A copy of one of these memos can be found in Appendix D. Site leaders who attended the webinar session or watched the recording of the session were invited to participate in the survey. Due to low attendance and response rates, the number of participants for these surveys ranged from two to eight site leaders per session out of the 35 participating sites. The analysis of session survey data involved calculating descriptive statistics (e.g., means, percentages) for the items on each session survey. Due to the small sample sizes, no further analyses were performed on this data, and the program manager was advised to interpret the results in the formative memos with caution.

Educator Outcomes					
EQ4. To what extent did educators identify as a STEM educator, feel competent in their own STEM-related knowledge and skills, feel confident in their STEM instructional skills, and engage in STEM planning and integration activities (i.e., the educator outcomes of interest for the STEM AC PL Grant Program)? - To what extent did educator outcomes <u>change</u> as a result of their participation in grant activities? - To what extent did <u>changes</u> in educator outcomes <u>differ</u> based on the extent and nature of engagement in grant activities?					
			✓	✓	✓

Appendix B. Scale Reliabilities & Lists of Items

Table 7. Reliability Estimates for Response Scales

Scale	Respondents	# Items	# Valid Responses	% Valid Responses	Cronbach's Alpha
<i>STEM Teaching Self-Efficacy</i>					
Start of Year Ratings	Educators	10	459	49.0%	0.975
End of Year Ratings	Educators	10	640	68.3%	0.958
<i>STEM Identity and Interest</i>					
Start of Year Ratings	Educators	5	553	59.0%	0.939
End of Year Ratings	Educators	5	668	71.3%	0.909
<i>STEM Planning and Instruction</i>					
Start of Year Ratings	Educators	9	473	50.5%	0.976
End of Year Ratings	Educators	9	666	71.1%	0.956
<i>PL Implementation</i>					
Effective Learning Design	Educators	9	703	74.5%	0.901
Supportive Learning Culture	Educators	9	737	78.1%	0.927
Effective Data Use	Educators	3	725	76.8%	0.859
Respectful & Effective Communication	Educators	3	797	84.4%	0.858
Shared Vision and Responsibility	Educators	3	771	81.7%	0.804
Focus on Professional Growth and Learning	Educators	3	771	81.7%	0.831
Adherence to Adult Learning Principles	Educators	9	700	74.2%	0.937
<i>STEM AC Grant Management</i>					
Fall 2023	Site Leaders	6	27	79.4%	0.901
Spring 2024	Site Leaders	6	27	79.4%	0.792
<i>STEM AC's Role Supporting Continuous Improvement</i>					
Fall 2023	Site Leaders	7	27	79.4%	0.936
Spring 2024	Site Leaders	7	27	79.4%	0.897

Table 8. PL Implementation Factors Scales and Items

Scale	Items
	Site Leaders: To what extent do you agree that the following statements are reflective of the STEM-related professional learning activities held at your school, district, or agency during this reporting period? Educators: The grant-related STEM professional learning activities I participated in this academic year...
<i>Effective Learning Design</i>	1. Clarified the purpose of our collaborative work. 2. Provided equal opportunity to participate by providing multiple sessions, series, or scheduling options. 3. Effectively leveraged technology to expand educator access to professional learning opportunities. 4. Allocated sufficient time for collaboration. 5. Provided flexibility to support spontaneous collaborations among participants. 6. Ensured structures or processes were in place to allow participants to choose when, where, and with whom to collaborate. 7. Focused on building the competence of all participants. 8. Intentionally developed participant skills for successful collaboration. 9. Provided effective structures for reciprocal accountability.
<i>Supportive Learning Culture</i>	1. Regularly recognized participant contributions. 2. Regularly recognized the assets of each participant. 3. Actively promoted idea sharing. 4. Actively promoted routine feedback - both seeking and receiving. 5. Viewed failure as part of professional practice. 6. Honored professional expertise and experience. 7. Regarded all participants as developing or emerging leaders. 8. Adapted to educators' professional learning needs and desired areas of growth. 9. Effectively leveraged technology to increase educator agency and voice in professional learning activities.
<i>Effective Data Use</i>	1. Data was used to prioritize actions to reach a shared vision of high-quality STEM PL. 2. Participants individually examined data and analyzed student work to enhance STEM-related teaching and learning. 3. Participants collaboratively examined data and analyzed student work to enhance STEM-related teaching and learning.
<i>Respectful & Effective Communication</i>	1. Participants engaged in dialogue that reflected a respect for diverse ideas. 2. Participants used effective inquiry strategies to seek clarification and/or expand on each other's ideas. 3. Participants' interactions reflected mutual trust and respect.
<i>Shared Vision and Responsibility</i>	1. Professional learning facilitators and participants shared responsibility for student learning. 2. Professional learning facilitators and participants shared a vision for STEM professional learning that focused on improving student learning. 3. Participants were actively involved in creating high expectations to increase students' STEM-related achievement.
<i>Focus on Prof. Growth & Learning</i>	1. Participants expanded their learning (i.e. knowledge, skills, and strategies). 2. Participants learned strategies to address diverse student needs. 3. Participants were provided with sufficiently scaffolded opportunities to apply their learning to practice.
<i>Adherence to Adult Learning Principles</i>	1. Were designed to ensure consistency between the different sessions and issues or topics addressed. 2. Were designed to deepen educators' understanding of Utah Core Standards. 3. Were designed to regularly integrate and/or align STEM professional learning activities and goals with Utah Core Standards. 4. Gave participants the chance to inform the construction of its content. 5. Gradually introduced new material to allow for deeper engagement and understanding. 6. Allocated sufficient time for participants to practice new skills between meetings. 7. Routinely ensured that individual participants' needs and interests were addressed. 8. Offered sufficient opportunities for participants to exchange their views, knowledge, and experiences on STEM-related topics. 9. Offered useful suggestions and resources for immediate application to practice.

Table 9. STEM AC as an Intermediary Scales and Items

Scale	Items
<i>Grant Management</i>	1. Established clear program quality standards 2. Supported alignment to program quality standards 3. Encouraged ongoing internal assessment of program implementation, quality, and outcomes 4. Collected and shared data to guide program improvement 5. Provided funding support for local capacity building efforts 6. Provided direct management support and assistance to grantees 7. Provided information about additional opportunities through the STEM AC and their partners to supplement professional learning activities 8. Provided repositories of high-quality instructional and other materials for grantees to distribute to educators supporting grant activities at their site
<i>Supporting Continuous Improvement</i>	1. Facilitated networks and communities of practice among grantees 2. Provided opportunities for grantees to reflect on the implementation of their programs 3. Provided grantees with opportunities to share challenges/concerns and/or request implementation support and resources 4. Provided opportunities for grantees to identify actionable steps for improving the implementation of their programs 5. Provided grantees with useful materials and resources to improve program implementation

Table 10. Educator Outcome Scales and Items

Scale	Items
<i>STEM Teaching Self-Efficacy</i>	1. I have adequate knowledge about relevant STEM concepts. 2. I have an in-depth understanding of the STEM concepts I teach. 3. I am able to address the common misconceptions my students have for relevant STEM concepts. 4. I am able to guide my students to use suitable learning strategies to understand STEM concepts. 5. I am able to use a variety of ways to help students understand STEM concepts. 6. I find it easy to explain STEM concepts to students. 7. I am comfortable addressing students' questions about STEM concepts. 8. I am confident in my ability to teach or integrate STEM concepts into my instruction effectively. 9. I continually find better ways to teach or integrate STEM concepts into my instruction. 10. I am willing to be observed by others while teaching STEM concepts.
<i>STEM Identity and Interest</i>	1. I enjoy the subject matter of STEM. 2. I make the time to be actively involved in professional learning that involves teaching or integrating STEM content. 3. I feel part of a community of teachers who teach or integrate STEM content. 4. I enjoy scientific ways of thinking. 5. I want to continue teaching or integrating STEM content in my instruction.
<i>STEM Planning and Instruction</i>	1. I can plan STEM lessons based on each student's learning level. 2. I can gauge student comprehension of the STEM materials I have taught. 3. I can help students apply their STEM knowledge to real-world situations. 4. I can ask thought-provoking questions during instruction on STEM concepts. 5. I can effectively incorporate the Utah Core standards in my STEM planning and instruction. 6. I integrate and show interrelationships of ideas and information across STEM areas. 7. I adjust STEM content for different student developmental levels and learning needs. 8. I plan STEM instruction using students' backgrounds and interests. 9. I establish challenging and attainable STEM learning goals for all students.

Appendix C. STEM PL Grant Program 23-24 AY Webinar Objectives

Table 11. List of Objectives for STEM AC PL Webinar Sessions Held During the 2023-24 AY

Session	Objectives
September 2023	1. Develop an increased awareness of what has been learned about effective STEM PL using program data and feedback. 2. Engage in collaboration and network building with like-minded educators from around the state. 3. Reflect on program implementation and consider refinements based on data-informed discussion. 4. Reflect on the overarching focus areas of the STEM AC PL Grant Program.
October 2023	1. Ensure clarity around webinar focus area: Developing shared understandings of high-quality STEM education, instruction, and assessment. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.
November 2023	1. Ensure clarity around focus area: Encouraging voluntary participation in STEM professional learning activities and involving educators in the design and facilitation of these activities. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.
December 2023	1. Ensure clarity around focus area: Providing coaching supports and resources that scaffold educators' application of their learnings and the implementation of new STEM instructional practices. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.
February 2024	1. Ensure clarity around focus area: Balancing the establishment of dedicated time for educators to regularly engage in STEM professional learning and flexibility in the scheduling of these activities. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.
March 2024	1. Ensure clarity around focus area: Balancing the establishment of dedicated time for educators to regularly engage in STEM professional learning and flexibility in the scheduling of these activities. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.
April 2024	1. Ensure clarity around focus area: Highlighting instructional strategies to differentiate instruction & promote the development of students' STEM identities. 2. Share resources that are available to help grant sites improve this focus area. 3. Increase conversation across grant sites about focus area with intent to improve this focus area. 4. Provide opportunities for self-reflection regarding specific components of this focus area.

Appendix D. Example Webinar Memo



STEM ACTION CENTER PROFESSIONAL LEARNING (PL) GRANT PROGRAM: OCTOBER 2023 WEBINAR FEEDBACK SURVEY RESULTS

This report is provided to the STEM Action Center Professional Learning Grant Program Manager to guide planning and continuous improvement efforts throughout the duration of the grant cycle. Results from these surveys will also be analyzed by the UEPC for annual reports as well.

Prepared by the Utah Education Policy Center

November 2023



Bridging Research, Policy, and Practice

The Utah Education Policy Center (UEPC) is an independent, non-partisan, not-for-profit research-based center at the University of Utah founded in the Department of Educational Leadership and Policy in 1990 and administered through the College of Education since 2007. The UEPC mission is to bridge research, policy, and practice in public schools and higher education to increase educational equity, excellence, access, and opportunities for all children and adults.

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Suggested Citation: Zemaitis, J. & Rorrer, A. (2023). *STEM Action Center Professional Learning (PL) Grant Program: October 2023 Webinar Feedback Survey Results*. Salt Lake City, UT: Utah Education Policy Center.

Summary of Findings

The summary of findings outlined below, and the contents of this report, are based on the responses of five STEM AC Professional Learning (PL) Grant Program representatives who attended or watched the recording of the *PL Grant Webinar Session* held on Saturday, October 11th. Participants' responses were de-identified and summarized to provide descriptive information to inform planning and continuous improvement efforts by the program manager. Due to the very small sample size and response rate (16%), extreme caution should be taken when interpreting the implications of the information presented. Furthermore, we strongly advise considering these findings in combination with other relevant information that program personnel may have available before making decisions or changes to program activities.

Key Successes:

- All five respondents rated the overall quality of the session as **very good** (80%) or **good** (20%).
- More than 75% or more of the respondents **strongly agreed** that the webinar session made them feel like they were a part of a community of STEM educators and that it supported the expansion of their STEM professional learning community.
- Multiple educators mentioned appreciating the opportunity to learn about the focus of other programs during these sessions.
- A couple educators mentioned the usefulness of materials that provided visions/definitions for STEM education.

Potential Areas for Improvement

- Due to the extremely small sample size and the fact that most response ratings were relatively positive, the ratings of respondents did not reveal any notable trends related to improvement.
- However, a couple of respondents made suggestions related to the following when asked to provide questions for consideration and ideas for future sessions:
 - Requesting more clarity about the focus area for the session at the outset and spelling out this focus area on all materials (i.e., slides, discussion notes page)
 - Reconciling interdisciplinary definitions of STEM that were shared with the fact that some grants only focus on one subject area.
 - Discussing specifics and sharing strategies related to educator recruitment and participation across participating sites.

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STEM Action Center Professional Learning (PL) Grant Program: October 2023 Webinar Session Feedback Survey

This report provides the results from the analysis of responses from STEM AC Professional Learning (PL) Grant Program representatives on the feedback survey administered following the *PL Grant Webinar Session* held on Saturday, October 11th. The survey was emailed directly to program representatives following the session. Those who were not able to attend the session, but instead watched the video recording of the online session, were also invited to respond to the survey and share their feedback. Participants' responses were de-identified and summarized to provide descriptive information to inform planning and continuous improvement efforts by the program manager.

Sample of Respondents

The following table provides information about who responded to the survey. Of the 31 PL Grant Program representatives who were sent email survey invitations, five responded to the survey (response rate of 16%). Respondents were required to indicate that they had attended the webinar on Saturday, October 11th or that they watched the recording of the webinar in order to proceed with completing the survey. Due to the small sample size and response rate (16%), caution should be taken when interpreting the implications of the information presented. Furthermore, we recommend considering these findings in combination with other relevant information that program personnel may have available before making decisions or changes to program activities.

Table 1 - Respondent Information

Respondent Characteristic	Amount	Percent
Total Responses (responded/invited)	5/31	16%
Survey Completion Status		
Fully-Completed Responses	4	80%
Partially-Completed Responses	1	20%

Session Feedback Results

Figure 1 - Attendee Perspectives on Overall Session Quality

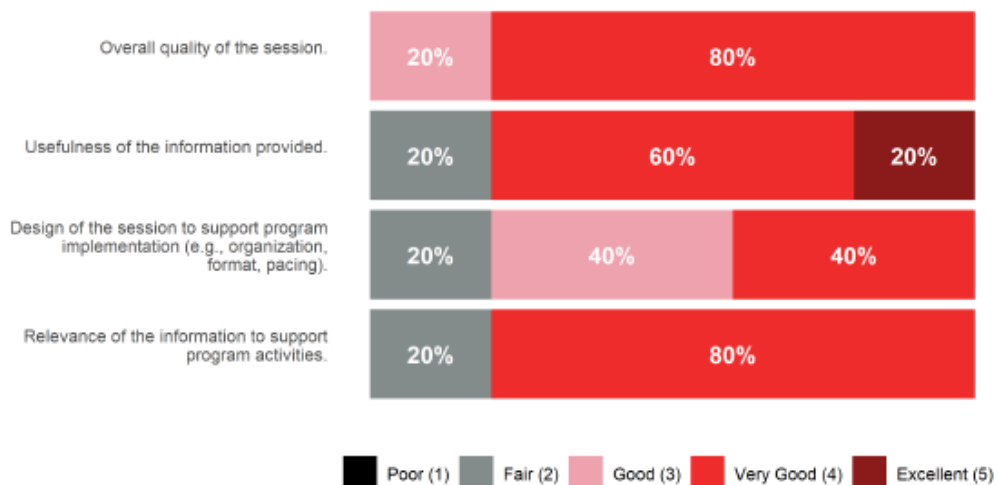


Figure 2 - Attendee Perspectives on Implementation Support Provided During Session

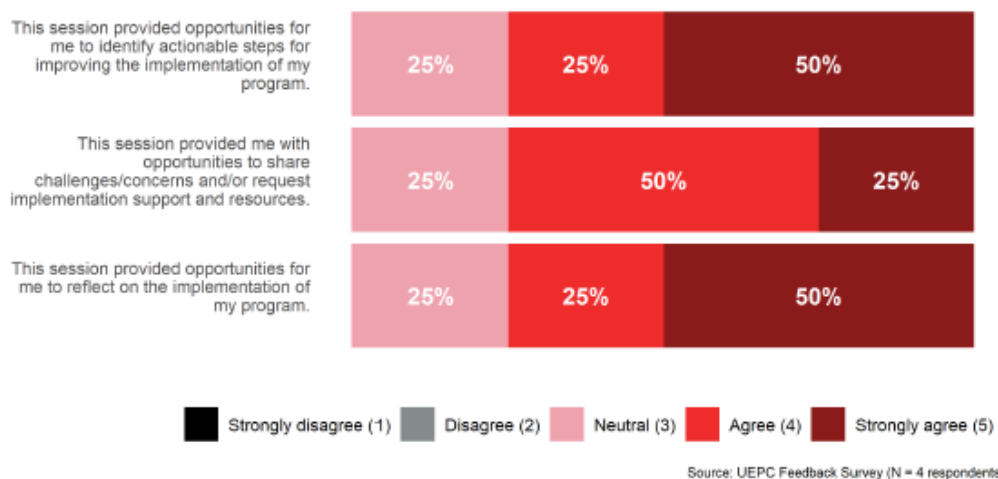
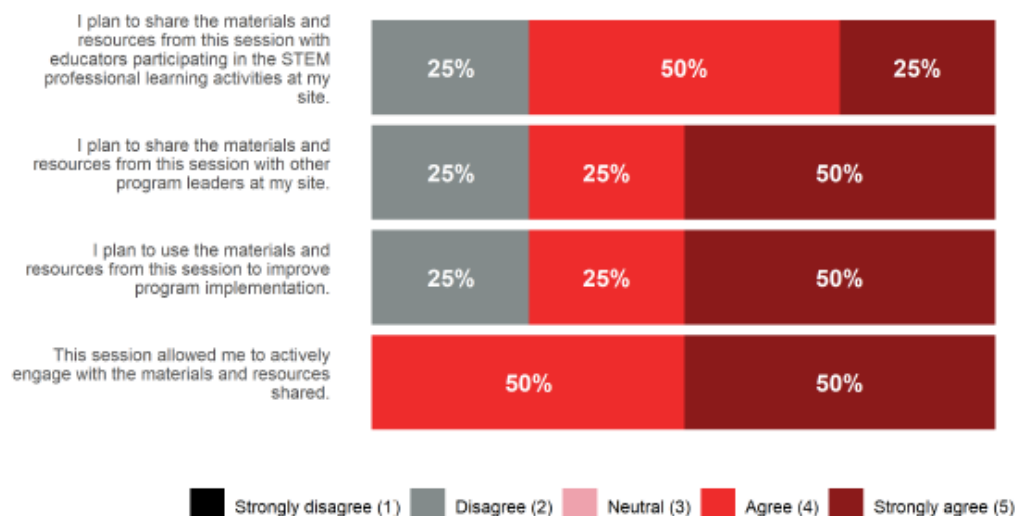
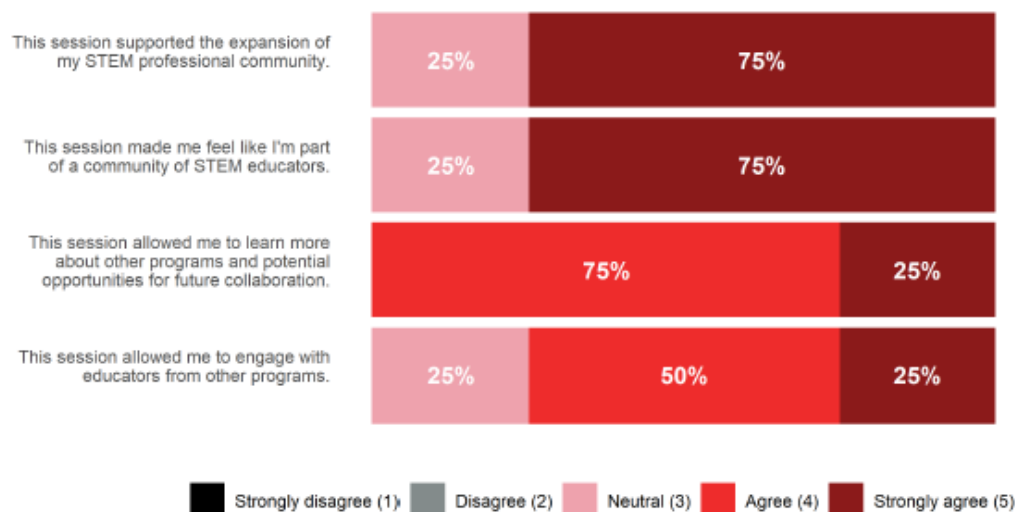


Figure 3 - Attendee Perspectives on Materials & Resources Provided During Session



Source: UEPC Feedback Survey (N = 4 respondents)

Figure 4 - Attendee Perspectives on Community Building



Source: UEPC Feedback Survey (N = 4 respondents)

Table 2. Comments About the Most Useful Session Materials and Resources

#	Comment
1	The STEM definition graphic is helpful. And, hearing the focus of other LEAs.
2	STEM Vision! That document was fantastic and hearing from other districts!

Figure 5. Attendee Ratings of How Well the Session Objectives Were Met

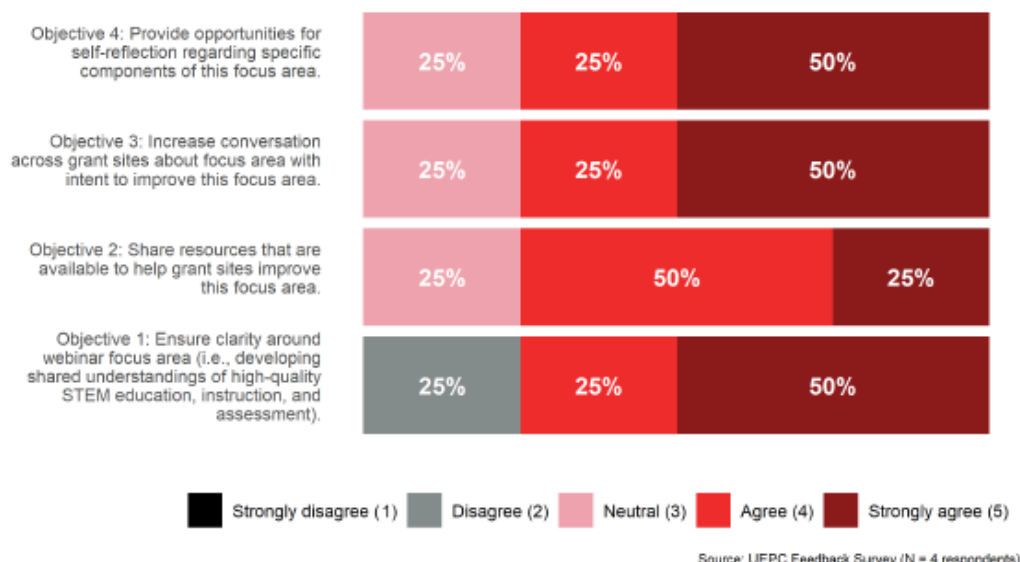


Table 3. Comments About the Most Meaningful Aspects of the Session

#	Comment
1	Finding out what the focus is in other LEAs.

Table 4. Questions for Consideration & Suggestions for Future Sessions

#	Comment
1	I would like to know specifics about teachers recruitment and participation in the PL. How do you bring them in?
2	Question/suggestion: It would be helpful to have the focus area spelled out on the slides instead of using the phrase "focus area." The notes document had a focus written at the top, but it seemed from the conversation like the focus was about defining STEM. My grant is only about science and we don't have the other STEM areas included in our grant, so thinking about STEM definitions didn't feel as immediately relevant to what we are doing with our grant. Future topics: Understanding the logistics of the grant (when things are due, what we need to submit, how we need to submit, etc.) is the thing I need the most help with. It is interesting to hear what others are doing; maybe having some people prepare a short summary of what they are doing, what results they are seeing, etc. would be interesting.

Appendix E. Sample Selection for 2023-24 AY STEM Professional Learning Grant Program Qualitative Data Collection Activities

Due to the large number of programs funded by the STEM Action Center's STEM Professional Learning Grant program during the 2023-24 academic year (AY) and the wide variation in the focus and scope of these activities across sites, the decision was made to focus qualitative data collection activities on a smaller, representative sample of participating sites. The goal of the data collection activities for this sample was to gathering rich, context-specific data about the implementation and outcomes that would provide richer understanding of the impacts of grant-supported activities across participating sites and would support the generation of more specific and useful information from the evaluation data collected. In an effort to this sample, available data provided by program site leaders as of March 11th, 2024, was reviewed. This included the following program data:

Data from the Fall 2023 STEM PL Site Leader Survey:

- **Progress towards site goals** – i.e., relative completion, average progress ratings, whether goals were discontinued or added,
- **Subject area focus(es) of their PL activities** – i.e., single focus or multiple focuses, STEM content focuses, non-STEM content focuses, Career and Technical Education and Special Education focuses,
- **Delivery mode of PL activities** – i.e., all in-person, hybrid with more in-person time than virtual time, hybrid with more virtual time than in-person time, all virtual time)
- **Educator participant lists to estimate program size** – i.e., relatively smaller programs with fewer than 50 participating educators, relatively larger programs with 50 or more participating educators.

An initial sample of 18 sites was selected that captured variation on each of the categories outlined above and was reviewed by the grant program manager, who suggested slight adjustments based on their knowledge of implementation activities across sites (e.g., sites that have yet to begin their activities and are preparing for implementation in the coming months) and general responsiveness to data requests in the past. After the initial round of data collection, two additional sites were added to the outreach list to obtain the perspectives of sites off the Wasatch Front, a few of which had already participated in the focus groups. Therefore, 20 sites, or 58% of the 34 participating programs, were selected for inclusion in the sample for qualitative data collection activities. However, due to logistical limitations and interest in participating in these sessions, only 11 or 55% of the sites selected in the target sample participated in the focus groups. The following tables compare PL programs' final sample, target sample, and overall characteristics during the 2023-24 academic year.

Program Size	Final Sample		Target Sample		Overall Estimates		Diff. (Final – Overall)
	Count	%	Count	%	Count	%	%
Large Program (50+ Educators)	5	45%	6	30%	13	38%	-8%
Small Program (<50 Educators)	6	55%	14	70%	21	62%	8%

Number of Content Focus Areas	Final Sample		Target Sample		Overall Estimates		Diff. (Final – Overall)
	Count	%	Count	%	Count	%	%
Single STEM Content Area	6	55%	10	50%	17	50%	5%
Multiple STEM Content Areas	5	45%	10	50%	17	50%	-5%

Content Area Focus	Final Sample		Target Sample		Overall Estimates		Diff. (Final – Overall)
	Count	%	Count	%	Count	%	%
STEM							
Science	6	55%	12	56%	19	56%	-1%
Technology and Computer Science	1	9%	6	33%	8	24%	-15%
Engineering	3	27%	7	33%	9	26%	1%
Mathematics	8	73%	15	78%	25	74%	-1%
Unknown (Missing Data)	0	0%	0	0%	0	0%	0%
Non-STEM							
English Language Arts (ELA)	4	36%	7	35%	9	26%	10%
Social Studies	2	18%	4	20%	4	12%	6%
Foreign Languages	1	9%	2	10%	3	9%	0%
Fine Arts	1	9%	2	10%	2	6%	3%
Physical Education (PE)	0	0%	1	5%	1	3%	-3%
Health Education	0	0%	0	0%	0	0%	0%
Unknown (Missing Data)	1	9%	1	5%	4	12%	-3%
Other							
Career and Technical Education (CTE)	1	9%	6	30%	7	21%	-12%
Special Education	5	45%	9	45%	10	29%	16%
Unknown (Missing Data)	1	9%	1	5%	4	12%	-3%

Group	# of Sites with Ratings	Avg. In-Progress Goal Rating
Final Sample	10	3.2
Target Sample	17	3.1
Overall Estimates	27	2.9

PL Delivery Mode	Final Sample		Target Sample		Overall Estimates		Diff. (Final – Overall)
	Count	%	Count	%	Count	%	%
All In-Person	5	45%	9	45%	16	47%	-2%
Hybrid: More In-Person Time	2	18%	5	25%	8	24%	-6%
Hybrid: Same In-Person and Virtual Time	1	9%	1	5%	1	3%	6%
Hybrid: More Virtual Time	2	18%	3	15%	3	9%	9%
All Virtual	0	0%	1	6%	1	3%	-3%
Unknown (Missing Data)	1	9%	1	5%	5	15%	-6%

Note: Although the hybrid sites with more in-person time are slightly overrepresented, the sample includes the same number of hybrid sites with more virtual time.

Appendix F. Template for Educator Lists and Program Calendars for the 2023-24 AY

Educator List Template

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	School, District, or Program: Central School District													
2	Liason(s) to STEM AC: Name of main grant lead(s)													
3	Grant Component or Focus Area: Focus Area #1													
4														
5	*Note: Please include both session participants and faciiliators in this list.													
6														
7	Participant During First Reporting Period (i.e., Aug-Dec 2023) (Mark "X" for YES)	Participant During Second Reporting Period (i.e., Jan-May 2024) (Mark "X" for YES)	Educator First Name	Educator Last Name	Email	CACTUS ID (If Available)	Educator Role (Select All That Apply)	Other Role (Please Specify)	Grade Level(s) Taught or Supported (Select All That Apply)	Other Grade Level(s) Not Listed (Please Specify)	Content Areas Taught or Supported (Select All That Apply)	Other Content Areas Not Listed (Please Specify)	Activity #1 Name (Please ensure this matches the name used in the calendar, Col. B)	Activity #2 Name (Please ensure this matches the name used in the calendar, Col. B)
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Educator List_Focus Area #1

Educator List_Focus Area #2

Planning and Actual Calendar

Educator Role Descriptions

Content Area Descripti

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Planning & Actual Calendar Template

	A	B	C	D	E	F	G	H	I	J	K	L
1	Planning Calendar							Actual Calendar				
2	Add rows as needed to have one learning opportunity per row.	Session Title	Description of STEM Learning Opportunity	Core Learning Objectives for Participating Educators (Max. 3 per session)	Expected Number of Participants	Who is this session intended for (for example, 3rd grade teachers, or 8th grade math teachers)	How will participants reflect and follow-up after learning opportunity?	Actual Monthly Learning Opportunity (Session Title)	Actual Number of Participants	Name of Facilitator	Facilitator Email	How did it go?
3	Jul-23											
4	August 2023											
5	Sep-23											
6	Oct-23											
7	Nov-23											
8	Dec-23											
9	Jan-24											
10	Feb-24											
11	Mar-24											
12	Apr-24											
13	May-24											
14	Jun-24											

Reference Sheet in Template Defining Educator Roles Used on Educator List Template Drop-Down Selections

	A	B	C
1	Roles	Description	
2	Classroom Teacher	This includes teachers who work directly with students in a classroom setting, delivering lessons, and facilitating learning.	
3	School Administrator	Principals, vice-principals, and other administrative staff who oversee the school's operations and manage teachers and students.	
4	Instructional Coach	School or district staff who work collaboratively with teachers to improve instructional strategies, curriculum implementation, and classroom management techniques.	
5	School Support Staff	or other personnel who provide additional support to classroom teachers.	
6	Out of School Educator	Individuals supporting out of school activities.	
7	Special Education Teacher	Teachers who work with students who have learning disabilities or special needs, providing specialized instruction and support.	
8	Media Specialist or Librarian	Staff who manage and support access to educational resources in school libraries, media centers, or other learning environments.	
9	Subject Specialist/Content Expert	Educators who focus on teaching a specific subject or discipline, such as math, science, language arts, interventionists, etc.	
10	Curriculum Faciliator or Coordinator	Staff who collaborate with teachers, administrators, and other stakeholders to design and update curriculum materials that align with state standards and district goals.	
11	Education Administrator (Non-School Level)	Individuals who hold administrative roles at the district, state, or national level in education.	
12	School Counselor	Counselors who offer guidance and support to students regarding academic, social, and personal issues.	
13	School Psychologist	Psychologists who assess and address students' mental and emotional well-being.	
14	Education Consultant	Experts who provide advice and guidance to educational institutions or organizations.	
15	Other	Please provide description in Column F.	
16	Not Applicable	Not an educator.	
17			

[Educator List_Focus Area #1](#)
[Educator List_Focus Area #2](#)
[Planning and Actual Calendar](#)
[Educator Role Descriptions](#)
[Content Area Descripti](#)
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Reference Sheet in Template Defining Educator Roles Used on Educator List Template Drop-Down Selections

	A	B
1	Content Area	Description
2	Science	Science education includes subjects like biology, chemistry, physics, earth science, and environmental science. It aims to foster scientific inquiry and understanding of the natural world.
3	Technology and Computer Science	Technology education introduces students to digital literacy, computer programming, and other technology-related skills.
4	Engineering	Engineering education introduces students to engineering principles, design thinking, and hands-on projects that simulate real-world engineering challenges.
5	Mathematics	Mathematics education covers topics such as arithmetic, algebra, geometry, statistics, and calculus. It aims to develop students' problem-solving and critical thinking skills.
6	Career and Technical Education (CTE)	CTE programs provide students with practical skills and knowledge for various career pathways, such as culinary arts, automotive technology, cosmetology, etc.
7	Special Education	Special education focuses on providing individualized instruction and support for students with disabilities or special needs.
8	English Language Arts (ELA)	This includes reading, writing, speaking, listening, and language skills. ELA focuses on developing students' communication abilities and understanding of literature.
9	Social Studies	Social studies covers a range of disciplines, including history, geography, civics, economics, and sociology. It aims to help students understand society, culture, and global issues.
10	Foreign Languages	Many schools offer foreign language courses, such as Spanish, French, German, Mandarin, etc., to promote cross-cultural understanding and communication.
11	Fine Arts	Fine arts education includes subjects like visual arts (painting, drawing, sculpture), music (instrumental and vocal), drama, and dance.
12	Physical Education (PE)	PE classes focus on physical fitness, sports, and health-related topics, promoting active and healthy lifestyles.
13	Health Education	Health education covers topics related to nutrition, personal wellness, mental health, and sexual education.
14	Other	Please provide description in Column J.
15	Not Applicable	Not applicable - i.e., you do not teach or support any content area.
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Educator List_Focus Area #2
Planning and Actual Calendar
Educator Role Descriptions
Content Area Descriptions
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Appendix G. Average Educator Ratings on PL Implementation Factor Items

The following table shows the average educator ratings for each of the PL implementation scales, organized from highest to lowest average rating.

Table 12. Average Educator Ratings on PL Implementation Factor Items

Scale	Items	Average Rating
<i>Effective Learning Design</i>	The grant-related STEM professional learning activities I participated in this academic year...	
	Focused on building the competence of all participants.	5.42
	Intentionally developed participant skills for successful collaboration.	5.27
	Clarified the purpose of our collaborative work.	5.22
	Allocated sufficient time for collaboration.	5.20
	Provided equal opportunity to participate by providing multiple sessions, series, or scheduling options.	5.18
	Provided effective structures for reciprocal accountability.	5.13
	Provided flexibility to support spontaneous collaborations among participants.	5.10
	Effectively leveraged technology to expand educator access to professional learning opportunities.	5.09
<i>Supportive Learning Culture</i>	Ensured structures or processes were in place to allow participants to choose when, where, and with whom to collaborate.	4.91
	Actively promoted idea sharing.	5.48
	Honored professional expertise and experience.	5.36
	Regarded all participants as developing or emerging leaders.	5.30
	Actively promoted routine feedback - both seeking and receiving.	5.26
	Viewed failure as part of professional practice.	5.21
	Adapted to educators' professional learning needs and desired areas of growth.	5.20
	Regularly recognized participant contributions.	5.20
	Regularly recognized the assets of each participant.	5.11
<i>Effective Data Use</i>	Effectively leveraged technology to increase educator agency and voice in professional learning activities.	5.09
	Participants individually examined data and analyzed student work to enhance STEM-related teaching and learning.	5.08
	Data was used to prioritize actions to reach a shared vision of high-quality STEM professional learning.	5.03
<i>Respectful & Effective Communication</i>	Participants collaboratively examined data and analyzed student work to enhance STEM-related teaching and learning.	4.98
	Participants' interactions reflected mutual trust and respect.	5.50
	Participants engaged in dialogue that reflected a respect for diverse ideas.	5.43
	Participants used effective inquiry strategies to seek clarification and/or expand on each other's ideas.	5.38

Scale	Items The grant-related STEM professional learning activities I participated in this academic year...	Average Rating
<i>Shared Vision and Responsibility</i>	Professional learning facilitators and participants shared a vision for STEM professional learning that focused on improving student learning.	5.43
	Participants were actively involved in creating high expectations to increase students' STEM-related achievement.	5.32
	Professional learning facilitators and participants shared responsibility for student learning.	5.13
<i>Focus on Prof. Growth & Learning</i>	Participants expanded their learning (i.e. knowledge, skills, and strategies).	5.53
	Participants learned strategies to address diverse student needs.	5.28
	Participants were provided with sufficiently scaffolded opportunities to apply their learning to practice.	5.27
<i>Adherence to Adult Learning Principles</i>	Offered useful suggestions and resources for immediate application to practice.	5.49
	Allocated sufficient time for participants to practice new skills between meetings.	5.39
	Offered sufficient opportunities for participants to exchange their views, knowledge, and experiences on STEM-related topics.	5.36
	Were designed to regularly integrate and/or align STEM professional learning activities and goals with Utah Core Standards.	5.36
	Gradually introduced new material to allow for deeper engagement and understanding.	5.35
	Were designed to ensure consistency between the different sessions and issues or topics addressed.	5.34
	Were designed to deepen educators' understanding of Utah Core Standards.	5.29
	Routinely ensured that individual participants' needs and interests were addressed.	5.25
	Gave participants the chance to inform the construction of its content.	5.05