



STEM Education Innovators (SEI) Evaluation Report Cohort 1 (2023-24)

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Introduction

House Bill 139 in the 2013 Utah Legislative Session established the STEM Action Center (STEM AC). STEM AC is charged with both identifying and disseminating STEM best practices. STEM AC offers multiple programs, including digital learning, computing partnerships, and professional learning.

Consistent with this third identified area, STEM AC launched the STEM Education Innovators (SEI) program for Cohort 1 of secondary educators from public education institutions, with the first convening in August 2023. This is a five-year professional learning program. SEI Cohort 2 for elementary educators will begin in August 2026. SEI was designed to provide professional learning, support, and resources for secondary STEM teachers in Utah. This professional learning program aims to improve Utah STEM teachers' ability to expand their knowledge and skills to support effective and engaging STEM learning environments for students, support and mentor peers in STEM, and develop teacher leadership and mentoring skills. As part of SEI, STEM AC, in partnership with the Utah Education Policy Center (UEPC), offers monthly professional learning sessions intentionally designed to develop a community of practice and support a focus on practitioner STEM-related problems of practice. The SEI provides \$7,500 annually for participants.

The Utah Education Policy Center (UEPC) is a partner with the STEM AC on the SEI initiative. One UEPC team (Bridgeworks) partnered with STEM AC to support the SEI program implementation, while the second UEPC team (Evaluation) partnered to serve as the external evaluator. First, the UEPC Bridgeworks team collaborated with the STEM AC to design and facilitate monthly professional learning sessions, which were held from August 2023 to May 2024. The team that facilitates professional learning met regularly with the STEM AC program director to design and plan the SEI professional learning, including identifying structure, roles and responsibilities, and the intended learning outcomes. Secondly, the UEPC supports the STEM AC in the ongoing evaluation of the five-year SEI program. Throughout the first year, UEPC evaluators administered and analyzed brief end-of-session surveys for each PL session. After each session, the UEPC Evaluation team shared and engaged in reflective practices related to findings on the formative data report with the STEM AC direct and PL facilitators, which included members of the UEPC Bridgework team. After completing the first year in May, the UEPC Evaluation team administered a year-end survey and conducted focus groups with participants.

This evaluation report provides a brief review of relevant literature, a description of the mixed methods used to collect and analyze data about implementation and impact on goals, findings pertinent to the evaluation questions, and considerations to further support and strengthen the implementation and outcomes of the SEI program for the upcoming years.

Relevant Literature

Teacher recruitment and retention have been long-standing concerns in Utah (Ni, Rorrer, & Nicolson, 2017; Ni & Rorrer, 2018). Studies have shown that beginning teachers (i.e., teachers in their first five years) leave the Utah public school system at greater than average rates across the country and that teacher turnover is among the leading causes of teacher shortages in the state (Ni, Yan, Rorer & Nicholson, 2017). There is also a critical need in the K-12 education system to recruit and retain highly effective STEM teachers (Carver-Thomas & Darling-Hammond, 2017; Townley, 2020). As such, the Utah STEM AC SEI project aims to support the retention of STEM teachers in Utah. According to the Utah STEM Action Center, retention rates for STEM teachers in Utah are lower than those of other subject areas (STEM Action Center, 2022). This literature review explores the impact of professional learning, teacher leadership, and communities of practice on teacher retention.

Professional Learning

Research on professional learning (PL) for STEM teachers suggests that building educators' content knowledge and pedagogical skills, coupled with ongoing support, can increase their commitment to staying in the teaching profession (Balgopal et al., 2022; Hurley, Butler & McLoughlin, 2023; Townley, 2020). As noted by many professional learning scholars (see Markholt et al., 2018; Ginsberg, 2011; Rorrer, Groth, & Colvin, 2024; Timperley, 2011), intentionally designed ongoing professional learning allows educational practitioners to refine and strengthen their pedagogical skills to improve student outcomes. To accomplish this, a systemic professional learning model is warranted (Rorrer, Groth, & Colvin, 2024).

Teacher Leadership

Beyond the importance of building content knowledge for STEM educators, professional learning can be used as a vehicle to help develop and strengthen STEM teachers' leadership capacity. The scholarship on the impact of teacher leadership continues to reinforce the findings that teacher leadership skills contribute to students' success and support positive changes in students' academic outcomes (Gaffney & Faragher, 2010; Lai & Cheung, 2015; Warren, 2021). In addition to academic outcomes, Öqvist and Malmström (2016) found that teacher leadership positively impacted academic motivation. Teacher leaders are essential advocates for change in the local and national educational context. When teacher leaders identify and address a problem of practice and have a meaningful impact on addressing an educational dilemma, they feel a greater sense of agency and belonging in their profession (Balgopal et al., 2022; Galosy & Gillespie, 2013) and support the growth of STEM teacher leaders (Kelsey Quaisley et al., 2023). The sense of belonging and community is critical, as research has shown that isolation contributes to teacher attrition (Balgopal et al., 2022; Keiler, 2018).

Communities of Practice

The intentional design of a community of practice can serve as an important professional learning design. Lave and Wenger (1991) identified a community of practice as a group of people who share a common interest, passion, or profession. Communities of practice can foster connectedness and collaboration to support continuous improvement in STEM (Townley, 2020). In addition to a sense of community, O'Dwyer et al.'s (2023) study highlighted how a professional learning community (e.g., a community of practice) supports STEM educators to improve their practice while also contributing to

the broader community's growth and development (O'Dwyer et al., 2023). As teachers engage in sustained, content-focused professional learning with a supportive community, they are better prepared to address the unique challenges of STEM education and inspire their students (Darling-Hammond et al., 2009). This is especially important to support STEM educators' resiliency as they work to grow their leadership skills and as they face both internal and external uncertainties and challenges (Kelsey Quaisley et al., 2023). By leveraging communities of practice as professional learning communities, STEM educators can engage in sustained, content-focused professional learning that develops their knowledge, skills, and leadership capacities.

Methods

The SEI evaluation was designed to generate actionable insights about the SEI program implementation and impact to promote continuous improvement. This first-year evaluation included ongoing formative assessment of monthly professional learning sessions via post-session surveys and monthly reflections among the UEPC evaluation and Bridgeworks teams along with the SEI program director. These surveys and reflections were used to gauge program progress and inform implementation. The UEPC evaluation team also facilitated the collaborative development of the SEI logic model (see Appendix A), which was used to identify program goals and refine program design and implementation. Additionally, the evaluation gathered evidence of program implementation and outcomes, which were analyzed to generate this report. As described below, methods were aligned to evaluation questions and included data analysis from monthly post-session surveys, The Annual SEI Participant Survey, and focus groups with participants.

Evaluation Questions

This UEPC evaluation used both quantitative and qualitative data from surveys and focus groups to address the evaluation questions guiding this study. Table 1 contains a summary of the evaluation questions and data sources. Additional information about data sources and collection methods will be discussed in subsequent sections.

Table 1. Evaluation questions

Evaluation Question	Annual Participant Survey	Participant Focus Groups	Post-Event surveys	Logic Model, Planning Meetings
1. To what degree are participants satisfied with the quality, relevance, and usefulness of the professional learning series and resources?	✓	✓	✓	
2. To what extent do participants gain the intended knowledge and skills?	✓	✓	✓	

3. In what ways do participants implement or apply what they learn in the professional learning sessions related to: a. STEM content knowledge and pedagogical content knowledge b. Teacher leadership capacity	✓	✓	✓	
4. How did SEI design and implementation support or detract from the quality and impact of participants' experiences?		✓	✓	✓
5. In what ways was the SEI implemented as intended and designed to address needs/priorities of participants?		✓	✓	✓

Data Sources & Analysis

To answer the evaluation questions, the UEPC Evaluation team used three primary data sources: 1) a year-end survey of SEI participants, 2) focus groups interview and transcripts of SEI participants responses, and 3) the monthly formative post-event surveys administered after each PL session. This section provides additional information about each data source and describes the UEPC's analyses.

Monthly Post-Session Surveys

Overview

Post-event surveys were distributed to participants after each monthly professional learning session throughout the first year of SEI. Post-event surveys were designed to provide immediate formative data about the quality, relevance, and usefulness of sessions. Additionally, post-event surveys offered a space for open-ended responses where participants could provide feedback and suggestions for improvement or support needed. The UEPC Evaluation team generated brief reports for each post-event survey and shared them with the STEM AC and the UEPC Bridgeworks PL team to spark reflection and discussion in their planning meetings between each monthly session.

Data Collection

The UEPC administered eight post-event surveys between August 2023 and May 2024 (no session was held in December 2023). In total, 199 responses were received with an average of 25 participant responses per survey. Each survey comprised a short set of Likert-scale items about the quality, relevance, and usefulness of the session (rated on a 5-point scale; 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent), Likert-scale items asking participants to rate the extent to which intended outcomes for the session were met (rated on a 5-point; 1 = not well at all, 2 = slightly well, 3 = moderately well, 4 = very well, and 5 = extremely well). In addition to the Likert-scale items, two or three open-ended questions were provided to understand what participants found most meaningful,

how they will apply their learning to practice, suggestions for improvement of the PL sessions, or additional supports they needed to contribute to their success in the SEI program.

For the first five monthly sessions, surveys were distributed via an anonymous link via Qualtrics Survey software. For the last three months, surveys were distributed via Qualtrics using participant-specific links, allowing for analysis of responses over time and comparisons between post-event and end-of-year survey responses. Given the limited timeframe for this data, these additional analyses were not included in this report. The UEPC will be conducting preliminary comparative and time-series analysis in preparation for Year 2 of SEI and anticipates including further analysis in next year's reporting.

Data Analysis

For this report, post-event survey data were reviewed for themes across sessions and integrated with end-of-year survey results and focus group data to generate themes and sub-themes. Analysis of survey items included generating and interpreting descriptive summary statistics to identify common trends in responses across topics. Furthermore, qualitative data from open-ended items were analyzed for context and examples and presented in the report alongside quantitative survey data to add depth and dimensionality to the findings.

Annual SEI Participant Survey

Overview

The Annual SEI Participant Survey (see Table 2) measures participants' perceptions of the SEI program implementation and outcomes in the first year. The Annual SEI Participant Survey included four sets of close-ended items that addressed the 1) professional learning design and support, 2) changes in STEM content and pedagogy knowledge and practice, 3) changes in teacher leadership knowledge and practices, and 4) the selected problems of practice.

Two sets of items (changes in STEM content and pedagogy; changes in teacher leadership practices) were administered as retrospective pre- and post-test items, which asked participants to rate each item according to their knowledge and/or practices at the start of the academic year (before beginning the SIE program) and now (after the end of the first year of the SEI program). Both sets of items were rated based on a five-point scale: 1) Strongly disagree, 2) Disagree, 3) Neither agree nor disagree, 4) Agree, 5) Strongly agree.

In addition, the Annual SEI Participant Survey also included seven open-ended items asking participants to reflect on how their teaching and teacher-leadership practices have changed because of participating in SEI, what notable outcomes have emerged because of their collaboration with peers and the problem of practice work, and how the SEI program may be improved moving forward. Table 2 provides examples from each category of close-ended survey items.

Table 2. Survey categories and descriptions

Category	Example Items
Professional learning design and support	In year 1, the SEI program... • was responsive to demands on my time and energy. • set clear expectations and goals for participants. • was well-designed (e.g., structure, pacing, organization). • provided content that was relevant to my work. • adapted educators' professional learning needs and desired areas of growth.
Changes in STEM content and pedagogy knowledge and practice	To what extent do you agree with the following statements NOW, and how much would you have agreed with them AT THE START OF THIS ACADEMIC YEAR? • 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. • I can develop a lesson plan that integrates instruction across disciplines. • I can effectively integrate pedagogical content knowledge (PCK) into my teaching.
Changes in teacher leadership knowledge and practices	To what extent do you agree with the following statements NOW, and how much would you have agreed with them AT THE START OF THIS ACADEMIC YEAR? • I understand the teacher-leader standards and how to implement them. • I see myself as a teacher leader at my school. • I understand why teacher leadership is important. • I feel confident in my ability to facilitate professional learning at my school.
Problems of practice	Rate the extent to which you agree with each of the following statements... • My STEM content knowledge and/or pedagogical practices have improved as a result of identifying and addressing a problem of practice. • My knowledge and/or skills as a teacher leader have improved as a result of identifying and addressing a problem of practice.

Data Collection

The survey was administered using the UEPC-licensed Qualtrics Survey software and distributed via email to all program participants in May 2024 following the completion of the final monthly professional learning session in the program’s first year. The survey was sent to 43 participants and completed by 31, which is a response rate of 74%. As shown in Table 3, most participants taught science (52%), with others teaching mathematics (23%) and Career and Technical Education subjects (26%). Table 4 shows that most secondary survey participants taught high school students (58%), while 35% taught middle-school, and a small number of participants taught across middle-school and high school grade levels. Numbers in parentheses in each table indicate totals for all SEI program participants.

Table 3. Year-end survey participants by subject area

Subject area	Count*
Science	16 (21)
Math	7 (9)
Computer Science/ Technology	6 (6)
Other Career and Technical Education	2 (7)

*Some participants teach multiple subject areas. Counts were based on the first subject listed.

**Career and technical education subjects included computer science, technology, robotics, and culinary arts

Table 4. Year-end survey participants by grade level

Grade level	Count
High school*	18 (20)
Middle school (6-8)	11 (21)
Other**	2 (2)

*This count includes career and technical institutes/centers that serve high school students

**Mountain Heights Academy (online school for 7-12)

Data Analysis

Analysis of the items on the survey included the generation and interpretation of descriptive summary statistics to identify common trends in responses across topics. When appropriate, statistical analyses (i.e., repeated measures Analysis of Variance (ANOVA) and pairwise comparisons, independent t-tests) were conducted to test for differences across item groups (e.g., comparing retrospective pre- and post-test ratings). Furthermore, qualitative data from open-ended survey responses were open coded and used to triangulate findings alongside quantitative and focus group analysis. Survey responses provided context and examples and are presented in the report alongside quantitative survey data to add depth and dimensionality to the findings.

Participant Focus Groups

Overview

The UEPC’s evaluation team conducted focus groups with SEI participants to better understand their experiences in the program’s first year. The UEPC’s evaluation team conducted focus groups with SEI participants to better understand their experiences in the program's first year. Focus group questions primarily focused on the following four categories: (1) quality, relevance, and usefulness of the monthly professional learning sessions, (2) processes for identifying and addressing problems of

practice, (3) outcomes from SEI participation, and (4) additional areas for program improvement and support.

Data Collection

Participants for the focus groups were determined in coordination with the SEI Director and facilitators from STEM AC and the UEPC Bridgeworks team, respectively. Focus groups were selected primarily on identifying members of schools and districts (e.g., participants from the same schools and/or districts were placed in the same focus groups) while teaching subject and focus area for a participant's problem of practice were also considered for those with small numbers of participants in each school or district. In total, 11 focus groups were identified, ranging in size from 2-5 participants. The UEPC emailed each potential participant with suggested focus group interview times during May 2024 and coordinated focus group scheduling via Doodle polls. All participants completed interview consent forms (via Qualtrics) prior to participation. In the end, evaluators conducted focus groups with representatives from all 11 identified groups, although two individual interviews were conducted when a group could not find a time for everyone to meet. Of the 43 SEI participants, 33 participated in focus groups (77%). Focus group interviews were conducted via Zoom and lasted 45-60 minutes. The interviews were recorded and transcribed for analysis.

Table 5. Focus group participants by subject

<i>Subject area</i>	<i>Count*</i>
Science	19
Math	6
Career and Technical Education**	8

*Some participants teach multiple subject areas. Counts were based on the first subject listed.

**Career and technical education subjects included computer science, technology, robotics, and culinary arts

Table 6. Focus group participants by grade

<i>Subject area</i>	<i>Count</i>
High school	12
Middle school/ Junior high	16
Other	4

Data Analysis

Focus group analysis involved open coding to generate themes based on participant responses (Saldaña, 2016). Throughout the report, key qualitative findings are integrated with the survey findings to provide more context and depth in the finds. Additionally, at times, qualitative data contrasted with the quantitative results. Quotes were included in the report to offer examples of participant experiences, including bright spots and challenges from the first year of the SEI program.

Evaluator's Role

As stated in the introduction to this report, the UEPC partnered with STEM AC in two ways to support the SEI program. First, the UEPC Bridgeworks Team members served as co-designers of SEI, working with STEM AC to develop a scope and sequence for the program and to facilitate monthly sessions. Secondly, the research and evaluation team at UEPC collaborated with Bridgeworks and STEM AC to

evaluate the program, including developing a logic model, collecting and analyzing data, and reporting on both monthly post-session surveys and year-end data collection. The UEPC Bridgeworks and evaluation teams collaborated with STEM AC to identify key evaluation questions, draft a logic model for the program, and regularly review and interpret findings from monthly post-session reports.

Primary Findings

The following sections present findings related to professional learning implementation and support, problems of practice, and growth in pedagogical knowledge and teacher leadership. Each section includes 2-4 key findings supported by quantitative and qualitative analysis. Subcategories within key findings are used to highlight survey data in figures and present illustrative quotes from open-ended survey responses and focus groups.

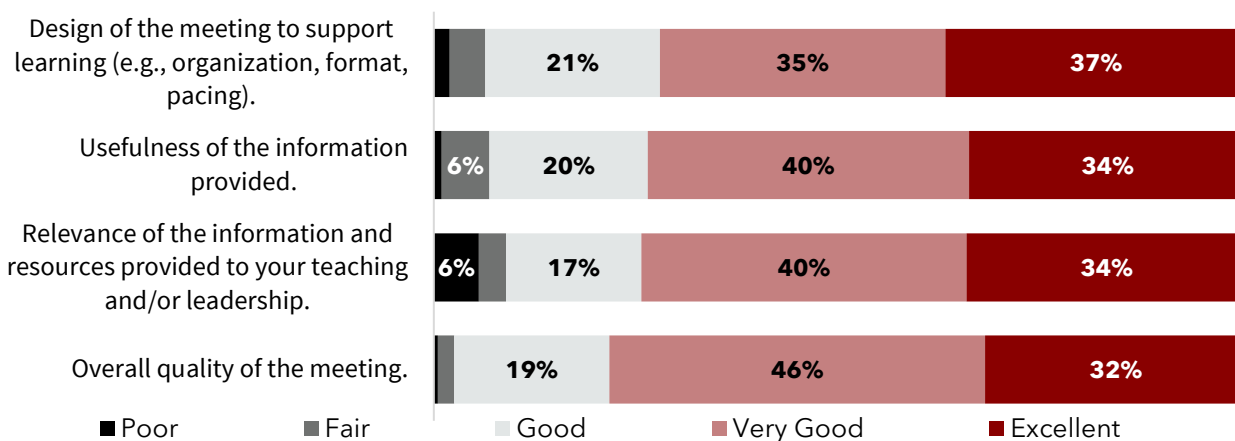
Professional Learning Implementation and Support

This section includes findings related to the monthly professional learning sessions and the overall design and structure of the SEI program. Focus group and survey data were analyzed to provide insights about participants' views of the quality, relevance, and usefulness of the monthly sessions; the support and responsiveness of STEM AC and the UEPC Bridgeworks throughout the first year; and the overall structure and design of the sessions and the program.

SEI delivered high-quality monthly professional learning sessions while providing strong support, responsiveness to feedback, and respect for participants.

Analysis of post-session surveys, focus groups, and open-ended responses in the end-of-year survey suggest that participants found monthly sessions to be of high quality, noting the design of sessions to support learning and the relevance and usefulness of the content presented. As shown in Figure 1, aggregate ratings from post-session surveys (conducted after each monthly meeting) indicate positive perceptions across items related to sessions' quality, relevance, and usefulness.

Figure 1. Post-session survey ratings of quality, relevance, and usefulness



Source: Post-session surveys (8 surveys, n = 199)

In focus groups and open-ended survey responses, most participants shared positive impressions of the SEI program. Data suggest that the SEI Director and facilitators treated participants as professionals and respected their time and energy while providing opportunities for participants to collaborate and reflect on ways to improve their teaching. These two subthemes provide additional detail of the positive feedback shared in surveys and focus groups.

Professionalism and respect for participants' time and energy

As noted in the following illustrative comments, participants cited the staff's professionalism and respect for participants as a strength. When asked about the professional learning sessions and support from SEI in focus groups, many participants described feeling that the SEI Director and facilitators were flexible and responsive to demands on their time and energy, including when teachers had to miss a session, were running late, or could not complete a Canvas assignment. Participants expressed a sense that SEI leaders "understood" their profession, which contributed to feeling valued and respected. The Annual SEI Participant survey did not include an open-ended item directly related to staff support, but one participant cited the SEI Director as a significant part of their positive experience in the program.

- *I felt just like I was treated very professionally... my opinions mattered and what I desired and the problems that I saw in the classroom were really important, which I really appreciated. Being in lots of different of these cohorts, professional developments, that's not always the case, especially in education. (Focus group)*
- *I feel like they've always been... really quick to respond. If somebody asks during the meeting, either in a chat box or over the microphone like, "What do you mean exactly? Can you elaborate? Can you give an example?" They always respond right away. Or if it's something that they can't respond, right, then it's like, "Well, I'll send you an email." And then within the next day or so, there's an email with more of an explanation. (Focus Group)*
- *I do feel like they understand our profession in a way that sometimes even our district doesn't.... I do feel like they respond to our needs as far as that goes. If we're sick, if we're busy, it's never a really big deal. Here's the video, you have to do it on your own, but it's never like, "We're going to call and figure out where you were and or why you weren't paying attention or why you aren't on video? (Focus group)*
- *I'm really glad that I get to be part of this program, and [the SEI director], in particular, has been a HUGE part of making it so that I feel comfortable asking questions, getting guidance, and seeking feedback. She has been instrumental in setting the tone for the program. (Survey Open-Ended Response)*

Opportunity to collaborate, reflect, and improve

Participants expressed general appreciation for the opportunity to participate in the SEI program, as it provided a space to reflect on their teaching practices and support the improvement of their teaching alongside a supportive group of peers and program staff. When asked in focus groups and in an open-ended survey item about the benefit of collaboration through the SEI program, teachers expressed a sense of camaraderie with their peers and a sense that other participants were all

interested and motivated in working together to improve their STEM teaching. The development of a community of practice among teachers was seen as a positive aspect of the SEI program.

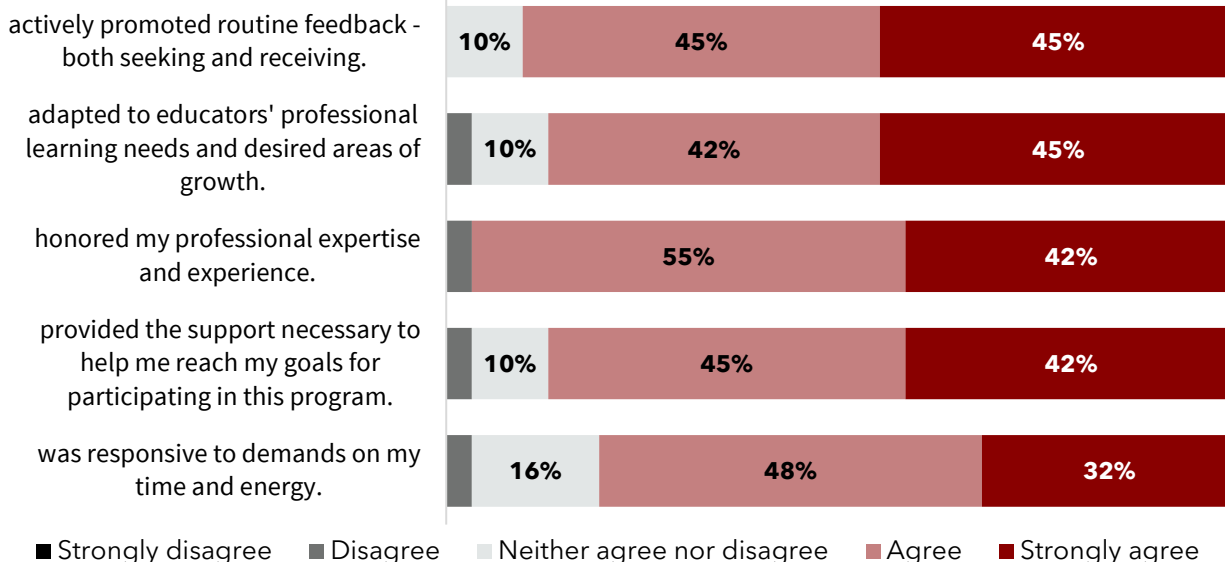
- *The overall program is phenomenal. Teaching STEM... my program has flourished to the point that my principal has asked if I would be willing to teach all STEM because kids want to be in my classes so bad. (Survey Open-Ended Response)*
- *I appreciate the opportunity to talk with the other teachers... I've gotten a lot of good ideas, and I've gotten also ideas about interesting ways to do cross-curricular learning just from talking with other teachers. (Focus group)*
- *This is a group of teachers that really care about students, improvement, and are dedicated to their work. Gaining thoughts and insights from others has been incredibly beneficial and added to my teaching and teacher leadership practices because I can use their ideas to get the ball rolling or see resources that I haven't used before. (Survey Open-Ended Response)*
- *They give me perspective and clarify the reality that there are other participants with my focus and priorities as an educator. (Focus group)*
- *I loved the ideas from others and hearing their feedback and it helped give me ideas for my own classroom. (Focus group)*
- *Thank you from the bottom of my heart for creating a program like this! Collaborating with other passionate educators has been inspiring and reinvigorating. Incorporating the teacher leader aspect with the PoP focus has really helped me see the value in this program and fostered my growth as a teacher leader. The support we've received has been crucial! Thank you for your intentionality in creating a safe space where we don't feel undermined as educators, but are seen and supported. This is really allowing us to do amazing work that would likely not happen without this program. (Survey Open-Ended Response)*

Support and responsiveness to feedback

The End-of-Year Annual SEI Participant Survey provided additional evidence of participants' perceptions of the quality of the SEI program. Figure 2 shows that 80% or more of participants agreed or strongly agreed with items related to the responsiveness, respect for their professionalism, feedback, and providing the support they needed to reach their goals for the program.

Figure 2. Participant perceptions of SEI support and responsiveness

The SEI program...



Source: End-of-year survey (n = 31)

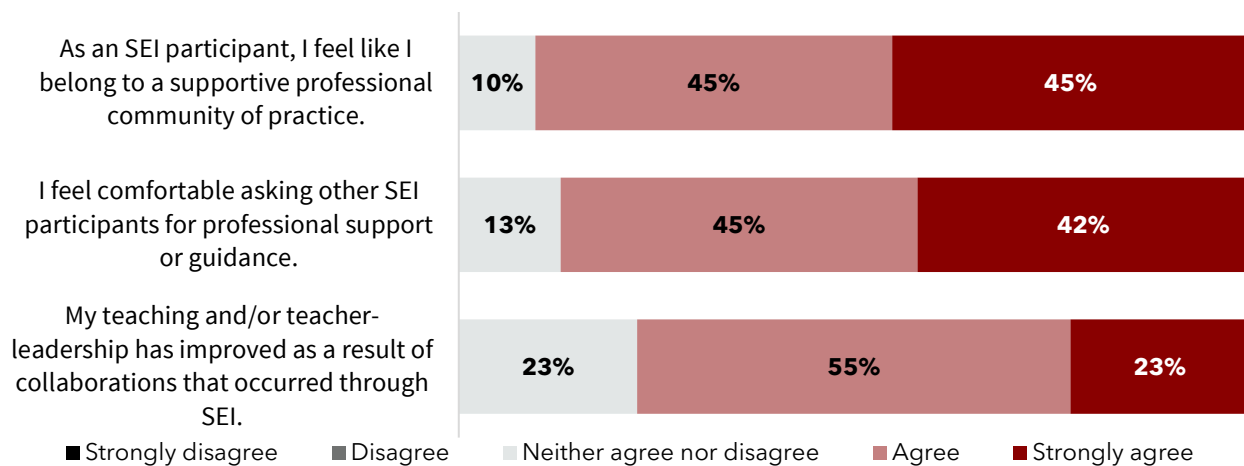
In focus groups and open-ended survey responses, participants noted how the SEI Director and PL facilitators actively solicited feedback and incorporated participants' ideas into the monthly sessions. The STEM AC and UEPC (SEI facilitators) collected feedback at the end of every monthly session and reviewed feedback as a collaborative team during planning sessions for the next month so that improvements could occur. As illustrated by the comments below, participants recognized that their feedback was heard and expressed that SEI facilitators actively worked to improve the structure and content of sessions based on participants' comments. Many participants cited one-on-one meetings with the SEI Director as particularly beneficial as she added clarity related to defining problems of practice and providing a better understanding of the program's purpose and design.

- *You ask for our feedback and then make adjustments based on it. That is huge! It models what we should be doing with our own students in our teaching. (Survey Open-Ended Response)*
- *They really worked on feedback. Everything that I ever mentioned on feedback was something that they specifically addressed the next time. So, they got a lot better about telling me, 'this is what we're learning, this is why we're learning it, this is how it's supposed to apply in your problem or practice.' (Focus group)*
- *I kind of knew from the get-go what I wanted to do [for the PoP]. I just didn't quite know how I wanted to do it. So, I came up with a couple of ideas, and then had a meeting with Kelly. One of the months she had a "Come meet with me and let's talk about it," which I thought was really, really, really helpful because that helps to clear things up tremendously. I don't know what everybody else was doing at that point in time. So, I wasn't sure if I was on the right track or if I was completely off in left field and doing something random. (Focus group)*

Collaboration and peer learning were valued parts of SEI, as participants expressed appreciation for the opportunity to discuss and reflect upon their teaching and access resources to benefit their students.

In the year-end survey, participants were asked to rate items related to their interactions and sense of belonging within a community of peers in the SEI program. As shown in Figure 3, participants rated these items highly—more than 85% agreed or strongly agreed with each. No participants disagreed or strongly disagreed with these items, suggesting peer engagement was a valued part of the SEI program. However, a smaller percentage of participants strongly agreed that SEI collaboration contributed to improvements in their teacher leadership (23% compared to 42% and 45% for other items). This difference is aligned with a separate finding that few participants reported changes in their teacher leadership practice overall—a point discussed later in this report.

Figure 3. Participant perceptions of belongingness and peer learning



Source: End-of-year survey (n = 31)

Peer collaboration and engagement

In the end-of-year survey, participants also responded to an open-ended item about how their collaboration with SEI peers contributed to their experience and influenced their teaching and teacher-leadership practices. In these open-ended responses and focus groups, participants provided further evidence that peer engagement has been a meaningful benefit of the SEI program and among the most impactful aspects of the monthly sessions. As illustrated in representative quotes below, participants appreciated the opportunity to spend time with other teachers who taught similar subject areas and shared their interest in improving as teachers and leaders. In these responses, teachers noted that breakout rooms and discussions were helpful in making connections between SEI content and their classroom practices—including learning how other teachers were adapting their teaching and considering ways to improve their own instruction.

- *I felt like the most I got out was talking to other teachers and other educators and I do feel like they shifted towards that more towards the end, which I really appreciated. (Focus group)*

- *I loved the breakout groups. I think that's when I was the most focused, when I got the most out of it, when I figured out what was actually happening. (Focus group)*
- *The times that I loved the most were the times that we could collaborate with others to say, "Here's what I'm doing in my class right now. Here's an idea. This is how I get my kids' attention. Here's how I get more engagement." Just little ideas, and they can be the smallest of things. But I got those through those breakout rooms, through collaboration. (Focus group)*
- *It was really helpful to be able to hear about other's PoP, and how they've changed and adapted. I think the showcase at the end of the year was one of the most valuable experiences. It was great to get ideas on how to change and adapt, as well as some reassurance that I was in a good place with my progress working on my PoP as well. (Focus group)*

Peer feedback

Participants cited the opportunity to collaborate and engage with feedback around STEM instruction, integration, and mentoring. They indicated that SEI offered opportunities to seek and give feedback and advice with others in their own and different STEM fields. Teachers expressed their respect and admiration for others in their cohort, which was linked to a willingness to provide and listen to feedback from their peers. They also described finding “like-minded” teachers as well as those able to provide different and constructive perspectives.

- *I loved the ideas from others and hearing their feedback and it helped give me ideas for my own classroom. (Survey Open-Ended Response)*
- *I've really liked being able to bounce problems and ideas off of other like-minded teachers. The activities where we shared what was going on with each other and talked through stuff were some of the most valuable for me personally. (Survey Open-Ended Response)*
- *There's an expert for almost any issue in education within the cohort. I've taken advice from nearly everyone I've spoken to. (Focus group)*
- *As a CTE teacher, there's me and one other person that teach the same subjects that we teach. And, sometimes we get tunnel vision as to what a lesson should look like or how we should cover content. And so, it's really nice to be able to talk to other people, even if they're in a different subject area. But, just to talk to someone else that can help you to figure out a better way to teach a lesson or just to have some ideas on how to teach things. (Focus group)*

Opportunities for improvement in collaboration and engagement

While the SEI program provided opportunities for peer engagement and learning, some participants did offer suggestions for how collaboration could be strengthened or expanded. A common suggestion was for more intentionally structured breakout rooms during the monthly sessions—groups could be organized by subject area, PoP focus, or otherwise, depending on the purpose of the session. Others explained that while they appreciated breakout rooms, they were interested in more opportunities to get to know the other participants better and develop stronger collaborations.

- *It seemed like there was always somebody different in the group. For some of them, it was a self-select group. For some of them, you were assigned to the breakout group.... And a lot of times people were like, "I didn't know which one to choose, so I just chose this one." If the purpose was*

to put us in a small group with people that had similar problems of practice, I don't know that that necessarily happened. (Focus group)

- I like hearing about others' experiences. I do feel disconnected though. I don't know those in the cohort very well yet. (Focus group)
- I am fortunate to be part of a group of fantastic educators from my school, and during breakout room time, we've been able to share and receive great ideas for addressing our PoP. At this point I would say any improvement has been based on inspiration from others, not true collaboration. I am hoping that will change as our time in the program goes on. (Focus group)
- I have done a lot of listening during the SEI year 1 cohort, but I don't feel like I've had a lot of time to get to know/work with educators that teach the same subjects as me. (Focus group)
- It was good to collaborate with others who were doing a similar POP. I wish there was more time for pairing and discussions with people who were doing something similar. (Focus group)
- In general, I have really positive feelings about the sessions. However, I was kind of open to get to know people in the cohort a little more. And so, if there had been a consistent, 'this is my breakout room group and I knew weekly I would get to talk to these people,' that would be... a belonging thing. That would be really nice. (Focus group)

The structure and sequence of SEI sessions limited the relevance and utility of SEI content, and clarity about the program's purpose and the connection between SEI's focus areas (PoP, teacher leadership, STEM pedagogy) took time to develop.

Figure 4 shows that in the end-of-year survey, participants generally agreed that the SEI Director and PL facilitators set clear expectations and goals for participants, that the program was well-designed, and that the content of the professional learning sessions was relevant to their work. When these ratings are contrasted with ratings of SEI's support for addressing participants' needs and responsiveness to feedback (see Figure 3), however, they suggest that clarity, design, and relevance may be areas where there is room for improvement. More specifically, "strongly agree" ratings were above 40% for items related to support and responsiveness to feedback, while items in Figure 4 have "strongly agree" percentages ranging from 13-16%.

Figure 4. Participant ratings of SEI program design and relevance in the end-of-year survey

In Year 1 of SEI...

staff set clear expectations and goals for participants.



the program was well-designed (e.g., structure, pacing, organization).



the content of professional learning sessions was relevant to my work.



■ Strongly disagree ■ Disagree ■ Neither agree nor disagree ■ Agree ■ Strongly agree

Source: End-of-year survey (n = 31)

Limited relevance of SEI session content

In addition to end-of-year survey ratings, some participants in focus groups were critical of the relevance of SEI monthly session content.¹ While some sessions were more engaging for some participants than others, there was a general sense in focus groups that it was difficult to “connect the dots” between session content, the problem of practice, and their own classroom teaching. Many teachers expressed feeling that they were already familiar with the content that was covered and that, while it may have been useful as a reminder of good pedagogy, it did not spark changes to their practice. There were no open-ended survey items directly related to the relevance of SEI content, although some teachers provided comments about relevance when asked about how their teaching had changed because of SEI (more of these responses are included in a later section). The quotes below provide examples of how participants felt about the relevance of SEI content, and findings later in this report provide more detail about participant outcomes and changes to pedagogical and leadership practices.

- *They're structured fairly well, they've got good organization, they're prepared. I found myself though, I will definitely say, feeling underwhelmed by the presentations, and didn't really see the relevance. I thought going into it, it was going to be mostly focused on the problem of practice and getting that going. I didn't realize how much professional development they were planning as being part of this, and I felt like the professional development side did not help me at all, it wasn't really relevant, or if it was, it was stuff I was already doing and didn't really need training on, and so that felt a little redundant. (Focus group)*
- *I have struggled to implement teaching strategies. I always try to diversify my teaching with different activities and to relate the content to student experiences in other areas, but I can't think of anything specific from this group that has changed my teaching. (Survey Open-Ended Response)*
- *And sometimes it can be tricky to connect the dots between the teacher leadership standards and what we're working on in the classroom in the problem of practice. Sometimes it can be a little disjointed trying to connect it all together. (Focus group)*
- *And so I think that would help the split feeling that we have sometimes as we go through these monthly meetings as to what their goals are, what ours are and what we should be trying to get out of it in terms of just overall being teachers and then specifically attacking our problems. (Focus group).*
- *But most of the time I felt like they were pretty good. There were a couple sessions that, and I don't remember exactly which session it was that I felt like, okay, this is a little overkill. It was something about data.... I'm just like, 'whoa, this is a lot,' and I don't specifically need help with that... I felt like that wasn't really applicable to my needs. (Focus group)*

¹ Participants were not asked directly about the relevance or clarity of the program structure in open-ended responses, given the opportunities to provide feedback already made available through monthly post-session surveys. Those open-ended responses were reviewed by the SEI team regularly and were thus not included in this report.

Connections between SEI components

For many participants, the lack of relevance of SEI content was related to—and perhaps compounded by—uncertainty related to both the structure and flow of monthly sessions as well as how the different program components (monthly sessions, PoP, pedagogy and leadership development) were intended to be connected. Specifically, participants noted uncertainty about the objectives and sequencing of sessions and how sessions were related to the identification and research on their problem of practice. Some participants also expressed concern about the Canvas page, suggesting that they were at times unclear about what work was expected and where to find resources discussed during the monthly meeting.

- *I was very rarely clear within a meeting what the focus was. Was there one focus? Were there two focuses? Were there five focuses? And... this hilarious coming out of my mouth because I'm terrible at objectives, but what's the objective? What am I trying to do by the end of these three hours? Or what am I trying to do by the end of this one-hour segment? (Focus group)*
- *I think two things as far as the monthly meetings that I would like to see a little bit different is maybe some kind of really clear agenda format sent out a week before and then the day of so we could say, 'oh, this happens, then this happens.' I am already ready. And they did that a little bit. And then maybe just, and we might bring this up later as well, clean up the Canvas page. I'm not a Canvas wizard, but I was very confused. I found myself being like, there's so much on here, but then some of it is not really on here. (Focus group)*
- *I feel, yes, I was respected professionally, do not get me wrong, but I feel like there needs to be a lot more accountability. Theoretically I'm not graded on this, but I'm getting paid for this. So, I felt like I should have a clear picture, what are we going to do by today? This is what you're going to achieve. Here's your accountability part. (Focus group)*
- *I think if I would've really truly understood what this whole thing was and how it applied to the problem of practice, then the monthly sessions would've made more sense. ... I wish I would've had a better description of what the program really was. And until the end, I didn't feel like there was a definite description of the program. (Focus group)*

Developing clarity over time

Clarity about the program's purpose and connections between the different elements did develop over time. The SEI Director and PL facilitators took time during multiple sessions around the midway point in the year to address questions and revisit the program structure and design. Participants were appreciative of those efforts and noted that they felt more comfortable by the end of the year about the goals of the program and how they were expected to achieve them.

- *I do really appreciate how they have pivoted to teacher feedback and doing those evaluations after the program. And they've pivoted and they've been figuring out this program and it's really gotten a lot more dialed throughout the time. (Focus group)*
- *Once we got to that [clarity], we came to that agreement that that's what we were doing, everybody was like, "Oh, okay. Now, we can continue moving on and what we were doing." (Focus group)*
- *I do think it developed... as it went along, they made that more apparent and more of an effort to connect [the different components]. Yeah, I do think that it improved. (Focus group)*

Suggestions for improving SEI structure and sequence

Participants offered suggestions about how the design and clarity of the SEI program may be improved, including more formal structures of accountability, utilizing a "flipped classroom" approach to leverage session time for collaboration discussion, and sharing outlines and agendas both for individual sessions and for the year.

- *I wonder too of structuring it a little bit more like a hybrid, where we have a little bit more of the backwards learning part of it, as far as discussions and things like that as part of the online experience. So that we also get to interact with each other in a way that keeps us at least somewhat on track and a little bit more accountable, but in a way that doesn't feel potentially punitive I guess. So I wonder if there's ways they can design some assignments that add to the online portion while furthering some of the other goals as well. But not taking a scheduled time so it can be asynchronous. (Focus group)*
- *I feel like we should be leveraging all of these teachers in this space. And if you're going to ask me to do a cross-curricular lesson, it would be really awesome if I could have the time to talk and discuss and do that with people that teach the same grade levels or whatever, and then have accountability where we are going to plan this out and discuss how it went and that piece... I just think the biggest asset in this setting are all of us in that space. (Focus group)*

SEI funds made participants feel supported and gave them flexibility to address their PoPs, although some were frustrated by limits related to how they received and spent SEI funds.

Processes for receiving and spending funds made available through the SEI program elicited mixed responses from participants in focus groups. The subsections below provide descriptions of both appreciation and frustration expressed by participants in focus groups related to SEI funding.

Appreciation for funding

As illustrated in the focus group quotes below, many participants expressed an appreciation for the stipend provided for participating in the program as well as the monetary support for addressing problems of practice. Teachers described the funding as opening new opportunities for addressing long-standing concerns and inspiring creative thought about how best to support their students and supplement their classroom resources.

- *Really, the program is fantastic. I'm already just envisioning what I'm going to be spending money on to get more engagement and all those other things. It's wonderful. It's not just money, it's money and... a support system on how to spend it. (Focus group)*
- *The funds and the time is not something that we usually are allowed in a professional development. It's also been a really soul-searching... what do I really care about and what have I seen in my students that I really want to make a difference? And I haven't implemented really much of anything this year, but I have this great plan that I realize I still have four years to implement that I think for my programming students can be a really cool, unique different. In four years, I feel like the programming students at our school will have a whole different more meaningful experience because I can take this time. (Focus group)*

- *I used the money to go to a conference to meet the Step Up people. So that was nice that I had that opportunity and availability to do that. (Focus group)*
- *The resources and funding particularly are going to give opportunities I would never have had otherwise (Survey Open-Ended Response)*
- *Initially it was hard. I feel like I got fixated on the fact that we were given \$2,500 as funds, and... what am I going to use this money for in my classroom?... The problem of practice was to try to address engagements in the classroom tangentially by showing application and then later became, okay, well, maybe I can take them on field trips to different careers and show them the math behind what is happening in those careers. (Focus group)*

Additional clarity, guidelines around funding

In contrast, others felt disappointed that the stipend was taxed—and therefore the net amount they received was less than they expected. In most cases, participants attributed confusion about funds—including taxation questions and how PoP funds could be spent—to district-level processes, suggesting that the SEI Director had made efforts to communicate expectations with districts and schools. Participants also suggested that additional guidelines, documentation, and concise communication would be helpful for future cohorts. Specifically, participants suggested providing districts with examples of how funds might be spent and what level of flexibility teachers should have to spend those funds.

- *At the district level, there's a lot of issues with funding and the way that funding was released. And then, they had to recall it because they sent it to our personal accounts, and that was kind of a bit of a mess. So, I don't know that the communication between my district and the STEM Action Center was very well coordinated, or maybe just somebody didn't read the right emails. I don't know. That part was a little dicey. (Focus group)*
- *I'm glad I have the opportunity and the expense budget to go and do these things, but I'm very disappointed in the fact that I was told, 'oh yeah, you'll get this much for expenses and you'll have this much for your time,' and it leaves a bad taste in my throat. Because teachers are constantly told, yeah, you're going to get this. And then like, 'oh, well, but, oh, well, but,' and once again, this was another teacher 'oh, well, but' moment.... So, I'd prefer that you just treated us like 1099 employees and said, here's your money. Make sure you have this much set aside for taxes or whatever. Instead of having to double pay social security, double pay Medicare, double pay into everything else. (Focus group)*
- *It seems like each district did very different things. And even just, it'd be really nice if there was some kind of paper guideline or digital guideline that was like, 'This is what the STEM Action Center is saying. And in our first year, this is how the districts, these are some examples of what districts did with it.' (Focus group)*
- *I'm disappointed in how the funding has been handled. I am having to double pay Medicare, double pay social security, pay into retirement, etc. When it all shakes out, I am making about \$20/hour for the time I put into the program. That is disappointing. I would like to be paid as a 1099 employee and worry about the taxes in that way and not have everything else taken from the check. (Survey Open-Ended Response)*

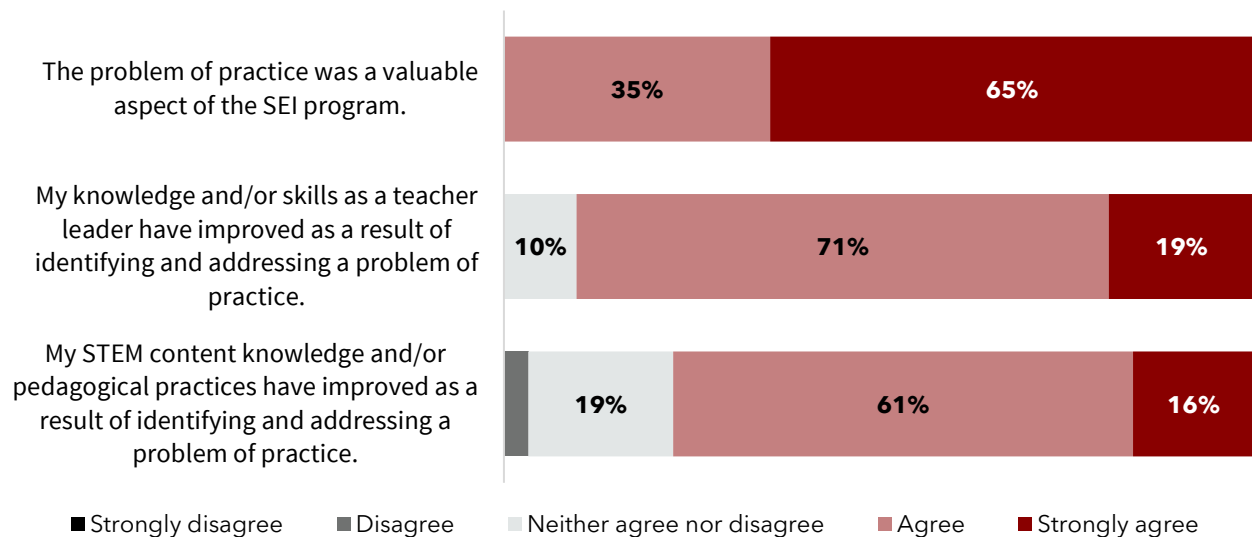
Problem of Practice

This section includes findings related to the SEI participants' experiences identifying, analyzing, and addressing STEM problems of practice. Focus group and survey data were analyzed to provide information about the extent to which participants were able to engage in the cycle of inquiry, including understanding expectations related to defining and addressing a problem of practice as well as the ways in which teachers' felt that the problem of practice was useful and applicable to their own teaching and leadership in their schools.

Most participants reported benefiting from the problem of practice process and felt it made an impact that will benefit their school and students.

Figure 5 shows that SEI participants overwhelmingly agreed or strongly agreed (100%) that the problem of practice (PoP) was a valuable part of the program, and more than 75% of participants also agreed or strongly agreed that the PoP contributed to growth in their teacher leadership and STEM pedagogy. These data build on findings shared throughout this report that many participants appreciated the opportunity to spend time researching and working toward addressing a PoP that held importance for them.

Figure 5. Perceptions of the problem of practice and its impact



Source: End-of-year survey (n = 31)

Impact of the PoP process

When asked in the end-of-year survey to describe the most notable outcomes of the PoP work, participants shared examples of how the PoP has made an impact in their classrooms and for their students. As the responses below illustrate, such outcomes included developing strategies to address concerns about enrollment in STEM courses in their schools, adding courses to expand student learning opportunities, and becoming more proactive in their school communities to initiate change.

- *I am more aware of student engagement and tech use, and I've come up with some ways to take quantifiable data that I can use to track progress and see the effect of my attempted changes. (Survey Open-Ended Response)*
- *As I have taken on the POP I have learned how to remove a lot of red tape. This has given me a great appreciation for how big and complicated schools are. It has also allowed me to work with other teachers and departments as I understand what I can and cannot change. (Survey Open-Ended Response)*
- *We have added classes that allow students to possibly earn college credit without prerequisites that could harm a student's ability to attempt advanced classes. (Survey Open-Ended Response)*
- *Rather than complacently accepting things as they were in my school, I have taken steps to address areas of concern. (Survey Open-Ended Response)*
- *Students have really enjoyed the "active learning" we have been able to give the . (Survey Open-Ended Response)*
- *Exploring dozens of accommodations and teaching practices that ease candid conversation with ML students. (Survey Open-Ended Response)*
- *I now have an idea on why students don't take AP/CE classes. (Survey Open-Ended Response)*

Participants described struggles to initially define their problem of practice, expressing a desire for added clarity about the scope, timeline, and expectations for the problems of practice.

Despite the recognized value of focusing on problems of practice within SEI, multiple participants expressed uncertainty about how to define their PoP at the start of the year. The subsections below provide examples of participants' desire for additional clarity about the PoP and examples of what a final product may look like, as well as an interest in continued support from the SEI Director and facilitators as the PoP process progresses.

Gaining clarity about the PoP

The most frequently cited recommendation for future cohorts was for additional clarity at the outset of SEI regarding expectations, scope, and timeline for the PoP. As illustrated in the quotes below, many participants were uncertain about how and where to begin the PoP process. These kinds of questions were expressed most clearly in focus groups, and participants were asked about outcomes of the PoP rather than process in open-ended survey items.

- *I think most of us walked in thinking that we were going to focus on a problem of practice as the main thing that we were focusing on. And then, the sessions that we had, the monthly sessions, were focusing more on improving ourselves as teacher leaders, and so there was some confusion. The water was muddy until about December.... And, I just think that we kind of had to look at things from two different viewpoints, that this problem of practice was something we were working on our own kind of on the backside. And then together as a cohort, we were working more on these skills that we were developing. (Focus group)*
- *I was very confused about the problem of practice and how it related to the rest of the work that we were doing in our monthly meetings. I didn't feel like I had a good understanding of the expectations of the program until January. (Focus group)*

- *Everyone was applying it to their problem of practice, and ours hadn't even really started yet. And so then it was even more difficult to come to understand. And I think I finally, the last couple months, got it. And then, when we did our showcase thing in May, I really understood it. (Focus group)*

Define and share examples of the PoP

Multiple participants said they could have benefited from additional information about the focus areas for other participants' PoPs, which may have provided opportunities for more formal collaboration during monthly sessions or informal support between sessions. Participants suggested spending more time in the first few monthly sessions defining the PoP and providing resources such as an outline, planning guide, and examples of what was expected.

- *I think in the future, maybe for a new cohort coming in, have better outline of what everything is. Have a website that explains really well what this problem of practice means. How does a problem of practice relate to your classroom? Or does it relate to leadership in your classroom or leadership in your school, or is it something you're doing? Because I think everybody was so different, and I didn't realize you could be so different.... make sure those clear directives, the scope and sequence or some clear outlines that are more functional to people. (Focus group)*
- *When they were training, they seriously gave one example or maybe two of what a problem of practice was, but there wasn't a lot to go on of what you could do as a project. So having ideas, 'Okay, this is what people have done, this is what people have looked into.' (Focus group)*
- *I don't remember a planning sheet. Just suggestions to get us started, maybe written so that you have to work through several questions to get thinking.... A guided template might help maybe. (Survey Open-Ended Response)*
- *I think connecting educators earlier could have been helpful- email contacts, more background information etc.). Also, pose a number of problems that educators are addressing (low enrollment, low representation of minority groups, needing parent volunteers in the classroom, needing materials for coding etc.) and ask educators for suggestions on how they would address these problems. Provide the document to everyone. It might expedite the process and generate a lot of ideas for each PoP. (Focus group)*
- *I am a visual person, so if I had a handout with clear expectations at the beginning, that would have been very helpful for me. (Survey Open-Ended Response)*
- *The PoP seemed to be of secondary importance during the first few months. I didn't connect that we were receiving money to spend in helping us solve our PoP. (Survey Open-Ended Response)*

Continue meetings and support

Over time, most participants felt that support from SEI's Director and PL facilitators helped them gain clarity about their PoP, and they expressed excitement about continuing to work toward addressing their problems in subsequent years. Participants also noted the value of—and suggestion to continue—one-on-one meetings with the SEI Director and ongoing support to help clarify and move their PoPs forward.

- *I had a point where I was like, "Kellie, I think I just need to drop." I'm like, "I don't think that this is the right fit for me." And she talked to me down and was like, "No, you're doing fine. You're where I want you to be." But I didn't know that until I was brave enough to just be like, "No, I don't know if I'm going about this the right way and I don't want to feel bad about taking money for something that I'm doing wrong." And so maybe just acknowledging that it takes time to get your problem of practice. Because it always sounded like it needed to be done yesterday. I felt behind from the very first meeting, and I don't think that was the intent, it's just it's how it came across. (Focus group)*
- *Once I realized I had the time to do that was really helpful. Kelly was super helpful in terms of just like, "Relax, you have time. This is why we wanted it to be five years"... I finally feel at a place where I can attack something that I think is really important and is going to take time and work and resources that I don't necessarily know still what that looks like right now. (Focus group)*
- *I mean, maybe even having meetings with other people outside of Kellie. That one-on-one is really helpful when it comes to talking about your problem of practice. Because like I said, with mine, I have no idea what everybody else is doing and how they're doing theirs. And so, it helped to have that one-on-one with Kellie. (Focus group)*

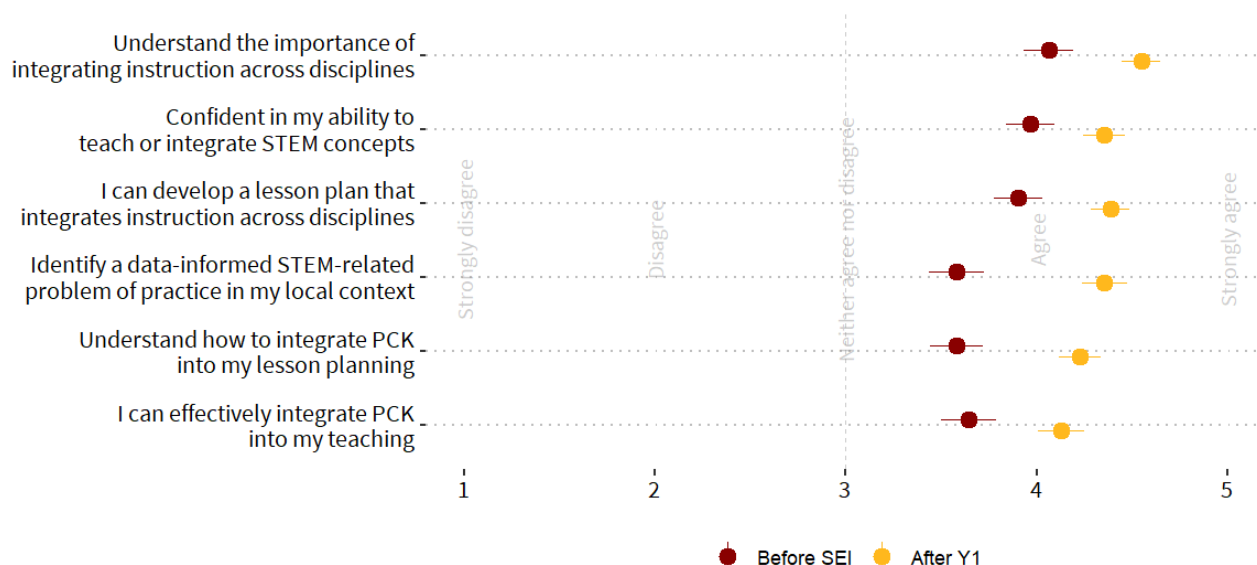
Growth in Development of Pedagogical Knowledge and Teacher Leadership

This section includes findings on SEI participants' perceived growth and development related to deepening and applying their pedagogical knowledge and teacher leadership skills. Focus groups and survey data were analyzed to provide information about the ways and extent to which SEI influenced changes in teachers' understanding of pedagogical and leadership concepts and strategies, as well as the ways in which teachers applied what they learned in SEI in their own schools and classrooms.

The SEI program supported growth in teachers' understanding and confidence in applying new pedagogical content knowledge (PCK) in their teaching and developing cross-curricular lessons.

In the end-of-year survey, SEI participants were asked to rate their understanding, confidence, and abilities across multiple items related to STEM pedagogy. Participants provided two ratings (on a 5-point agreement scale) for each item: the first based on how they perceived their knowledge/skills at the start of the academic year (before starting the SEI program), and the second rating based on how they felt after completing the first year of the program. Figure 6 highlights the items identified that were reported to show positive significant differences were found between means of the two ratings among participants. The largest gap in pre- and post-SEI ratings was participant's ability to identify a STEM-related problem of practice, suggesting that SEI has supported increased awareness among participants of STEM-related issues in their schools. The ratings also indicate improvements in understanding and confidence related to integrating instruction and developing lesson plans across disciplines, as well as confidence and understanding about how to integrate pedagogical content knowledge into their lesson plans.

Figure 6. Teaching areas where participants reported significant improvement since the start of SEI



Source: End-of-year survey (n = 31)

Time to reflect, and improved confidence and energy

In focus groups and open-ended survey responses, participants described SEI as an opportunity to reflect on their own teaching and build confidence in certain areas. As highlighted in the responses below, teachers described taking time to "tighten up" what they have already been doing in their classes and feeling validated through SEI sessions that their pedagogy reflects the concepts they're learning in the program. For many participants, this reflection has led to improved confidence in their teaching practices and a sense of energy and motivation to continue to improve their teaching.

- *I don't know that it has changed dramatically, but my confidence in my teaching practices has been solidified by what we discussed in SEI this year. (Survey Open-Ended Response)*
- *I am more thoughtful and reflective about my practices. (Survey Open-Ended Response)*
- *I've changed things in my teaching, but that's more directed towards my problem of practice than what we did in the sessions. Mainly it was more of a reflective time for me. Okay, what do I need to tighten up that I have been doing? (Focus group)*
- *I want to say that when I think about this grant, I think about it as being life-changing.... I feel like it's only one year, but I feel like it took blinders off and it really opened up possibilities for me. (Focus group)*
- *I am more mindful of pedagogical practices having reviewed them more recently. Also, I emphasize certain cross-curricular connections when possible. (Survey Open-Ended Response)*
- *The learning sessions were a good reminder as to what I should be doing as an effective teacher. (Focus group)*
- *At first I was a little disheartened because I'm like, "Oh yeah, I've read this before. I've thought about this..." But I started taking away that I'm focused on good things. And in my teaching, just*

my teaching in general, I feel like the monthly session started to be a place where I was like, yes, how can I do that a little bit better?... I feel like be validated in my teaching practice. (Focus group)

- *I have been missing the piece of my teacher identity that has been engaged through the SEI program. So being a leader, actually seeing change, doing things in a fun space, the things that we are doing with the program we're developing, that's been huge.... But really for me it's been like lighting this fire that died out a little when we were doing this for free on our own time. (Focus group)*

Adapting classroom practices

While most of the survey and focus group responses focused on reflection and building confidence, some participants did indicate that SEI has influenced their teaching practices. The responses below do not reflect a majority of participants but do highlight cases where teachers have applied what they learned in SEI to, for example, incorporate more data and data informed practices into their pedagogy and develop cross-curricular lesson plans.

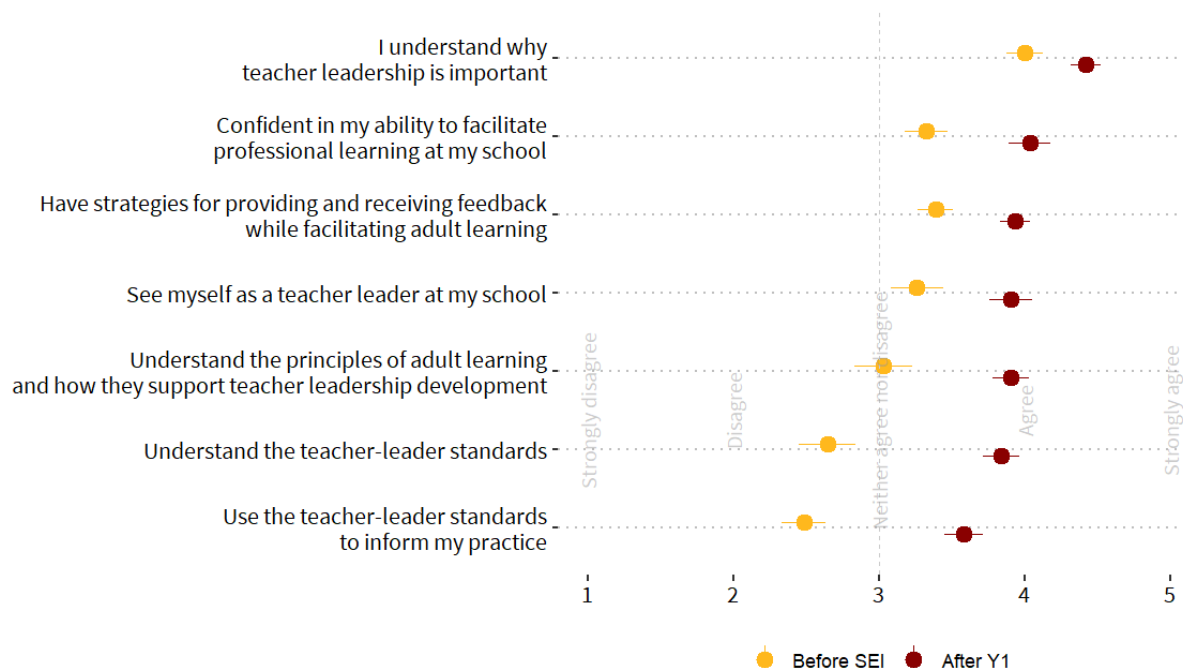
- *I've definitely been better about using more quantifiable data so that I can create targeted ways to help students and my teaching improve. I'm more conscious of how students are using technology, as well as ways that I can answer the question, "now what?" when a lesson goes well, or doesn't go well. (Focus group)*
- *There was [a session] on data collection that was awesome because I love that. And so, that definitely helped me to think more about the types and pieces of information that I collect to inform my classes and how they work. (Focus group)*
- *SEI has allowed me to learn the importance of different topics, such as making other courses relevant in the course I teach, and gaining feedback from peers has helped immensely. (Survey Open-Ended Response)*
- *I have always wanted to do a cross curricular lesson but have never thought I had the "time." This program put my feet to the fire and also gave me the toll to succeed in implementation. (Survey Open-Ended Response)*
- *My participation in the program highlighted my desire to improve my math curriculum to incorporate cross-curricular lessons and aim to offer opportunities for students to improve their STEM identity, and not just their math identity. Through the frequent opportunities to share what I am doing as a teacher with other participants and the facilitators, I was able to receive much needed validation, praise, and, more importantly, feedback to improve and/or make changes. I also was able to frequently gain insight from other teachers on ways to incorporate what they're doing or thought of how to address their challenges, which continued to spark ideas for how I can improve my teaching. (Survey Open-Ended Response)*

SEI has supported new learning and increased confidence related to teacher leadership

Similar to findings related to participants' teaching practices, survey data suggest that participants feel that their confidence in teacher leadership has grown. Figure 7 shows that participants reported significant changes in perceptions of their teacher leadership across a range of items. Notably, mean ratings of participants' understanding and use of teacher-leader standards were significantly higher

after Year 1 than before starting the SEI program. Teachers also provided lower baseline ratings (prior to the SEI program) for these leadership items compared to pedagogy and practice items displayed in Figures 5 and 6, indicating greater room for growth in Year 1 and later years of the SEI program.

Figure 7. Changes in teacher leadership perceptions and practices from the end-of-year survey



Source: End-of-year survey (n = 31)

Increased confidence and excitement about teacher leadership opportunities

Open-ended survey responses and focus groups also provided evidence of growth in participants' leadership confidence and ability. Some teachers provided examples of how they have grown as leaders in their schools, including being more vocal in addressing issues and developing a greater understanding of teacher leader standards. Others cited better understanding of the teacher leader standards and potential opportunities to share what they were learning at a broader scale.

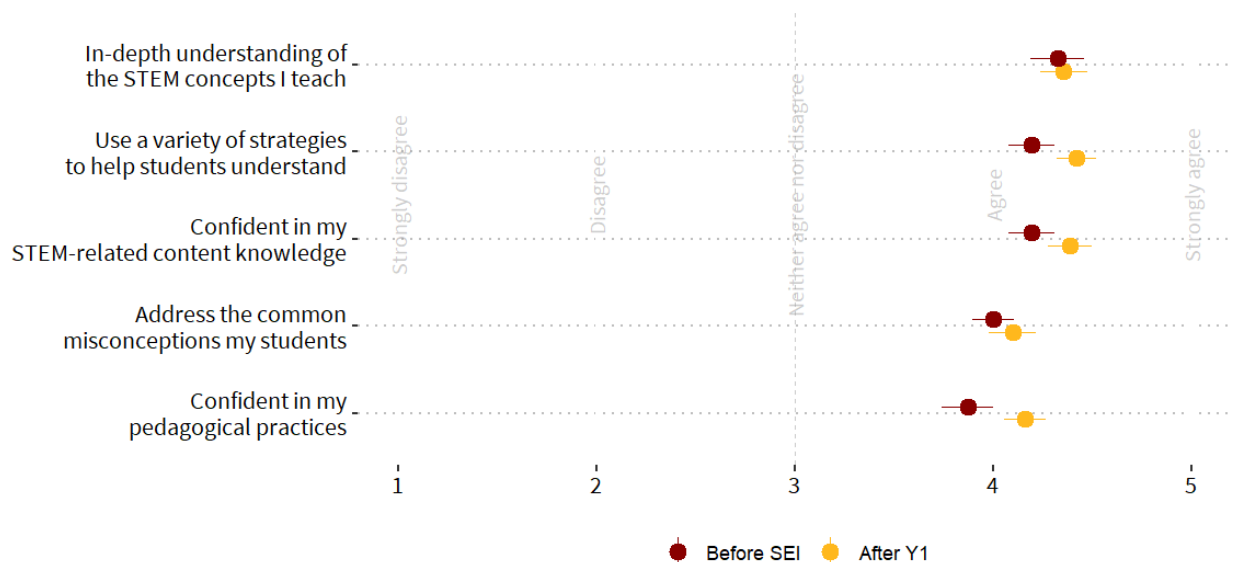
- *I have been a more vocal proponent of addressing school issues in a proactive way vs. dealing with a problem after the fact. For instance, poor student attendance has been an issue at my school. I advocated for changing our messaging... as well as dealing with problems of poor attendance afterwards. (Survey Open-Ended Response)*
- *Maybe a month ago, two months ago, when they were talking about the five-year plan of going out and presenting conferences and that kind of thing, I was like, "Oh boy, that sounds like a lot." But I feel like I have a little bit more excitement about that, that I will have some things to say that can be applied more broadly than my classroom. And I would say that's probably my biggest change in the way I'm seeing teaching is like, in maybe two or three years, [my colleague] and I could have some really exciting things to say at some regional national conferences that will matter to other people. (Focus group)*

- *The biggest thing that has changed as a result of participating in SEI has just been the awareness of specific teacher leadership standards that are out there and thinking about them specifically in my practice. (Survey Open-Ended Response)*

Most participants felt that SEI has not led to changes in their teaching or increases in their teacher leadership practices.

While participants indicated increased confidence and attention to some aspects of their STEM pedagogy and teacher leadership, survey results also indicated areas where there is less significant growth identified. Figure 8 shows additional survey items where teachers rated their knowledge and skills before the beginning of the SEI program and after completing the first year—these items were not found to be significantly different at the two time points. Areas where teachers reported minimal growth include understanding STEM concepts and content, confidence in their pedagogical practices overall, and using various strategies to support student understanding. It is important to note, however, that teachers' ratings of their knowledge and skills prior to starting the SEI program were already high (near or above 4.0 on a 5-point scale).

Figure 8. Teaching areas where participants reported limited or no change since the start of SEI



Source: End-of-year survey (n = 31)

Limited changes to teaching practices

In open-ended survey responses and focus groups, most participants were unable to identify real or measurable changes to their practices. Some participants cited the lack of relevance of monthly sessions (which was discussed earlier in this report) as a reason that SEI had not generated changes in practices. At the same time, most teachers expressed general confidence in their teaching before the SEI, suggesting that they may not have been as open to or likely to make meaningful changes to their practice based on professional learning sessions. Some participants also indicated that more of their focus was on the problem of practice in Year 1, with less attention to shifts in teaching.

- *I'd say there's been absolutely zero change in my classroom. I haven't really been able to apply much of what we did in the meetings and just the fact that I'm having trouble speaking to it right now. It's been really, really cloudy for me at times. (Focus group)*
- *Our group has focused so much time and energy on our PoP, which is not part of my classroom teaching, that I have struggled to implement teaching strategies. I always try to diversify my teaching with different activities and to relate the content to student experiences in other areas, but I can't think of anything specific from this group that has changed my teaching. (Survey Open-Ended Response)*
- *Maybe a little more thought and analysis. I have been teaching for 15 years. I always have and always will try to get better and better. The SEI didn't help me with that. It did help me with my PoP. (Survey Open-Ended Response)*
- *So just the idea of doing something like that has been exciting enough that it has energized my teaching a little. But as far as particular skills, I can't think of anything we've done that I would say, wow, that just revolutionized everything. (Focus group)*

Limited changes to teacher leadership

Many participants expressed uncertainty about how they had grown as teacher leaders—and what was expected in terms of growth through the SEI program. For instance, multiple participants expressed in focus groups that they didn't see teacher leadership as a focus for the program in Year 1 and, therefore, hadn't implemented any changes to their leadership practices. Some participants also described not seeing themselves as a teacher leader and reluctance to take on that role in their school.

- *I don't think we've addressed [teacher leadership] yet. We're just a pilot group. We're the guinea pigs. They have made it very clear that that is a goal, that that is a learning target for the group.... Each thing we're doing takes leadership, but it's not been addressed specifically yet. (Focus group)*
- *[My teacher leadership] hasn't [changed] yet this year, aside from the role of my work in the PoP. I have a higher understanding of what teacher leadership is and how to engage in it in theory, though not in practice. (Survey Open-Ended Response)*
- *It hasn't [changed], ultimately. At least, not specifically. I have too many other programs I participate in that facilitate teacher leadership to pin down SEI as a difference maker in this area. (Survey Open-Ended Response)*
- *I don't feel comfortable presuming that I could teach [other teachers at my school] how to teach better. I mean, they could see things in my class that are different than their class, and they could sit in and learn something from me, I'm sure, but I don't see myself as someone to step up and say, this is how to be a good teacher... As far as a teacher leader, I don't see myself in that role and don't presume to think I can tell people how to teach. (Focus group)*
- *Leadership, in their defense, I don't think is a theme yet. But it will be when we start training the next groups. (Focus group)*

Considerations

The considerations below are based on findings presented throughout this report, with a particular focus on the suggestions for improvement provided by the SEI participants in open-ended responses and focus groups. While these considerations are not intended as prescriptive, they offer specific practices that the SEI Director and SEI Facilitators may incorporate into the program in Year 2 and beyond. Overall, this report suggests that SEI delivered high-quality professional learning and that participants feel that the process of identifying and addressing problems of practice has been rewarding and impactful. Participants noted that there was room for additional clarity about the purpose of monthly sessions and the connections between different components of the SEI program. The evaluation also found that while participants reported increased confidence in their teaching practices, the application of pedagogical skills and teacher leadership practice remains an area for growth. The considerations below suggest opportunities for building on SEI's strengths and addressing these areas for improvement.

Clarify the purpose and intentionality of PL implementation and support

The findings from this first-year evaluation illustrate the importance of a clear and intentional design to develop and implement professional learning in the SEI program. One of the central concerns raised by participants in focus groups and open-ended survey responses was the uncertainty about the purpose of the monthly sessions and how different components of the SEI program (e.g., monthly sessions, PoP) were intended to connect and build upon one another. In Year 1, uncertainty in the first few months led to one-on-one meetings with the program director and additional time spent during monthly sessions to review the purpose of SEI—before participants ultimately felt comfortable with the direction of the program late in the academic year. Considering how better to clarify program structure and monthly session expectations has implications for Year 2 for the current cohort and future cohorts entering the program.

To address these challenges, possible action steps include:

- Grounding the program structure and design more intentionally and thoroughly around the problem of practice, including orienting each monthly session to deliberately support the cycle of inquiry required to address a problem of practice.
- Sharing an overview of the focus and intended outcomes for each monthly session 1-2 weeks in advance.
- Sharing and discussing an outline of the scope and sequence for the year and revisiting the aims/structure of the program in an early session of the second year.
- Developing and sharing a planning guide and/or examples of problems of practice to support quicker identification of problems for future cohorts.
- Use a flipped classroom model more often, including providing pre-work ahead of sessions linked to session outcomes to help participants prepare for the session activities and emphasize discussion and collaboration during meeting time.

Increase focus on developing applicable teacher leadership standards and skills and strengthening participants' pedagogical knowledge and skills

Another notable area for improvement highlighted in the first-year evaluation is the limited influence on participants' practices in their schools and classrooms—including both teacher leadership, instruction, and STEM pedagogical instructional skills. For some teachers, the SEI program enabled the SEI participants to engage in reflection related to their pedagogy and reinforced some of their current practices, but very few reported implementing new ideas in their classrooms or efforts to leverage their teacher leadership skills in their schools. Additionally, participants indicated in focus groups that they often found it difficult to relate some of the conceptual or theoretical discussions in monthly sessions to their classroom practice. Furthermore, some teachers also reported that they felt teacher leadership was not sufficiently addressed in year one of the program.

While limited application may be expected in the first of a five-year program, SEI may consider increasing the focus on pedagogical and teacher leadership development in year two.

Moving forward, SEI may consider the following:

- Centralize the SEI's program design around problems of practice to serve as a foundation for developing a scope and sequence for monthly professional learning sessions that offer opportunities to continue learning and deepening pedagogical and leadership skills as they relate to key STEM problems of practice.
- Allocate more time for collaboration, sharing, and planning with peers during the 3-hour meeting times to support PCK integration and teacher leadership development.
- Continue to engage participants in regular reflections about the relevance and applicability of monthly sessions.
- Develop self-assessment tools for participants to reflect more directly on the ways they are learning new skills and transferring the new learning to practice, and the ways in which the practices support student outcomes.

Intentionally leverage participants' knowledge and experience to strengthen the community of practice seeking to develop teacher leaders

In professional learning programs such as SEI, one of the greatest strengths is the creation of a community of practice focused on STEM education where STEM teachers come together to share ideas and learn from each other. Findings from this report indicate that participants highly valued the opportunity to engage with others in the field, including those who face similar challenges and those who teach in different content areas. Participants described working with their peers—either in collaborative PoP work or breakout rooms during the monthly sessions—as among the program's highlights. At the same time, many participants also noted that they did not have an opportunity to get to know and learn from some of the other participants to the extent they would have liked. This was especially true for participants who were the only individuals from their school and/or district in the cohort.

The SEI Director and PL facilitators may consider how further to develop the program as a professional learning community, leveraging participants' expertise to improve the development of pedagogy and teacher leadership knowledge and skills.

Possible action steps may include:

- Offer more intentional ways for participants to share their expertise in monthly sessions, including leading discussions or facilitating short scenarios or case examples in breakout rooms.
- Design more strategic groupings in breakout rooms. For example, depending on topic or purpose, participants may be grouped by subject area, district, or separated to create a range of perspectives.
- Identify opportunities in the monthly sessions for teachers to pair up (who teach different STEM areas) and model a STEM integrated lesson with the cohort. This could serve several purposes: (1) strengthening their teacher leadership skills, (2) building integrated lessons to house in the shared library, and (3) helping participants to explore and become more proficient with STEM integration lesson planning.

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Appendix A. Logic Model

