

California Statewide Early Math Initiative

Evaluation Report of the Professional
Learning and Coaching Model

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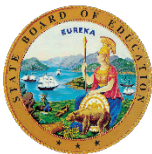


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Executive Summary

This report summarizes the evaluation findings related to the professional learning and coaching model implemented as part of the California Statewide Early Math Initiative (CAEMI). The evaluation focused on the implementation of the professional learning and coaching provided to participants from agencies across the state. The evaluation also examined changes in participants' math identities, as well as their confidence in their knowledge of children's math development, math teaching skills, and training and coaching skills. Finally, the evaluation examined how agencies implemented professional learning and coaching with educators in their local communities.

To support early math outcomes for California's children ages birth through eight years, the California Department of Education funded the CAEMI. The lead agency, Fresno County Superintendent of Schools, partnered with the AIMS Center for Math and Science Education (AIMS), the California State Board of Education, the California Early Math Project, Les Mayfield III (feature film director), and WestEd to

- support young children's math outcomes;
- raise educators' and families' awareness of the importance of early math;
- build positive math identities for adults who care for and teach young children; and
- build the confidence and capacity of educators and families to support children's early math.

To promote these outcomes, the partners implemented a professional learning and coaching model, developed early math resources for families and educators, and piloted family engagement efforts at the Lighthouse for Children demonstration site.

WestEd conducted a formative evaluation of the CAEMI. This report summarizes the evaluation findings related to the professional learning and coaching model. The evaluation team utilized quantitative and qualitative methods to address the following evaluation questions.

1. What were the key characteristics of the implementation of the professional learning and coaching model offered to agency facilitators?
2. What were the perceptions of the implementation of the professional learning and coaching model offered to agency facilitators?
3. How did the agency facilitators' self-reported knowledge and skills change after participating in the professional learning and coaching model?
4. What were the key characteristics of the professional learning and coaching sessions that agencies offered to educators in their local communities?
5. How did the CAEMI influence educators' early math confidence, knowledge, and teaching practices?

Thirty agencies across California each invited a team of two to four individuals to participate in the CAEMI professional learning and coaching model, for a total of 91 agency facilitators. The agency facilitators included trainers, coaches, administrators, teachers, and science, technology, engineering, and mathematics (STEM) coordinators. In their roles and agencies, facilitators worked with educators of young children ages birth through eight years.

To kick off the yearlong initiative, the AIMS team hosted a five-day CAEMI Summer Institute in July 2019. The AIMS coordinators served as the CAEMI coaches, who continued to support the facilitators through quarterly community of practice (COP) sessions, which were offered in person to local agencies and virtually to agencies across the state. In addition, the facilitators participated in monthly virtual coaching with their CAEMI coach. Due to the COVID-19 pandemic, the year concluded with a virtual CAEMI Summer Institute in August 2020.

The CAEMI professional learning and coaching model served as a train-the-trainer approach. As agency facilitators built their capacity through professional learning and coaching, they were required to provide professional learning and coaching to educators in their local communities. The CAEMI grant required each agency to engage at least 20 educators in three professional learning sessions and six coaching conversations. Within these requirements, agencies had flexibility in how they implemented professional learning and coaching in their communities. This flexibility led to variation in the number and types of educators engaged, math content addressed, and delivery and sequencing of training and coaching sessions.

Key Findings

Overall, the evaluation findings indicated that the CAEMI successfully achieved its goals to increase the agency facilitators' awareness of the importance of early math and to build their

confidence and capacity to support children’s early math learning. Utilizing a train-the-trainer approach, the CAEMI coaches provided professional learning and coaching to the agency facilitators, who were then required to provide professional learning and coaching to educators in their local communities.

Effective Professional Learning and Coaching for Agency Facilitators

The CAEMI professional learning and coaching model followed research-based principles of adult learning and professional development. The following key characteristics of the professional learning and coaching approach delivered by the CAEMI coaches fundamentally supported the successful implementation of the CAEMI:

- Facilitating ongoing and collaborative professional learning and coaching
- Using playful, hands-on math learning experiences
- Offering virtual professional learning and coaching

The model for professional learning and coaching was ongoing and collaborative in nature. It coupled intensive training at the summer institute with ongoing supports through the COP and regular coaching sessions. The model provided many opportunities for the facilitators to connect with one another to support peer learning and collaboration. In line with research on effective professional development, the CAEMI coaches regularly engaged the facilitators in hands-on, playful learning experiences to build their knowledge of math concepts and to provide activities that support educators and children from infancy through early elementary grades.

The initiative’s virtual professional learning and coaching allowed for a wide-reaching early math support system. The CAEMI featured a hybrid of in-person opportunities, complemented with virtual experiences for the agency facilitators, including quarterly virtual COP sessions and monthly virtual coaching sessions with the CAEMI coaches. The virtual model helped the initiative extend its reach and make professional learning accessible to facilitators across the state.

The agency facilitators consistently reported positive feedback on all components of the professional learning and coaching model, including the summer institutes, COP, and coaching. The results showed a significant decrease in agency facilitators’ negative feelings toward math after participating in the CAEMI. The data also indicated an increase in the facilitators’ confidence in their knowledge of children’s math development and math teaching skills, and in their math training and coaching skills. This significant growth was evident on most outcomes, regardless of the facilitators’ previous experience providing early math training and coaching.

Local Implementation of Professional Learning and Coaching with a Range of Early Childhood Educators

The 30 participating agencies across California successfully implemented early math training and coaching with a range of early childhood educators in their local communities. The majority of agencies met or exceeded the grant requirement for the number of professional learning sessions and educators served. Using a variety of resources and activities offered by the initiative, the locally implemented professional learning and coaching sessions aimed to build educators' early math knowledge, practice, and confidence. Local implementation varied across agencies in the number and type of educators engaged, the math content addressed in professional learning and coaching, and the schedule and delivery of professional learning and coaching sessions throughout the year.

Despite differences in local implementation, all agencies similarly reported a positive impact on educators. Most agencies reported that educators deepened their early math knowledge and engaged in ongoing implementation of early math practices. They also reported observing educators' increased awareness of and confidence in math, as well as improved abilities of educators to implement newly acquired early math teaching practices in their settings.

The facilitators reported challenges in their local implementation, such as limited time, educators' buy-in, and how to meet diverse educator needs. They also had to overcome the impact of the COVID-19 pandemic on completing their professional learning and coaching. Although the data suggest these challenges persisted over the course of the initiative, many agencies met or exceeded the grant requirements and addressed many of the needs shared by local educators.

Some structural aspects of the grant seemed pivotal for the successful implementation of the CAEMI in local communities. The CAEMI's lead, Fresno County Superintendent of Schools, and its partners have made strategic decisions about the implementation of the grant, including

- flexibility of the grant requirements;
- addressing the birth-to-eight-continuum; and
- recruiting a team of facilitators at local agencies.

The flexibility of grant requirements allowed agencies to tailor their implementation of the CAEMI according to their local needs and provided opportunities for creativity and innovation in local plans. Additionally, the decision to include agencies that serve children across the birth-to-eight age range created new opportunities for cross-age collaboration. Finally, professional learning and coaching of a team of facilitators enabled collaboration among facilitators and helped build local leadership, an important step toward sustainable supports that can extend long after the initiative.

Recommendations

Amidst the positive self-reported outcomes from the CAEMI, feedback from the facilitators pointed out the need for additional supports in certain areas. Although the flexibility of the grant allowed agencies to design and implement professional learning and coaching that met their local needs, for some agencies, this flexibility presented a challenge. They expressed the need for more direction and concrete guidance on how to implement professional learning and coaching in their communities. Furthermore, some agencies lacked clarity on how to determine what math areas they should focus on and used different approaches for making this decision. Additionally, the wide age range of children served under the initiative posed opportunities for cross-age collaborations but also challenges for the implementation of professional learning and coaching for agency facilitators and educators. The CAEMI partners may consider being more intentional in how the initiative supports early math development across the entire age range, including the infant and toddler years and early elementary grades.

In their feedback, some facilitators also pointed out that as much as they appreciated the early math content provided by the CAEMI coaches, they would have liked deeper content on some math areas described in the *California Infant/Toddler Learning and Development Foundations* and in the *Common Core State Standards* for elementary students as part of the professional learning sessions. The initiative partners may consider utilizing the hands-on, playful approach to early math professional learning in ways that deepen the facilitators' content knowledge, expand their understanding of the developmental progressions, and build their capacity to use math teaching practices and activities with greater flexibility. Future implementation of the CAEMI would benefit from being more explicit and intentional about what facilitators (and educators) need to know and practice to improve math teaching and support children's math learning.

Finally, the participating agencies varied in their capacity, knowledge, and previous experience in early math. Nearly half of the agency facilitators never trained or coached on math-related topics prior to the CAEMI. Future implementation of the CAEMI may benefit from a professional learning and coaching model that varies the intensity and areas of supports based on the needs of individual agencies. Additionally, to support quality assurance of local implementation, the evaluation team recommends incorporating direct observations of facilitators as part the CAEMI approach to coaching as well as inviting participants to share their professional learning agendas, presentations, and other materials with the coaches more systematically. Finally, to support all participating agencies in local implementation, the initiative partners may consider ways to integrate the newly developed CAEMI resources into the training, coaching, and COP sessions and to expand the use of the Lighthouse for Children Child Development Center program as a demonstration site as part of the initiative's professional learning and coaching sessions.

The evaluation team has made the following recommendations to inform the future implementation of the CAEMI:

- Ensure professional learning fully addresses the birth-to-eight age range and provide guidance and resources to promote articulation and continuity in math learning across age groups.
- Deepen the facilitators' understanding of early math content knowledge, developmental progressions, and teaching skills while engaging them in hands-on, playful math experiences.
- Further tailor the CAEMI professional learning and coaching to participants' diverse strengths, needs, and backgrounds. For agencies that need higher levels of support, provide additional tools and concrete guidance on planning and implementing local professional learning and coaching.
- Build in additional supports for quality assurance of local implementation, such as observations and review of materials.
- Disseminate the newly developed CAEMI resources more strategically during the CAEMI Phase II.
- Expand the use of the Lighthouse for Children Child Development Center as a demonstration site.

Conclusion

Overall, the evaluation findings indicated that the CAEMI successfully achieved its goals to increase the agency facilitators' awareness of the importance of early math and to build their confidence and capacity to support children's early math learning. Results from this initial study suggest that engaging educational leaders in playful, hands-on math experiences, as well as equipping them with tools and ongoing professional development, effectively built their positive math identities and capacity to provide training and coaching in their communities in ways that meet their local needs. Future research may further explore the impact of this model beyond self-report measures and gather outcome data on educators and children.

Introduction

To support early math outcomes for California’s children ages birth through eight years, the California Department of Education funded the California Statewide Early Math Initiative (CAEMI). The lead agency, Fresno County Superintendent of Schools, partnered with the AIMS Center for Math and Science Education (AIMS), the California State Board of Education, the California Early Math Project, Les Mayfield III (feature film director), and WestEd to

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- raise educators’ and families’ awareness of the importance of early math;
- build positive math identities for adults who care for and teach young children; and
- build the confidence and capacity of educators and families to support children’s early math.

To promote these outcomes, the partners implemented a professional learning and coaching model, developed early math resources for families and educators, and piloted family engagement efforts at the Lighthouse for Children demonstration site. Please see Appendix A for an overview of all of the CAEMI resources developed during the CAEMI Phase 1.

In addition, WestEd conducted a formative evaluation of the CAEMI. This report summarizes the evaluation findings related to the professional learning and coaching model. The evaluation team collected qualitative and quantitative data to learn about the implementation of the professional learning and coaching provided to participants from statewide agencies. The evaluation team also examined changes in participants’ math identities as well as their confidence in their knowledge of children’s math development, their math teaching skills, and their training and coaching skills. Finally, the evaluation team gathered data on how agencies implemented professional learning and coaching with educators in their local communities.

Evaluation and content reviews of other components of the initiative, such as family engagement activities and resources, were summarized in previous reports. Additional CAEMI resources and activities will be evaluated in future implementation of the CAEMI Phase II.

Overview of the Professional Learning and Coaching

A total of 30 agencies across California (see Exhibit 1) each invited a team of two to four individuals to participate in the CAEMI professional learning and coaching. Throughout this report, these individuals are called *agency facilitators* or *facilitators*. The agency facilitators included trainers, coaches, administrators, teachers, and science, technology, engineering, and mathematics (STEM) coordinators. In their roles and agencies, facilitators worked with educators of young children ages birth through eight years. Each agency received grant funding to support their participation in the CAEMI professional learning and coaching model.

Exhibit 1. Agencies Participating in the CAEMI

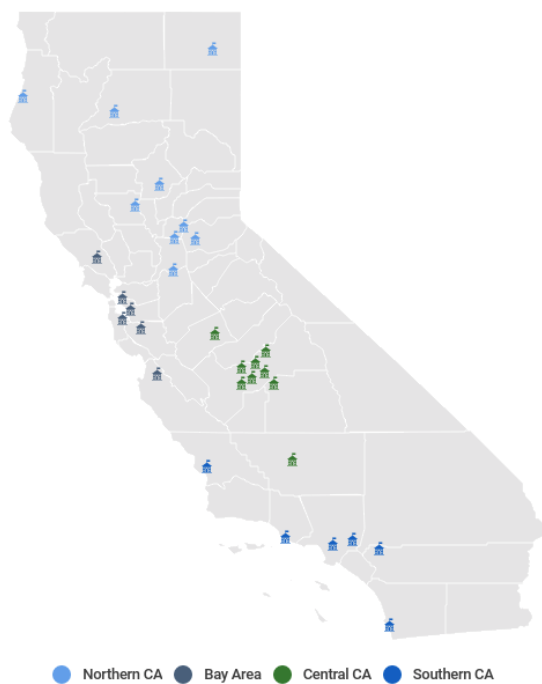


Exhibit Note: This map of California shows the number of agencies participating in the CAEMI within each region of the state. More details are provided in Exhibit 2.

To kick off the yearlong initiative, the AIMS team and CAEMI partners hosted the five-day CAEMI Summer Institute in July 2019. The in-person event allowed each of the four CAEMI coaches to meet the agency facilitators in their assigned geographic region, or base group, whom they would work with throughout the year. The CAEMI coaches continued to support the facilitators through quarterly community of practice (COP) sessions, which were offered in person to local agencies and virtually to agencies across the state. In addition, the facilitators participated in monthly virtual coaching with their CAEMI coach. The virtual engagement

allowed the CAEMI coaches to continue facilitating the COPs and coaching after the onset of the COVID-19 pandemic in March 2020.

Due to the continued pandemic, the year concluded with the virtual CAEMI Summer Institute in August 2020. The CAEMI was extended for agencies interested in continuing from September 2020 to June 2021; however, this report focuses on the first year of the implementation of the grant. Exhibit 2 provides an overview of the delivery, frequency, duration, and key activities of the components of the professional learning and coaching model.

Although all facilitators participated in all components, the implementation of the CAEMI components and the facilitators' experiences may have varied due to their geographic region (i.e., Bay Area, Central California, Northern California, and Southern California). Specifically, portions of the summer institutes, COP sessions, and monthly coaching occurred by region and thus may have varied across regions.

Exhibit 2. Components of the Professional Learning and Coaching Model

Component	Delivery	Frequency	Duration	Key Activities
Summer Institute 2019	In person	Annual	5 days	<ul style="list-style-type: none"> • Whole-group sessions on how to deliver professional learning and coaching • Breakout sessions on topics, such as early math (e.g., spatial reasoning), learning theory, family engagement • Hands-on math activities • Planning time with agency team
Coaching	Virtual	Monthly	0.5–2 hours per session	<ul style="list-style-type: none"> • Check-in on implementation plan • Reflection on implementation • Discussion of emerging challenges and successes
Community of practice	In person for local agencies Virtual for non-local agencies	Quarterly	3 hours per session	<ul style="list-style-type: none"> • Initiative updates • Implementation plan shareouts • CAEMI partner presentations of early math resources • Hands-on math activity in base group breakout sessions

Component	Delivery	Frequency	Duration	Key Activities
Summer Institute 2020	Virtual	Annual	2 half days	<ul style="list-style-type: none"> • Keynote speaker • Presentation of agency posters • Evaluation team presentation of case study findings • Hands-on math activity in base group breakout session • Final panel and call to action

Overall, the professional learning and coaching model featured a hybrid of in-person opportunities, complemented with virtual experiences. The initial in-person CAEMI Summer Institute 2019 allowed the CAEMI coaches and agencies to build relationships with one another, which facilitated successful virtual follow-up engagement. In addition, the hybrid model made it easier to continue implementation when virtual supports were required with the onset of the COVID-19 pandemic in March 2020.

In line with research on effective professional development (Fukkink & Lont, 2007; Sheridan et al., 2009; Zaslow et al., 2010), the model coupled in-depth training at the CAEMI Summer Institute 2019, with ongoing supports for agencies provided through regular COPs and coaching. The CAEMI Summer Institute 2020 provided a capstone of the yearlong initiative, where agencies celebrated their successes and shared their challenges and lessons learned with their colleagues from across the state.

Throughout all of these components, the CAEMI coaches intentionally sought to promote the agency facilitators’ positive math identities. To do so, the CAEMI coaches made math playful for the facilitators, in hopes they would make math playful for the educators, parents, and children they worked with in their communities. The CAEMI coaches regularly engaged the facilitators in hands-on, active learning experiences to build their knowledge of math concepts, learning theory, and activities for educators and children.

For more information on the CAEMI approach to professional learning and coaching, see Chapter 1. Professional Learning and Coaching for Agency Facilitators.

Train-the-Trainer Approach

The CAEMI professional learning and coaching model served as a train-the-trainer approach. As agency facilitators built their capacity through professional learning and coaching, they were then required to provide professional learning and coaching to educators in their local communities (see Exhibit 3). In this report, the term *educators* includes early childhood teachers, elementary school teachers, family child care providers, professional development

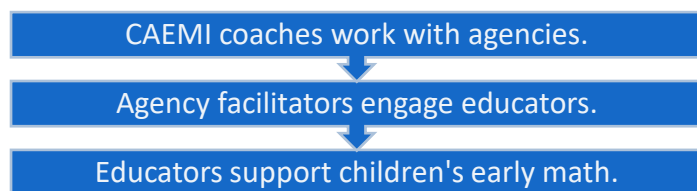
providers, and parents and families, as these groups of adults were each served by agencies. The CAEMI grant required each agency to engage at least 20 educators in

- three professional learning sessions; and
- six coaching conversations.

However, within these requirements, agencies had flexibility in how they implemented professional learning and coaching in their communities. This flexibility led to variation in the number and types of educators engaged, math content addressed, and delivery and sequencing of training and coaching sessions. In addition, the COVID-19 pandemic had an impact on local implementation—although some agencies had already completed many of their grant requirements, some agencies had to pivot to virtual professional learning and coaching or postpone their implementation plans.

For more information on agencies' local implementation and educators served, see Chapter 3. Professional Learning and Coaching for Educators and Chapter 4. Building Local Educators' Early Math Capacity.

Exhibit 3. The CAEMI Train-the-Trainer Approach



Participants in the Professional Learning and Coaching

The CAEMI partners intentionally selected a range of agencies to participate in the professional learning and coaching. In April 2019, agencies from across the state applied to participate in the CAEMI. The applicant pool consisted of 125 completed applications from county offices, school districts, nonprofits, for-profits, and institutions of higher education. During the first round of review, some applications were eliminated: duplicate applicants and institutions of higher education, child development centers on college campuses, for-profit organizations, and agencies that did not commit to all grant requirements.

In addition, the lead partners highlighted the importance of including specific populations in the CAEMI, such as tribal populations and organizations that serve family, friend, and neighbor (FFN) care. The CAEMI partners conducted strategic outreach to agencies serving tribal communities, libraries, and a science museum.

As part of the systematic review process of completed applications, the following key considerations were discussed and weighed:

- Representation across geographic areas
- Existing capacity to support the early childhood education workforce
- Current reach of educators, professionals, or families to whom agencies offered training and coaching
- Age range of children served by agency
- Building on existing initiatives or networks within an organization or within the state
- Increasing access to diverse populations (e.g., tribal, FFN)

As a result of this review process, in May 2019, 30 agencies were invited to participate in the CAEMI professional learning and coaching. The agencies included 14 county offices, 7 school districts, and 9 nonprofit agencies across the state. At the outset of the initiative, 91 agency facilitators across the 30 agencies attended the CAEMI Summer Institute 2019.

The distribution of agencies and participants was uneven across geographic regions, with the largest numbers of agencies and participants from the Central California and Northern California regions. Furthermore, the types of agencies participating within each region varied. For example, 52 percent of agency facilitators who work in nonprofits belonged to the Central California base group, and 49 percent of facilitators who worked in a county office belonged to the Northern California base group. Exhibit 4 shows the distribution of participants by agency type and geographic region.

Exhibit 4. Facilitators by Agency Type and Geographic Region

	Northern CA	Bay Area	Central CA	Southern CA	Total
County offices	7 agencies 17 facilitators	3 agencies 7 facilitators	2 agencies 6 facilitators	2 agencies 5 facilitators	14 agencies 35 facilitators
School districts	1 agency 4 facilitators	1 agency 3 facilitators	3 agencies 11 facilitators	2 agencies 7 facilitators	7 agencies 25 facilitators
Nonprofit organizations	1 agency 3 facilitators	2 agencies 6 facilitators	4 agencies 16 facilitators	2 agencies 6 facilitators	9 agencies 31 facilitators
Total	9 agencies 24 facilitators	6 agencies 16 facilitators	9 agencies 33 facilitators	6 agencies 18 facilitators	30 agencies 91 facilitators

Demographics

Most agency facilitators were women (97 percent), with the highest frequencies identifying as either White or Latino/a. Almost all facilitators reported fluency in English (97 percent), and some were also fluent in Spanish (32 percent) or another language (9 percent). The facilitators had high levels of education, with 46 percent having a bachelor’s degree and 37 percent a graduate degree. See Exhibits 5–6 for more detailed demographic information.

Exhibit 5. Demographics of the Agency Facilitators: Race and Ethnicity

Race	Frequency	Percentage
American Indian or Alaska Native	2	2.2
Asian	5	5.5
Black or African American	3	3.3
Hispanic, Latino/a, or Spanish origin	32	35.2
White	36	39.6
More than one race	11	12.1
Did not respond	2	2.2

Exhibit 6. Demographics of the Agency Facilitators: Education

Highest level of education	Frequency	Percentage
Some undergraduate	2	2.2
Associate’s degree	5	5.5
Bachelor’s degree	42	46.2

Highest level of education	Frequency	Percentage
Master's degree	32	35.2
Doctorate	2	2.2
Did not respond	8	8.8

Professional Background

The agency facilitators brought extensive backgrounds in teaching, training, and coaching. In terms of teaching experience, most facilitators had taught young children before: 76 percent of facilitators had taught preschool, 63 percent of facilitators had taught infants or toddlers, and 51 percent of facilitators had taught elementary school.

The majority of facilitators reported training and coaching as one of their main responsibilities in their current position. In fact, 76 percent of facilitators had at least one year of experience coaching, and 84 percent of facilitators had at least one year of experience training educators. However, about half of the facilitators had never coached or trained educators in early math. In the last five years, 60 percent of facilitators had not provided any professional development on early math. These percentages highlight the need for professional learning and coaching on how to support educators in the area of early math. See Exhibit 7 for a summary of facilitators' previous training and coaching experiences.

Exhibit 7. Previous Training and Coaching Experience

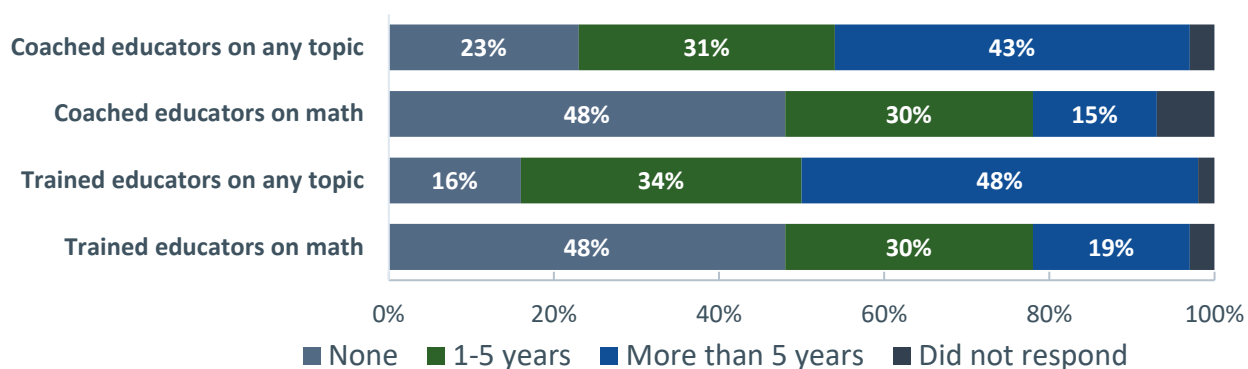


Exhibit Note: Percentages less than 10% are not labeled in the bars.

Evaluation Questions and Methods

The evaluation team focused on the following primary evaluation questions around the professional learning and coaching model. Evaluation sub-questions will be presented in each respective chapter of the report.

1. What were the key characteristics of the implementation of the professional learning and coaching model offered to agency facilitators?
2. What were the perceptions of the implementation of the professional learning and coaching model offered to agency facilitators?
3. How did the agency facilitators' self-reported knowledge and skills change after participating in the professional learning and coaching model?
4. What were the key characteristics of the professional learning and coaching sessions that agencies offered to educators in their local communities?
5. How did the CAEMI influence educators' early math confidence, knowledge, and teaching practices?

To answer these questions, the evaluation team gathered data from diverse perspectives through multiple quantitative and qualitative methods.

Quantitative Methods

Throughout the year, the evaluation team administered surveys with the agency facilitators. To develop the surveys, the evaluation team collaborated with the CAEMI partners to understand key outcomes of interest, such as building positive math identities and deepening knowledge of children's early math development. Then, the evaluation team examined the research literature to identify existing measures to align with the desired outcomes. Existing measures tended to focus on teachers, and because this evaluation focused on agency facilitators, the evaluation team utilized some items, and adapted others, from existing measures. In addition, the evaluation team developed new survey items to assess facilitators' perceptions of the professional learning and coaching model.

Surveys with Agency Facilitators

To understand the agency facilitators' perspectives on the different components of the professional learning and coaching model, as well as their self-reported outcomes, the evaluation team conducted multiple surveys (see Exhibit 8). The evaluation team administered surveys 1–4 with all agency facilitators participating at each time point ($n = 91$). One agency facilitator joined the evaluation after the CAEMI Summer Institute 2019; therefore, the response rates for surveys 1–2 were calculated out of 90 facilitators, while the response rates for surveys 3–4 were calculated from 91 facilitators. In addition, each of the 30 agencies was

invited to complete an agency questionnaire ($n = 28$). For more information on the specific items and composites within each survey, see Appendix B.

Exhibit 8. Overview of Surveys Taken by Agency Facilitators

Instrument	Timing	Mode	n (response rate)	Constructs
Survey 1	July 2019	Paper and pencil	90 (100%)	<ul style="list-style-type: none"> Demographics and professional background Pre-outcomes: math identity, knowledge of children’s math development, math teaching skills, training and coaching skills
Survey 2	July 2019	Paper and pencil	86 (96%)	<ul style="list-style-type: none"> Perceptions of the effectiveness of the CAEMI Summer Institute 2019
Survey 3	November–December 2019	Electronic	80 (88%)	<ul style="list-style-type: none"> Confidence in math training and coaching skills Perceptions of the COP and coaching Progress on local implementation
Survey 4	August 2020	Electronic	69 (76%)	<ul style="list-style-type: none"> Post-outcomes: math identity, knowledge of children’s math development, math teaching skills, training and coaching skills Perceptions of the COP, coaching, and CAEMI Summer Institute 2020

Instrument	Timing	Mode	n (response rate)	Constructs
Agency questionnaire	July 2020	Electronic	28 (93%)	<ul style="list-style-type: none"> • Reach and content of professional learning and coaching in the local community • Impact of the COVID-19 pandemic on local implementation • Perceived level of impact on educators

Qualitative Methods

Throughout the year, the evaluation team conducted focus groups, interviews, observations, and document review.

Focus Groups with Agency Facilitators

In addition to the surveys described previously, the evaluation team conducted two 60-minute focus groups with a subsample of agency facilitators ($n = 17$) in July 2019. The focus groups took place in person and were audio recorded. The discussions focused on the agency facilitators' individual strengths, challenges or concerns, and goals for the initiative year. In addition, the evaluation team invited facilitators to share about their experiences during the CAEMI Summer Institute 2019, such as their level of engagement in the content and activities, how the institute helped them develop their math training and coaching skills, and their suggestions to improve future professional learning experiences.

Toward the end of the initiative, in March 2021, the evaluation team conducted two 90-minute focus groups with a subsample of agency facilitators ($n = 12$). The focus groups took place virtually and were audio recorded. The discussions focused on the agency facilitators' reflections on implementation, including challenges, successes, and the impact of the COVID-19 pandemic on their efforts. The facilitators also shared their perceptions of how the CAEMI made an impact on them, the educators they work with, as well as the children and students served in their local communities.

Focus Groups with the CAEMI Coaches

The evaluation team conducted a one-hour focus group with the CAEMI coaches, as well as leaders from the AIMS Center for Math and Science Education ($n = 6$) at the end of the CAEMI Summer Institute 2019. The focus group was conducted in person and was audio recorded. The

discussion focused on the team's goals for the institute, approach to professional learning, examples of activities that built facilitators' knowledge and skills, perceptions of the facilitators' knowledge and engagement, and lessons learned to inform the future professional learning and coaching activities.

Toward the end of the initiative, in March 2021, the evaluation team conducted another 90-minute focus group with the CAEMI coaching team ($n = 6$). The focus group took place virtually and was audio recorded. The discussion focused on the team's overall reflections on implementation, including challenges, successes, and the impact of the COVID-19 pandemic on their efforts. The team also shared their perceptions of how the CAEMI made an impact on the facilitators and educators in local communities.

Interviews with CAEMI Coaches

In February 2020, the evaluation team conducted individual interviews with each CAEMI coach to capture perceptions during the CAEMI implementation. The interviews were conducted virtually over Zoom and were audio recorded. The interviews focused on the coaching approach, variation across agencies (e.g., implementation plans, level of supports needed), and implementation challenges or supports they experience as coaches.

Observations

The WestEd evaluation team observed different components of the professional learning and coaching model. The evaluation team attended the CAEMI Summer Institute 2019 in person; specifically, they observed 17 sessions that represented content (e.g., math, professional learning, coaching), structure (e.g., whole-group, base-group breakouts), and instructors across the full set of 35 sessions. The observer completed an observational protocol that captured descriptive information on the content (e.g., math, science, professional development), delivery of content (e.g., organization, adult learning strategies), goals and level of impact, and participant engagement. In addition, the evaluation team virtually observed all four COP sessions and the CAEMI Summer Institute 2020. For these observations, team members took descriptive notes on the agency shareouts of their local implementation and the hands-on activities during breakout sessions.

Document Review

As part of the CAEMI Summer Institute 2020, all 30 agencies created a poster to share out with the other participating agencies and initiative partners. The posters provided an overview of the agencies' local implementation, perceptions of impact in their communities, and any challenges or takeaways from implementing the initiative. To supplement the agency questionnaire data, the WestEd evaluation team conducted a document review of the posters to understand the process, challenges, and impact of implementing professional learning and coaching with educators in local communities.

Case Studies

To better understand the planning and implementation of professional learning and coaching in local communities and any changes in educator outcomes, the evaluation included two case studies. Of the 30 agencies participating in the CAEMI, two agencies were purposefully selected. The criteria for case study agency selection considered geography within the state, agency type, ages of children served by the agency, and diversity of roles of the agency facilitators.

The evaluation team invited four agencies to participate: two county offices of education, one unified school district, and one nonprofit. The school district was unable to participate due to research restrictions in the district, and the nonprofit was unable to participate due to wildfires in its local community. The two county offices of education, from different parts of California, agreed to participate. Case Study 1 took place in a large urban county, and they focused primarily on spatial reasoning. Case Study 2 took place in a small rural county, and they introduced coding and other math areas.

To study local implementation and educator outcomes, the evaluation team gathered data through the following qualitative and quantitative methods:

- Observations of coaching sessions between agency facilitators and CAEMI coaches
- Semi-structured interviews with facilitators
- Document review of professional learning materials
- Observations of professional learning sessions for educators
- Educator interviews
- Surveys of educators' math content knowledge, confidence in supporting children's early math, and math teaching practices before and after the professional learning and coaching

For more information on local implementation and the findings from the case study, please see the full case study report, [California Statewide Early Math Initiative in Local Communities: Building Educator Math Capacity](#).

For more information on the analytic approach for the data collected from these methods, please see Appendix C.

Overview of the Evaluation Report

The following report features four chapters summarizing the evaluation findings related to the train-the-trainer model.

Chapter 1. Professional Learning and Coaching for Agency Facilitators describes key characteristics of the professional learning and coaching that the CAEMI coaches provided to the agency facilitators. Strengths and positive feedback on the approach are highlighted, as well as specific areas of improvement.

Chapter 2. Building Agency Facilitators' Early Math Capacity shares the changes in agency facilitators' personal feelings about math, knowledge of early math development, math teaching skills, and professional development skills from the beginning to the end of the CAEMI. In addition, subgroup analyses by agency type and previous experience training and coaching in math are presented.

Chapter 3. Professional Learning and Coaching for Educators illustrates how agencies implemented professional learning and coaching with educators in their local communities. The chapter documents key characteristics of the professional learning and coaching, such as reach, content, and structure. It also describes implementation challenges, successes, and drivers of effective implementation.

Chapter 4. Building Local Educators' Early Math Capacity summarizes the small amount of evaluation data related to educators' outcomes (e.g., case study findings, agency questionnaire data, agency posters). Similar to the topics covered in Chapter 2, this chapter focuses on how professional learning and coaching promoted positive math identities, raised educators' awareness of early math, and built their confidence in implementing math teaching practices.

Finally, the Discussion section reviews the key evaluation findings, as well as any additional interpretation. Based on these findings, recommendations for the future implementation of the CAEMI are suggested. Limitations of the current evaluation, as well as any next steps for future evaluations of the CAEMI, are also provided.

Chapter 1. Professional Learning and Coaching for Agency Facilitators

This chapter highlights the overall evaluation findings related to the professional learning and coaching, or train-the-trainer, model that the CAEMI offered to agency facilitators. As part of the model, the CAEMI coaches facilitated two summer institutes, quarterly COP sessions, and monthly coaching. Research on professional development in early childhood education, including in the area of early math, offers insights into principles and practices that effectively engage and promote adult learning (Brenneman, 2014; Sheridan et al., 2009; Zaslow et al., 2010). This chapter will describe how the professional learning and coaching model for the agency facilitators aligns with such research-based principles and practices.

Evaluation Questions

This chapter presents findings related to the implementation of the professional learning and coaching model for agency facilitators. The chapter addresses the following evaluation questions and sub-questions:

1. What were the key characteristics of the implementation of the professional learning and coaching model offered to agency facilitators?
2. What were the perceptions of the implementation of the professional learning and coaching model offered to agency facilitators?
 - a. What strengths were reported or observed?
 - b. What specific areas to improve were reported or observed?

Overview of Methods and Sample

This chapter draws on data from several quantitative and qualitative methods with different participants. To understand the goals of and implementation of the professional learning and coaching model, the evaluation team conducted a focus group ($n = 6$) with the CAEMI coaches at the end of the CAEMI Summer Institute 2019, interviews with the CAEMI coaches ($n = 4$) in early 2020, and a final focus group with the CAEMI coaches in March 2021 ($n = 6$). The focus groups included the CAEMI coaches as well as leaders from the AIMS Center for Math and Science Education.

To report on agency facilitators' perceptions of the professional learning and coaching model, the evaluation team relied on data from survey 2 ($n = 86$), survey 3 ($n = 80$), survey 4 ($n = 69$), an agency questionnaire ($n = 28$), two focus groups ($n = 17$) conducted during the CAEMI Summer Institute 2019, and two focus groups ($n = 12$) conducted in March 2021.

Finally, the evaluation team observed professional learning sessions during the CAEMI Summer Institute 2019, the quarterly COP sessions, monthly coaching of the case study agencies, and the CAEMI Summer Institute 2020. Observations primarily documented information on math content addressed and adult learning strategies.

Key Findings

First, this chapter presents an overview of the overall approach to professional learning and coaching, making connections to research on adult learning and effective professional development as relevant. This chapter continues with an examination of the ratings on the professional learning and coaching provided by the agency facilitators. Finally, specific areas of improvement are identified.

The CAEMI professional learning and coaching model follows many research-based principles of adult learning and professional development.

Ongoing and Collaborative Nature of Professional Learning and Coaching

Research on effective professional development to improve early childhood educator outcomes indicates the need for intensive training, as well as ongoing supports through coaching, mentoring, or other technical assistance (Sheridan et al., 2009; Zaslow et al., 2010).

Additionally, collaboration with peers, particularly in the same organization, has been shown to lead to more lasting changes (Zaslow et al., 2010; Zaslow, 2014). Research on effective professional development in the area of early math also suggests that ongoing professional development, as well as engaging a team of colleagues, more likely results in positive educator

outcomes (Brenneman, 2014). The CAEMI professional learning and coaching model reflects these research-based principles.

The initiative launched with a five-day summer institute, which included training on specific content in early mathematics and how to deliver professional development. The institute also provided the opportunity for the CAEMI coaching team to build relationships with agency facilitators, as well as for facilitators to connect with one another to support peer learning and collaboration. The initiative continued with monthly coaching between the CAEMI coach and each agency team and an additional network of support through the quarterly COP sessions. All of these components featured facilitators working together within their agency teams to plan and implement professional learning and coaching in their communities over the course of a year.

In focus groups at the end of the initiative, agency facilitators and a CAEMI coach highlighted the agency team approach as a strength to bring together staff who work with children of different age and grade levels to collaborate, often for the first time. Finally, some of these components, such as the institutes and COPs, allowed agencies to share their ideas and learn from one another at different stages of the ongoing process.

“I think it’s exciting to see people who have those different backgrounds and expertise areas come together. It’s certainly influenced the way I would like to think about this kind of work in the future to bring together either teams of people who are interdisciplinary teams or who work in different contexts.”

CAEMI Coaching Team, Focus Group Response, March 2021

Engaging Adults in Hands-On, Playful Math Experiences

Research suggests that all humans, including adults, learn through hands-on experiences that are relevant to their lives (National Research Council, 2000). Professional development that integrates active participation and interactive strategies engages adult learners more effectively (Borman & Feger, 2006; Kretlow & Bartholomew, 2010; Rush & Sheldon, 2011). In the area of early math and science specifically, early childhood professionals may experience anxiety or a lack of confidence (Chen et al., 2014; Copley, 2004). Engaging early childhood professionals in hands-on, playful math experiences may serve to build their positive feelings toward math and strengthen their math content knowledge.

“I would say that there’s been a beauty in these very strong relationships around math, and that is so beautiful because it changed the narrative for a lot of these people. They not only have a mentor they can go to help them with math, but they’ve experienced math in playful fun; they’ve had joy around it. So both the relationships that are all positive around math learning and math teaching, it just inspires me; that’s what gives me joy too and feels like this work is so meaningful.”

CAEMI Coaching Team, Focus Group Response, March 2021

During the focus group after the CAEMI Summer Institute 2019, the CAEMI coaching team clearly stated that they intentionally engaged adults as learners, both to support their own professional learning and to help them better understand the perspectives of children as learners of math. This sentiment was echoed and appreciated by the agency facilitators who also participated in focus groups. Almost all of the agency facilitators in the focus groups reported enjoying the hands-on, active learning experiences for adults. They found these activities to be highly engaging for them as adult learners.

Agency facilitators also reported that the activities helped them learn new math concepts and see learning from a child’s perspective, reminding them what it feels like to learn something new. They discussed how these activities could be directly taken and used with the educators in their communities. Specifically, the focus group participants talked about the following activities from the summer institute: alphabet math, lobster counting, interactivities (e.g., icosahedron, Froebel’s gifts), community walk, and find the star. When asked in survey 2 about the information from the institute that facilitators will use in their work with educators, 41 percent said they will use the activities and 20 percent said they would integrate play into math and professional development. The evaluation team observations during the summer institute also indicated high engagement of the facilitators during the hands-on, active learning experiences.

“When I did the fishbowl, it was an opportunity to reflect on how did it feel to do that activity. I had them thinking about what they would use for their training. A lot of good reflection happened during that time. We thought about what might children do. What misunderstandings will they have? It was important for the staff to do the activity and not just to tell them what to do. That activity was a way for them to reflect and to sit down and play with blocks and think about if the kids would have the same reflections.”

CAEMI Coaching Team, Focus Group Response, July 2019

“I’m going to use the alphabet math. That was a really good example to me on how to make adults children again. It was really eye opening for me because I struggled in the beginning with it and trying to figure out how am I gonna add letters together? I don’t get this. But to me, I feel like I understood it, and it did make everyone in the room, I felt, into a primary kid again. It was really eye opening to me ... So, like that is a tool that I’m going to use because it’s really hard to recreate something like that too ... I’ve been to in services and they’ve tried to do activities where you’re the child and it’s like, well, I’m not a child and I know how to put this together. But that was a really good tool.”

Agency Facilitator, Focus Group Response, July 2019

This trend of appreciating the hands-on learning experiences continued until the end of the initiative year. Responses to survey 4 indicated that facilitators highly value the interactive elements of the COP sessions. When asked how valuable each of the elements of the COP was in supporting them in this initiative, facilitators identified the hands-on activities during the base group breakouts (90 percent of facilitators reported *very/extremely valuable*) and the interactive discussion about early math concepts and standards during base group breakouts (88 percent of facilitators reported *very/extremely valuable*) as most valuable.

Additionally, out of the 55 facilitators who shared what they would keep the same about the COPs if the CAEMI is offered to a different group of participants in the future, 45 percent reported that they would keep the hands-on activities. Similar to what was reported in survey 4, facilitators also rated the interactive elements of the CAEMI Summer Institute 2020 as most valuable. For example, the majority of the facilitators reported that creating a poster to share at the institute (83 percent) and the base group breakouts (80 percent), featuring a hands-on activity, were *very/extremely valuable*. Taken together, these findings suggested that the facilitators highly valued the aspects of the COPs and institutes that offered invitations for active, hands-on engagement.

Research-Based Coaching Strategies

Research identifies joint planning, reflection, feedback, and observation as key characteristics of effective coaching in early childhood education (Gupta & Daniels, 2012; Rush & Sheldon, 2011). Specifically, math professional development efforts that have positively affected math teaching practices and children’s math outcomes have involved in-person observations and additional supports, such as reflection and feedback, as part of the coaching (Rudd et al., 2009; Sarama et al., 2016). In coaching, feedback should be given based on direct observations of the participant or actions reported by the participant (Rush & Sheldon, 2011).

The evaluation data suggest that the CAEMI coaches used the following research-based coaching practices to varying degrees: joint planning, reflection, feedback, and observation. In

their midyear interviews, all CAEMI coaches discussed how they checked in with agencies on their implementation plans and ended sessions with a nugget of learning. All coordinators reported using reflection in an ongoing way. Most coordinators reported providing ideas or feedback, but they provided it when asked or once the agency facilitators ran out of their own ideas. At this stage of the grant, all coordinators reported that observation was not part of their ongoing approach, though one coordinator had observed a professional learning session of some agencies.

“I would say across the board, everybody really does appreciate the reflective space and I think that’s why they like showing up, because it’s hard to plan that in when you have multiple hats. So the fact that we’re just asking questions like, how did it go? What would you change? It almost is like a deep breath that your brain needs in order to be able to kind of process what’s happening.”

CAEMI Coaching Team, Focus Group Response, March 2021

The agency facilitator survey responses corroborated the reports of CAEMI coaches about their use of coaching strategies. Exhibit 9 shows the percentages of facilitators who reported engaging in each coaching strategy in survey 3 (November 2019) and survey 4 (August 2020). The data suggest that by the end of the year, the CAEMI coaches engaged nearly all facilitators in joint planning (98 percent), reflection (97 percent), and feedback (98 percent). However, much smaller percentages of facilitators reported being observed by their CAEMI coach (34 percent), either in person or on video, which is consistent with the CAEMI coaches sharing that observation was not part of their ongoing approach. At the end of the year, the agency facilitators also reported perceptions of value for each of these research-based coaching strategies. Overall, the greatest percentages of facilitators rated the joint planning (86 percent), reflection (84 percent), and feedback (81 percent) as *very/extremely valuable*.

Exhibit 9. Facilitator-Reported Coaching Strategies

Research-Based Coaching Strategy	% Facilitators Reporting Strategy by November 2019	% Facilitators Reporting Strategy by August 2020
Collaboratively set goals and action steps	90%	98%
Prompted them to reflect on their practices	80%	97%
Provided them with useful, constructive feedback	79%	98%
Observed them in person or on video	9%	34%

Exhibit Note: The sample size for the percentage of facilitators reporting the strategy by November 2019 was 76–77 agency facilitators. The sample size for the percentage of facilitators reporting the strategy by August 2020 was 64–65 agency facilitators.

Responsive Coaching Approach

Coaching allows professional development providers to offer responsive, individualized support that builds on an adult learners’ existing knowledge, skills, and experiences (Schachter, 2015). Coaching may also include offering adult learners specific resources that address their particular needs (Knight, 2009). It provides the opportunity to focus on the current situation of the coachee—by jointly setting goals, identifying ways to overcome challenges, and discussing implementation—all in the specific context of the coachee (Rush & Sheldon, 2011).

The evaluation data suggest that the coaching approach was responsive to the needs, issues, and questions participants shared with their CAEMI coach. During their midyear interviews, the CAEMI coaches discussed the importance of responding to the diverse needs of participants. This included being able to make the coaching meaningful for those at different levels and ensuring coaching was not viewed as just a requirement. In their midyear survey, 92 percent of facilitators *agreed/strongly agreed* that the coaching sessions were individualized based on their agency’s goals, strengths, and needs; 94 percent reported that their CAEMI coach was responsive to their agency team’s questions and needs.

Yet, a few more experienced participants did question the value of the coaching given their level of experience. For example, a more experienced participant suggested that coaching could go beyond updating CAEMI coaches on their progress to deeper discussions, such as planning professional learning based on community needs and data.

“I feel like we got all the tools we need at our workshop. Like [my colleague] said, it’s like checking a box because that’s what the grant says we have to meet with our coach. It just feels like an update session.”

Agency Facilitator, Interview Response, January 2020

During midyear interviews and the final focus group, the CAEMI coaches reported that facilitators’ agency type was related to the level of supports needed. Most coaches observed that the county offices of education and school districts required less support, which translated to shorter durations of coaching and allowed those participants more autonomy in planning professional learning and coaching. Conversely, the coaches described that nonprofit organizations required more intense scaffolding on all aspects of planning the professional learning, such as identifying goals, which content to present, and the logistics of a training (e.g., providing bathroom breaks and snacks).

“I like that our coach was available to us whenever we needed her—not just when our scheduled sessions were. It was nice to be able to meet via Zoom, because we work at a county office of education, and it was extremely difficult to get away and meet in person. Our coach was very supportive of our work and gave/reminded us of the many resources available to us.”

Agency Facilitator, Survey Response, August 2020

“The ones that I was helping to resource and just sort of validate or just helping them run through what they had planned already were those larger, either county offices or school districts. And then the other ones were helping them think about it from the ground up would be the smaller nonprofits. And with those smaller groups, I felt myself within the coaching context, building in that time for them to be able to reflect on their own learning, whether it be what they just experienced in the COP or something that they were thinking about planning like a concept that they had gone through or one of the learnings or sessions that they had gone through in the summer institute, to talk through that.”

CAEMI Coaching Team, Focus Group Response, March 2021

At the end of the grant year, facilitators shared in survey 4 elements of the coaching approach that they would keep the same if the CAEMI were offered again. Almost a quarter of facilitators responded that they would keep the collaboration and guidance from the CAEMI coach. Specifically, they appreciated the coach offering support and providing a space to brainstorm ideas. Nearly 20 percent appreciated having a responsive coach, one who answers their questions and individualizes to the needs of their agency. About 15 percent also alluded to the

flexibility of the coaching sessions, including the scheduling, meeting agenda, and duration being flexible enough to tailor to the agencies' needs.

When asked what they thought about the number of coaching sessions offered, 69 percent of facilitators reported "Meeting monthly felt about right," 28 percent reported "Less often would have been fine," and 3 percent reported "More often would have been preferred." Open-ended responses suggested that those who liked the number of coaching sessions felt that the coaching helped them stay on track, provided them opportunities to reflect and plan, and supported their coaching skills. However, those who would have preferred less coaching felt they had nothing to discuss at some sessions or that they already had a lot of experience training and coaching educators.

Future implementation of the CAEMI may benefit from the continued responsive coaching approach, yet additional ways to provide supports for participants should be considered. As described previously, the coaching approach rarely included observations of agency implementation, and consistent review of agency training/coaching materials did not occur. In addition, the CAEMI coaches reported following the lead of what facilitators asked rather than proactively offering suggestions. Without these structures in place to see or more concretely hear about agency implementation, the amount of specific feedback that can be given is limited. In particular, some facilitators reported lacking knowledge and experience in early childhood math, which means they may not know what they do not know or what questions to ask their CAEMI coach. Without direct observation and specific feedback on materials used in local communities, the quality of information that facilitators shared with educators in their agencies is somewhat unknown.

Likewise, the responsive coaching approach could include further ways to individualize for participants with different needs. For example, for some experienced trainers or coaches, fewer numbers of sessions may be warranted while less experienced facilitators may require additional coaching sessions or more review of their materials.

The agency facilitators consistently offered high positive ratings for the implementation of the summer institutes, COPs, and coaching.

Throughout the initiative, facilitators reported high positive ratings of all of the components of the professional learning and coaching model (see Exhibit 10).

CAEMI Summer Institute 2019

At the beginning of the initiative year, the evaluation team asked facilitators on survey 2 to share their perceptions of the CAEMI Summer Institute 2019. Facilitators reported on their perceptions of the institute effectiveness in building their knowledge and skills related to providing professional development on early math (e.g., "The training institute increased my understanding of how to support early math learning through play."). They also rated their

perceptions of the content and delivery of information (e.g., “The training institute addressed content that is relevant to my role working with educators.”). Participants rated a series of items on a five-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were averaged to form a composite. See Appendix B for a full list of the items and composites.

Overall, the facilitators provided high ratings for the effectiveness of the CAEMI Summer Institute 2019, with an average of 4.29 out of 5. They generally *agreed* or *strongly agreed* with positive statements about how the institute built their knowledge and skills related to providing professional development on early math. The facilitators rated the content and delivery of information slightly higher than the effectiveness, with an average of 4.41 out of 5.

Community of Practice Sessions

In the middle of the initiative year, the evaluation team asked facilitators on survey 3 to share their perceptions of the COP. Facilitators reported on their perceptions of the COP content (e.g., “The COP sessions helped build my knowledge of how young children develop and learn math skills and concepts.”) and delivery (e.g., “The COP sessions offered enough time for me to reflect on how to use the information in my work.”). Participants rated a series of items on a five-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). In addition, at the end of the initiative year, the evaluation team invited facilitators on survey 4 to rate the level of value for various COP elements (e.g., “hands-on activities during the base group breakouts,” “implementation plan shareouts by other agencies”). Participants rated each element on a five-point Likert scale from 1 (*not at all valuable*) to 5 (*extremely valuable*). For each of these constructs, items were averaged to form a composite. See Appendix B for a full list of the items and composites.

In the middle of the year, the facilitators rated the content of the first two COP sessions in supporting them to provide professional learning and coaching for educators as 3.91 out of 5. The facilitators, on average, rated the delivery of information slightly higher, at 4.11 out of 5. At the end of the year, the facilitators, on average, rated the COP sessions as 4.22 out of 5, suggesting that they found the elements *very* to *extremely valuable*.

“These [COP] sessions do definitely help me and our group during our planning meetings. This last community of practice we did activities (Froebel gifts) that we actually used in our professional learning day. It was also very helpful to our group to listen to other groups’ planning process for their trainings. This helped us in planning our own training.”

Agency Facilitator, Survey Response, December 2019

“I like coming together as a statewide community. It was great to hear about how everyone else was implementing their grant. I liked being all together as a statewide group, and then going to breakout sessions in smaller groups to discuss concepts and play with materials. I think there was a nice variety of professional learning/research from WestEd, sharing with others, and guided activities. Well done!”

Agency Facilitator, Survey Response, August 2020

Coaching

In the middle of the initiative year, the evaluation team asked facilitators on survey 3 to share their perceptions of the coaching sessions. Facilitators provided ratings of the effectiveness of the coaching (e.g., “The coaching sessions supported my agency in planning and implementing professional learning sessions.”) and the relationship with the CAEMI coach (e.g., “I have a positive, collaborative relationship with my coach.”). Participants rated a series of items on a five-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). At the end of the initiative year, the evaluation team invited facilitators on survey 4 to rate the level of value for various elements of the coaching in helping them plan and implement math training and coaching in their communities (e.g., “Our coach prompted me to reflect on my practices.”). Participants rated each element on a five-point Likert scale from 1 (*not at all valuable*) to 5 (*extremely valuable*). For each of these constructs, items were averaged to form a composite. See Appendix B for a full list of the items and composites.

In the middle of the initiative year, facilitators rated the effectiveness of the coaching support as 4.27 out of 5. In addition, they had the highest positive ratings for the items that focused on the relationship with their CAEMI coach. On average, facilitators rated items related to the collaborative relationship they had with their CAEMI coach as 4.42 out of 5. At the end of the initiative year, the facilitators continued to rate, on average, the elements of the coaching as *very to extremely valuable*, with an average of 4.27 out of 5.

"[My coach] has been an amazing resource and support system for our team. We email her questions and she is always timely with responding and providing us the information or resources we need. We have been able to use the information gathered from her to incorporate into our training and coaching sessions. We are very grateful for our coach. Just yesterday, my colleague and I said, 'Wow! So this is what it feels like to have a coach!' It feels so supportive because we can just email her any time and she is always so responsive!"

Agency Facilitator, Survey Response, December 2020

CAEMI Summer Institute 2020

At the end of the initiative year, the evaluation team invited the facilitators on survey 4 to rate the value of each element of the CAEMI Summer Institute 2020 (e.g., "Having to create a poster to share at the institute," "base group breakouts"). Participants rated each element on a five-point Likert scale from 1 (*not at all valuable*) to 5 (*extremely valuable*). Items were averaged to form a composite. See Appendix B for a full list of the items.

Like ratings of other supports, the facilitators provided high ratings of the CAEMI Summer Institute 2020. The facilitators, on average, rated the value of the different elements of the CAEMI Summer Institute 2020 as 4.00, or *very valuable*, on a five-point scale.

"I appreciated that the institute tied this initiative together from beginning to end by providing the opportunity for all participating agencies to present their process and share out their experiences."

Agency Facilitator, Survey Response, August 2020

"I appreciate how well they were able to change to a virtual format and still deliver an experience that was informative, fun, and a great wrap up to our year of work. All of the presentations from the panel sparked ideas on future math projects I want to put together. Thank you."

Agency Facilitator, Survey Response, August 2020

Exhibit 10. Facilitator Ratings of the CAEMI Components

Measures	N	Mean	SD
CAEMI Summer Institute 2019: Effectiveness in building early math knowledge and skills (July 2019)	86	4.29	0.51
CAEMI Summer Institute 2019: Content and delivery (July 2019)	86	4.41	0.47
COP sessions: Content (November 2019)	74	3.91	0.78
COP sessions: Delivery (November 2019)	74	4.11	0.75
Coaching: Effectiveness of supports (November 2019)	77	4.27	0.69
Coaching: Relationship with CAEMI coach (November 2019)	77	4.42	0.71
COP sessions: Value of COP elements (August 2020)	61	4.22	0.64
Coaching: Value of coaching elements (August 2020)	51	4.27	0.69
CAEMI Summer Institute 2020: Value of institute elements (August 2020)	56	4.00	0.80

Exhibit Note: N = sample size; SD = standard deviation. The measures used at the beginning of the grant and midyear implementation were on a scale from 1 (strongly disagree) to 5 (strongly agree), with 5 representing the highest positive rating. The measures used at the end of the grant were on a scale from 1 (not at all valuable) to 5 (extremely valuable), with 5 representing the highest positive rating.

The agency facilitators consistently requested more content on children of specific ages, as well as information on California’s foundations and frameworks and the Common Core State Standards.

At the start of the initiative, the agency facilitators were asked to provide suggestions for future CAEMI professional learning experiences. In both survey 2 open-ended responses and the focus groups, some agency facilitators felt that they did not get enough information during the CAEMI Summer Institute 2019 related to the California Department of Education (CDE) foundations, standards, and resources (17 percent of facilitators in survey 2). Similarly, the facilitators noted the need for more individualized content based on age, such as for infants and toddlers or elementary school students (19 percent of facilitators in survey 2). The evaluation team

observations corroborate these findings. Across the CAEMI Summer Institute 2019 sessions, there were inconsistent references to the California foundations. In addition, more sessions could have gone deeper into the full developmental progressions for young children’s math development, from infancy up through the early elementary years.

“I think the overarching goal is great because we want to see that 0–8 continuum. I think it needed some support from the actual CDE documents that already exist and the early learning system that already exists.”

Agency Facilitator, Focus Group Response, July 2019

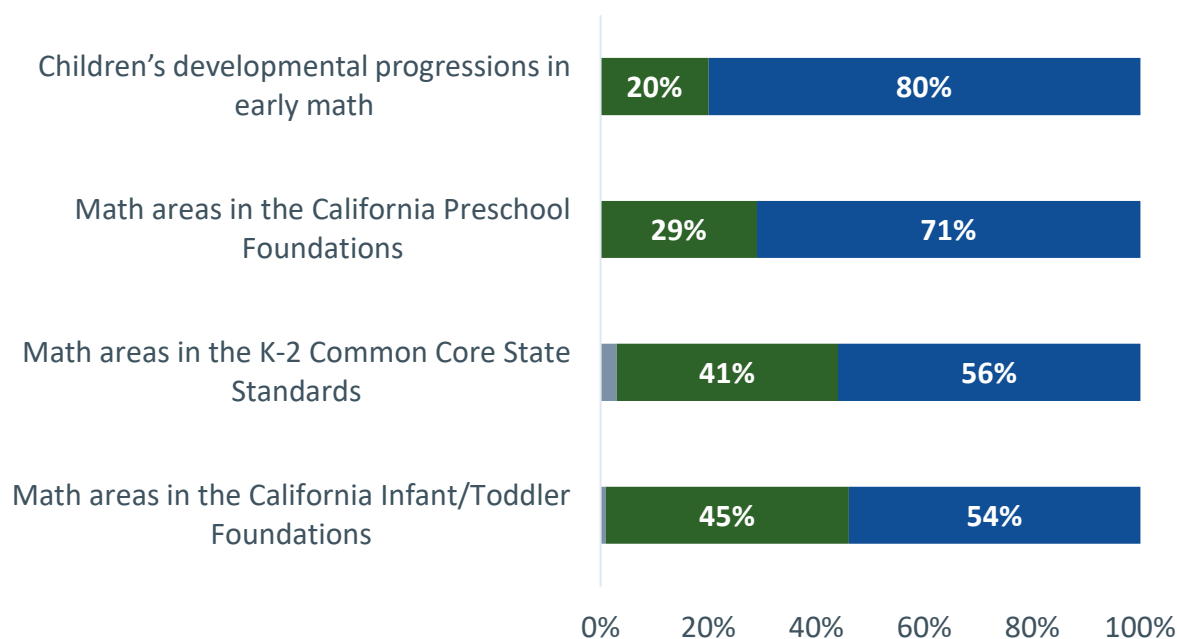
When asked about what additional supports the COPs may provide during the midyear implementation check-in, this theme continued. A very small number of agency facilitators requested more content on these same topics: age-specific content and the California foundations.

At the end of the initiative year, the evaluation team asked all agency facilitators to rate how well the CAEMI provided information on various topics related to children’s math development. Exhibit 11 shows large percentages of facilitators reported that they would have liked deeper content learning on math areas described in the California foundations for infants and toddlers (45 percent of facilitators), math areas in the Common Core State Standards for elementary school students (41 percent), specific math areas in the California foundations for preschoolers (29 percent), and children’s developmental progressions in early math (20 percent).

Furthermore, the facilitators reported on the specific math areas in which further training and coaching would be valuable. On survey 4, 55 percent of facilitators would have liked further training or coaching on mathematical reasoning, which represents an area for the CAEMI to expand or enhance supports on. Smaller percentages of facilitators would have appreciated further training or coaching on the other math foundations of algebra and functions (34 percent), measurement (31 percent), geometry (29 percent), and number sense (23 percent).

In addition, facilitators reported a desire for further training and coaching on the Common Core State Standards for elementary school students: operations and algebraic thinking (35 percent), number and operations—fractions (32 percent), number and operations in base 10 (20 percent), geometry (19 percent), measurement and data (17 percent), and counting and cardinality (12 percent). Observations at the CAEMI Summer Institute 2019 suggested that the focus was heavily on number and geometry, which may explain why smaller numbers of facilitators selected these math areas.

Exhibit 11. Facilitators Report on How Well the CAEMI Provided Math Content



- This topic was not addressed at all.
- This topic was addressed but not enough. I would have liked to explore content more deeply.
- This topic was addressed deeply throughout the professional learning and coaching opportunities.

Finally, when asked how they would recommend grouping participants if the CAEMI were offered again, 69 percent of facilitators suggested grouping by the main age level of children whom educators in their agency work with, such as infants and toddlers, preschoolers, or elementary school students. Taken together, these findings suggest that the facilitators seek deeper exploration of the content by the age level their agencies and educators primarily serve.

Agency facilitators also requested more information and resources on how to implement professional learning and coaching in their communities.

At the beginning of the initiative year, in both survey 2 and the focus groups, the evaluation team asked agency facilitators to provide suggestions for future CAEMI professional learning experiences. Some of the suggestions centered around wanting more information and opportunities that could directly inform their implementation of professional learning and coaching:

- More information on coaching
- More guidance on how to apply content
- More training information
- More time for reflection
- More activities

During the focus groups, the agency facilitators talked about how the coaching content felt rushed, particularly for those new to coaching, and thought that it would have been helpful to have some of the breakout sessions focused on coaching as an option for those with less experience in the area. Furthermore, some facilitators also wished they had received more information on how to apply what they were learning during the institute to their work in their agencies. The focus group participants specifically mentioned how they were expecting a train-the-trainer model, which would provide more structure and guidance on what to deliver, how to deliver, and how all the pieces fit together. Evaluation team observations corroborated these sentiments; the sessions often did not make enough explicit connections on how facilitators may apply what they have learned in the session to their work in their settings. This type of application or reflection was often crammed into the last few minutes of the session, if at all.

“Some of these things are for adults. Some of these things are just for us to develop our knowledge. Sometimes the coaches have been explicit and other times they haven’t ... This is a train-the-trainer. So you are coming as a learner but also a presenter. Tutusa, lobster [math activities]—we experienced as learners, but ... 10–15 minutes about presenter info would be helpful.”

Agency Facilitator, Focus Group Response, July 2019

“That goes back to the train-the-trainer piece. It needs to be more explicit on what these trainings are for and how you can use them ... As a trainer of trainers, I go to a lot of these things. You get some guidance on how to deliver, you have an orientation and how this goes together. I do not feel like we are getting that. It’s up to me to put it all together. I am an experienced trainer, but I wonder for those who are less experienced. They may be at a loss.”

Agency Facilitator, Focus Group Response, July 2019

During the midyear check-in, agency facilitators reported that they appreciated the guidance, ideas, and resources for planning professional learning and coaching that they received during the COPs and monthly coaching. For example, 47 percent of facilitators reported that the monthly coaching helped provide them guidance for planning professional learning sessions or

coaching in their communities. In addition, some facilitators requested more types of this concrete implementation support, such as 21 percent of facilitators wanting more coaching information and supports and more concrete materials and guidance from the COP sessions. When asked what additional supports they would find helpful from the monthly coaching, 15 percent of facilitators described needing more resources, more feedback and guidance, and more ideas for coaching.

During the final survey, a very small number of facilitators continued to suggest that the coaching provide additional support and guidance, such as having the CAEMI coach review presentation materials or for the CAEMI coach to provide more resources.

Conclusion

This chapter summarized the overall evaluation findings related to the CAEMI professional learning and coaching, or train-the-trainer model, that the agency facilitators participated in. Multiple sources of data suggested that the professional learning and coaching model followed many research-based principles and practices of effective professional development to support adult learning, such as providing ongoing and collaborative opportunities for professional learning or engaging adult learners in hands-on experiences. Although the responsive coaching approach follows many research-based practices, the approach could be enhanced by adding observations as a strategy. The overall structure of the coaching may be adjusted to further individualize supports, such as increasing the frequency and duration of coaching for agencies who need more intensive guidance and vice versa.

Overwhelmingly, the agency facilitators provided high positive ratings of all components of the professional learning and coaching model: summer institutes, COP sessions, and the coaching. Some areas of improvement were consistently cited across the initiative year, such as deeper content on children of different ages and more concrete guidance on the planning and implementation of professional learning and coaching in local communities.

“The CAEMI work over the last year truly was some of the most rewarding work I have done in my 30-year [early childhood education] ECE career. Thank you for this opportunity to participate in CAEMI. I think the way that each agency was allowed to create an implementation plan that was flexible and individualized to suit the needs of their participants was incredible. Usually grants are so regimented and prescribed, with narrow parameters, and there is no room for creativity. The CAEMI grant was so exciting to develop, because we were allowed to do what we wanted/what was best for our county.”

Agency Facilitator, Survey Response, August 2020

“The way we were treated and worked with as an individual agency. CAEMI took the time to assure that we were all supported based on what we were doing per agency, and there wasn’t just a blanket response or information sent out. Everything was adapted to meet our individual needs as an agency.”

Agency Facilitator, Survey Response, August 2020

Chapter 2. Building Agency Facilitators' Early Math Capacity

This chapter presents the results from the pre-post analyses examining changes in agency facilitators' self-reported knowledge and skills after participating in the professional learning and coaching model. Research shows that early childhood professionals may have anxiety related to math and lack confidence in supporting children's early math (Chen et al., 2014; Copley, 2004). They also report less knowledge about math than other areas of learning and development, such as language or social-emotional development (Hyson & Woods, 2014). As such, effective professional development for early childhood educators should address both the knowledge of math development and specific teaching practices to support children's math (Brenneman, 2014). In addition to deep content knowledge of math development and pedagogy, those who provide training to early childhood educators need the knowledge and skills to support adult learning (Artman-Meeker et al., 2015; Brenneman, 2014; Gupta & Daniels, 2012).

As such, the CAEMI evaluation team sought to assess agency facilitators' changes in their personal feelings about math, as well as their self-reported confidence in their knowledge of children's math development and pedagogy. Additionally, the evaluation team measured facilitators' confidence in their self-reported training and coaching skills at the beginning and end of the initiative.

Evaluation Questions

This chapter presents the results from pre-post analyses examining the following two evaluation questions:

- 3.** How did the agency facilitators' self-reported knowledge and skills change after participating in the professional learning and coaching model?
 - a. How do self-reported changes in knowledge and skills vary by agency type and previous experience in math training and coaching?

First, this chapter highlights overall changes in facilitators' self-reported knowledge and skills in early math after participating in the professional learning and coaching model. Second, this chapter reports how changes in knowledge and skills vary by agency type and previous experience in math training and coaching.

Overview of Sample and Methods

The evaluation team invited all 91 agency facilitators to report on their early math knowledge and skills across survey 1, survey 3, and survey 4. This chapter focuses on items related to five outcome measures within the surveys: (1) personal feelings toward math; (2) confidence in knowledge of children's math development; (3) confidence in knowledge of math teaching skills; (4) confidence in general training and coaching skills; and (5) confidence in math training and coaching skills. Survey 1 collected baseline data from the facilitators on all five outcome measures. Survey 3 repeated items from survey 1 related to confidence in math training and coaching skills. Finally, survey 4 collected data on all of the five outcome measures to allow for pre-post analyses.

Each of the five outcome measures comprised multiple items. Participants rated all items on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*) with a score of 3 representing *neutral*. One composite score was formed for each outcome measure by averaging across all items for that measure. Composites were formed for participants who had at least 70 percent of complete data for each measure. Please see Appendix B for a detailed list of the items that made up each outcome measure and further details about the methods.

Below is a short description of each of the five outcome measures:

Personal Feelings Toward Math

For this outcome measure, facilitators reported on their personal feelings about math. The measure included the following two items: "I'm not a math person" and "Just the word *math* can make me feel nervous." Because these items are negatively worded, the desired outcome in a pre-post analysis would be a decrease in facilitators' negative feelings toward math.

Knowledge of Children's Math Development

For this outcome measure, facilitators reported on nine items focused on their confidence in their knowledge of children's developmental progressions in early math (e.g., "I am confident in my knowledge of age-appropriate math goals for children"), as well as their knowledge of how children develop concepts and skills in specific math areas (e.g., "I am confident in my knowledge of how children develop concepts and skills in measurement").

Knowledge of Math Teaching Skills

For this outcome measure, facilitators reported on 14 items focused on their confidence in their early math pedagogical knowledge (e.g., “I am confident in my ability to differentiate math instruction based on children’s individual strengths and needs”), as well as their knowledge of how to support children in specific math areas (e.g., “I am confident in my ability to support children’s geometry knowledge and skills”).

Knowledge of General Training and Coaching Skills

For this outcome measure, facilitators reported on six items focused on their confidence in their general training and coaching skills (e.g., “I am confident in my ability to develop positive relationships with the educators I train and coach”).

Knowledge of Math Training and Coaching Skills

For this outcome measure, facilitators reported on two items focused on their confidence in their math training and coaching skills (e.g., “I am confident in my ability to conduct coaching related to early math development and learning”). Because the grant required facilitators to provide math professional learning and coaching to educators, items about the facilitators’ confidence in their math training and coaching skills were included at the beginning (survey 1), middle (survey 3), and end of the initiative (survey 4).

Overview of Data Analysis

Of the 91 agency facilitators invited to take the survey, a large proportion (75 percent) completed both survey 1 and survey 4 (complete case participants). However, a number of facilitators (25 percent) only completed survey 1 (missing data participants). The attrition in survey 4 may be explained by the fact that this survey was administered during the summer break and in the middle of the COVID-19 pandemic. The evaluation team conducted a nonresponse analysis to determine whether the complete case participants were representative of the population of agency facilitators. The nonresponse analysis yielded that the complete case participants ($n = 68$) were representative of the population of agency facilitators on the following variables: agency type, languages spoken, highest level of education, number of years of experience coaching on math, number of years of experience training on math, and the survey 1 baseline scores on the five outcome measures. Therefore, the pre-post analyses reported in this chapter include complete case participants only.

For the analysis of all quantitative data, the evaluation team used IBM SPSS Statistics for Macintosh, Version 26.0. First, descriptive statistics were calculated to learn more about the data, including measures of central tendency (e.g., means, standard deviations) and frequencies. For all pre-post analyses, paired samples t-tests were used to measure growth

from the beginning to the end of the initiative. For the selected subgroup analyses, one-way ANOVAs determined whether the subgroups differed from one another on pre-initiative and post-initiative measures. If the ANOVA was significant, Tukey's HSD test was used to determine which subgroups differed from one another.

Key Findings from Pre-Post Analyses

This section reports on changes in facilitators' confidence in their early math knowledge and skills from the beginning to the end of the initiative.

From the beginning to the end of the initiative, facilitators reported a significant change in all outcome measures.

Exhibit 12 shows the pre- and post-initiative means for all five outcome measures along with p-values and effect sizes. From the beginning to the end of the initiative, facilitators' responses indicated a significant decrease in their negative feelings toward math. Facilitators' responses also indicated a significant increase over the course of the initiative in their confidence in their knowledge of children's math development, math teaching skills, and general training and coaching skills.

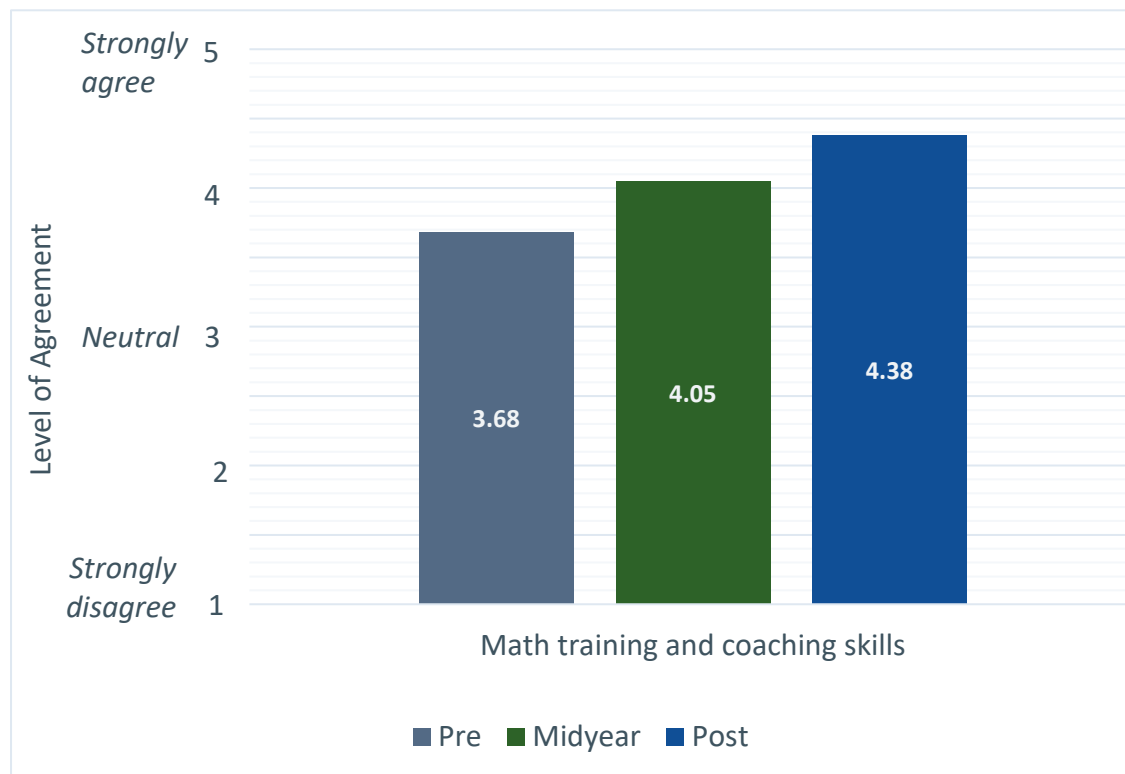
Facilitators reported on their confidence in their math training and coaching skills across three time points (beginning, middle, and end of the initiative). A repeated measures ANOVA and post hoc tests suggested a significant increase in facilitators' confidence in their math training and coaching skills at each time point (M: before = 3.67, midyear = 4.02, after = 4.39). Exhibit 13 presents facilitators' self-reported confidence in their math training and coaching skills across the three time points.

Exhibit 12. Pre-initiative and Post-initiative Means

Measure	Pre-initiative mean	Post-initiative mean	Significance level	Effect size (Cohen's d)
Personal feelings toward math	2.78	2.20	p<.001	.65
Knowledge of children's math development	3.79	4.29	p<.001	.66
Math teaching skills	3.93	4.40	p<.001	.68
General training and coaching skills	4.18	4.43	p<.01	.48

Exhibit Note: The items within the “personal feelings toward math” measure are negatively worded; therefore, the desired outcome in a pre-post analysis would be a decrease in these negative feelings toward math. Cohen's d was used as the measure of effect size. Generally, effect sizes around .5 are considered medium, while effect sizes of .8 or greater are considered large (Cohen, 1988).

Exhibit 13. Change in Facilitators' Pre-initiative and Post-initiative Means



Key Findings from Selected Subgroup Analyses

Data gathered during the midyear implementation check-in suggested that facilitators' experiences and outcomes may have varied based on the type of agency they worked in and their level of previous training and coaching experience. This section reports on how changes in facilitators' confidence in their early math knowledge and skills varied by agency type and previous experience in math training and coaching.

Please note the following limitation of the data reported in this section: agency type and previous experience were confounded with base group geographic region. For example, 52 percent of facilitators who worked in nonprofit organizations belonged to the Central California base group, and 49 percent of facilitators who worked in a county office of education belonged to the Northern California base group. Additionally, 35 percent of facilitators who previously had trained and coached on math-related topics for more than one year belonged to the Central California base group. Therefore, the evaluation cannot fully tease out whether differences in self-reported outcomes are due to agency type and previous experience or base group.

Growth in outcomes from the beginning to the end of the initiative varied by agency type.

This analysis examined growth in outcome measures based on the type of agency where the facilitator works: county office ($n = 28-29$), school district ($n = 17$), or nonprofit organization ($n = 20-21$).

Exhibit 14 presents facilitators' average ratings for all outcome measures by agency type. The average ratings indicate that facilitators from all agency types reported a significant increase in their confidence with math training and coaching skills, the focus of this initiative. However, growth on the other outcome measures varied based on program type. The responses from facilitators from nonprofit organizations indicated a significant increase on all other outcome measures, but for facilitators from school districts, their increase in confidence was significant only in relation to math training and coaching skills. The responses from facilitators working in county offices of education were similar to responses from facilitators in nonprofit organizations, indicating a significant increase on all outcome measures, with the exception of their confidence in their general coaching and training skills.

In addition, at the beginning of the initiative, facilitators from nonprofit organizations reported significantly lower ratings, compared to facilitators from county offices of education, on three outcome measures: their confidence in their knowledge of children's math development, general training and coaching skills, and math training and coaching skills. However, by the end of the initiative, the ratings of confidence by facilitators from nonprofit organizations were no longer significantly different from the ratings by facilitators in county offices of education. Therefore, not only did nonprofit agencies show growth from the beginning to the end of the initiative, but also their ratings were no longer significantly different from those of the facilitators from county offices of education by the end of the initiative.

Exhibit 14. Pre-initiative and Post-initiative Means by Agency Type

Measure	Nonprofits	County offices	School districts
Personal feelings toward math	Pre: 2.98 Post: 2.26 **	Pre: 2.66 Post: 2.07 ***	Pre: 2.74 Post: 2.35
Knowledge of children’s math development	Pre: 3.49 Post: 4.35 ***	Pre: 3.94 Post: 4.40 **	Pre: 3.88 Post: 4.05
Math teaching skills	Pre: 3.75 Post: 4.46 ***	Pre: 4.10 Post: 4.49 **	Pre: 3.88 Post: 4.19
General training and coaching skills	Pre: 4.01 Post: 4.45 ***	Pre: 4.46 Post: 4.60	Pre: 3.92 Post: 4.13
Math training and coaching skills	Pre: 3.35 Post: 4.38 ***	Pre: 4.00 Post: 4.57 ***	Pre: 3.62 Post: 4.06 *

Exhibit Note: The items within the “personal feelings toward math” measure are negatively worded; therefore, the desired outcome in a pre-post analysis would be a decrease in these negative feelings toward math. *Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .05$. **Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .01$. ***Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .001$.

Regardless of their previous experience in early math training and coaching, facilitators reported significant growth on most outcomes after participating in the CAEMI.

This analysis examined growth in outcome measures for facilitators with varying levels of previous experience providing math training and coaching. It included two subgroups: facilitators who had trained and coached on math-related topics for more than one year (more experienced in math training and coaching; $n = 26-28$) and those who had trained and coached

on math-related topics for less than one year (less experienced in math training and coaching; $n = 29$).¹

Exhibit 15 presents mean facilitator ratings for all outcome measures by levels of experience in math training and coaching. The responses from less experienced facilitators indicated significant increases on all outcome measures from the beginning to the end of the initiative. The responses from more experienced facilitators also indicated significant increases on all outcome measures except their confidence with general training and coaching skills, which did not increase significantly. Taken together, these findings suggest that both groups made significant gains throughout the initiative regardless of their previous experience in math training and coaching.

In addition, at the beginning of the initiative, less experienced facilitators reported significantly lower ratings than more experienced facilitators on their confidence in their knowledge of children's math development, general training and coaching skills, and math training and coaching skills. However, by the end of the initiative, there were no significant differences in any outcome measures between the groups. Therefore, although less experienced facilitators started off with lower ratings of confidence on most outcome measures, these differences were no longer significant by the end of the initiative.

¹ Six participants did not fit into either subgroup and were excluded from these analyses. Three of these participants had training experience of more than one year but coaching experience of less than one year, and the three other participants had coaching experience of more than one year but training experience of less than one year.

Exhibit 15. Pre-initiative and Post-initiative Means by Math Training and Coaching Previous Experience

Measure	More experienced math trainers and coaches	Less experienced math trainers and coaches
Personal feelings toward math	Pre: 2.63 Post: 2.02 **	Pre: 2.72 Post: 2.28 *
Knowledge of children’s math development	Pre: 4.04 Post: 4.46 ***	Pre: 3.62 Post: 4.28 ***
Math teaching skills	Pre: 4.13 Post: 4.51 ***	Pre: 3.87 Post: 4.40 ***
General training and coaching skills	Pre: 4.46 Post: 4.56	Pre: 4.03 Post: 4.40 ***
Math training and coaching skills	Pre: 4.10 Post: 4.60 ***	Pre: 3.47 Post: 4.34 ***

Exhibit Note: The items within the “personal feelings toward math” measure are negatively worded; therefore, the desired outcome in a pre-post analysis would be a decrease in these negative feelings toward math. *Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .05$. **Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .01$. ***Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .001$.

The evaluation also explored the subgroups of facilitators who had prior general training and coaching experience for at least five years (and those who had not). The pattern of results was similar. See Appendix D for a summary of these results.

Conclusion

The pre-post analyses examined changes in agency facilitators' self-reported confidence in their knowledge and skills in early math before and after participating in the professional learning and coaching model. Findings from these pre-post analyses suggest that agency facilitators reported significant growth from the beginning to the end of the initiative on all five outcome measures. Although facilitators from all agency types reported growth on most outcomes, this growth was only significant for facilitators from nonprofit agencies and county offices of education. Furthermore, facilitators demonstrated significant growth on most outcomes, regardless of the amount of previous experience they had in math training and coaching.

Chapter 3. Professional Learning and Coaching for Educators

All 30 agencies participating in the CAEMI provided early math professional development to educators within their local communities. The initiative required agencies to engage at least 20 educators in three professional learning sessions and six coaching conversations around early math. This section describes local implementation of the early math professional learning and coaching sessions.

Improving the quality of early math learning experiences requires effective preservice preparation of educators, as well as in-service professional development on math. However, research indicates that prospective and practicing teachers of young children have few and/or inadequate opportunities to receive preparation and training in mathematics education (Ginsburg et al., 2014; National Research Council, 2000). Very little, if any, content related to early childhood math is included as part of the professional preparation requirements for preservice teachers (Hyson & Woods, 2014). Furthermore, opportunities for in-service professional development in early mathematics are limited.

Most states require some in-service professional development for teachers, but math is rarely a required element (Hyson & Woods, 2014). In-service professional development often features one-time, isolated workshops given by math experts and does not provide sufficient opportunities to observe and implement specific teaching practices (Hyson & Woods, 2014). Research shows that effective early childhood professional development can have a positive influence on teachers' knowledge and practices (Clements et al., 2011; Clements & Sarama, 2008; Lee et al., 2012).

The CAEMI aimed to enhance the early math professional development landscape across California. Each agency developed and implemented a plan for providing local educators access to ongoing professional learning and coaching in early math.

Evaluation Questions

The evaluation questions related to the local implementation of the CAEMI include:

4. What were the key characteristics of the professional learning and coaching sessions agencies offered to educators in their local communities?
 - a. What were the goals for the professional learning and coaching?
 - b. What was the reach of the professional learning and coaching in local communities?
 - c. What objectives and content areas were addressed in the professional learning and coaching?
 - d. What were the challenges and successes experienced during local implementation of early math professional learning and coaching for educators?

This chapter begins with an overview of the goals and key characteristics of the professional learning and coaching that agencies implemented in their local communities. It includes a description of the reach of the initiative, modes of engaging educators, and the objectives and content of early math professional learning and coaching. Finally, the chapter provides a summary of the challenges and successes during local implementation and identifies drivers of effective implementation within local agencies.

Overview of Methods and Sample

The evaluation team collected data over the yearlong initiative to understand the implementation of the math professional learning and coaching in local communities. At the beginning of the initiative year, the evaluation team conducted survey 1 ($n = 90$) and two focus groups ($n = 17$) with agency facilitators during the CAEMI Summer Institute 2019. The survey and focus groups focused on the facilitators' professional backgrounds as well as their goals, strengths, and anticipated needs or challenges related to implementation of the initiative within their local communities.

During the midyear check-in, the evaluation team administered survey 3 ($n = 80$) to agency facilitators in November and December 2019 to learn about their early implementation progress, challenges, and successes.

At the end of the initiative year, agencies ($n = 28$) completed the agency questionnaire in July and August 2020, in which they shared details about implementation in their community. For the two agencies that did not complete the questionnaire, the evaluation team gathered data on their implementation from their poster presented during the CAEMI Summer Institute 2020. Consequently, the agency questionnaire self-reported data represent anywhere from 27 to all 30 agencies (unless otherwise noted).

Additionally, at the end of the initiative year, the evaluation team gathered data during the poster sessions ($n = 30$) at the CAEMI Summer Institute 2020 to learn about the agencies' local implementation, perceptions of impact in their communities, and any challenges or takeaways from implementing the initiative.

Finally, the evaluation team conducted focus groups in March 2021, one with the CAEMI coaching team ($n = 6$) and two with a subsample of agency facilitators ($n = 12$). The focus groups invited the CAEMI coaching team and facilitators to share overall reflections on participating in the CAEMI.

Professional Learning and Coaching in Local Communities

This section describes the characteristics of implementation of professional learning and coaching in local communities. Relevant successes will also be highlighted.

At the outset of the initiative, agency facilitators shared goals that closely aligned with the CAEMI's overall mission to build local capacity around early math.

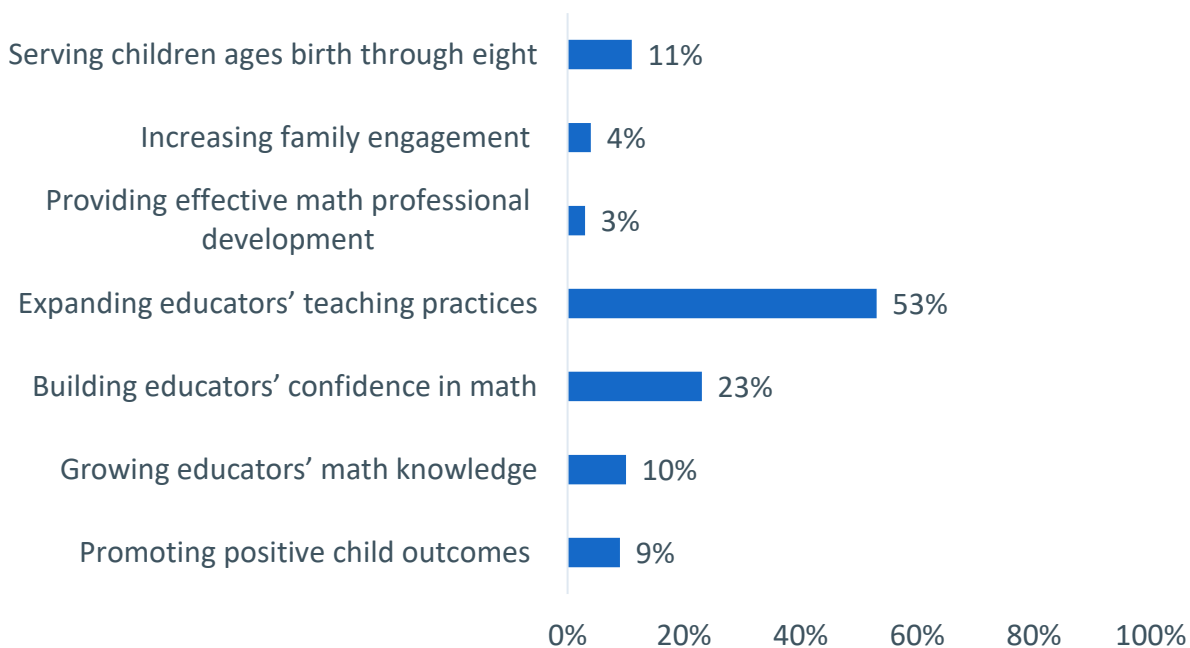
During the CAEMI Summer Institute 2019, agency facilitators shared their goals for early math in their communities in survey 1 open-ended responses and as part of the focus groups. Exhibit 16 shows an overview of the goals the facilitators shared in survey 1.

Facilitators stated goals related to building agency-wide capacity in early math education. For example, the facilitators expressed the need to address the birth-through-eight continuum and to align math content and practices across age levels and grades (11 percent). They also communicated the need for more collaboration among educators, facilitators, and leadership to meet this goal.

Additionally, 4 percent of facilitators initially expressed wanting to engage families in early math. One facilitator commented they would like to "help families see the connection of what they do at home and how it relates to math." This goal became more of a priority once the COVID-19 school closures were in effect.

To provide more effective professional development in early math, 3 percent of facilitators mentioned improving their own professional development skills. They hoped to gain more resources to share with educators through their participation in the initiative.

Exhibit 16. Facilitators' Goals for the Initiative (N = 72)



The highest percentages of facilitators reported goals related to building the capacity of educators. These goals aligned with the CAEMI's mission to increase educators' confidence, knowledge, and teaching practices in early math. About half (53 percent) of the facilitators mentioned improving educators' math teaching practices. Specifically, they hoped to enhance curriculum planning, use of early math strategies, and math pedagogy. For example, in the focus groups, facilitators cited integrating the California's Preschool Learning Foundations and Common Core State Standards into professional learning sessions and growing educators' math content knowledge.

Additionally, the facilitators specified building educators' confidence in math (23 percent) and developing educators' early math knowledge (10 percent) through their participation in the initiative.

In addition to the goals related to building the capacity of educators and facilitators in early math, a small subset of facilitators (9 percent) specifically discussed improving child outcomes in early math.

Early on, the majority of agencies were able to build on existing capacity to develop and begin implementing their plan for professional learning and coaching.

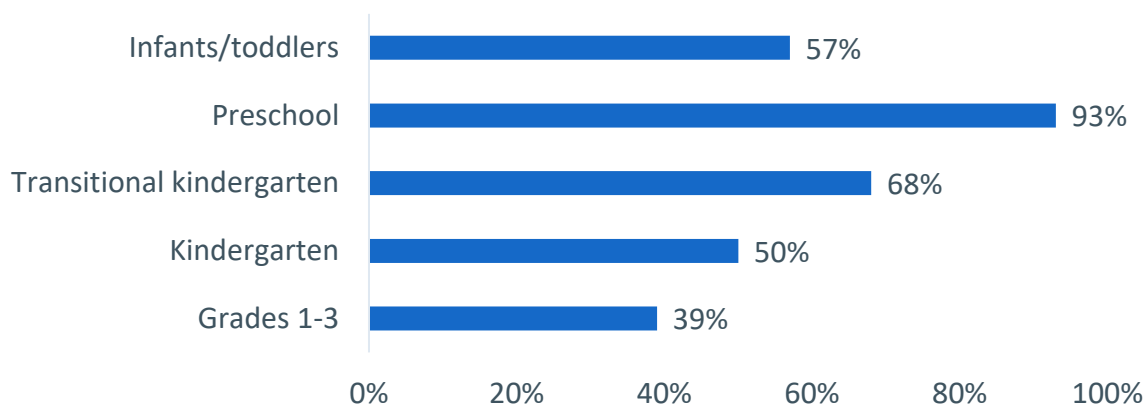
Results from survey 3 revealed that by the midyear check-in, all agencies had clearly defined goals and a plan for at least three professional learning experiences. In addition, 81 percent of

the facilitators also reported having a plan for at least six coaching conversations with educators. The vast majority of facilitators felt confident that their implementation plans would help them reach their goals for the initiative. Beyond developing plans for implementation, most (82 percent) of the facilitators reported that their agencies had already begun putting their plan into action. A majority (90 percent) of the facilitators agreed or strongly agreed that their implementation team had enough resources to carry out their implementation plans and that they had the full support from the agency’s leadership to implement their plans. These results indicate that despite the challenges the agency facilitators had to overcome, they were able to utilize local resources to successfully develop and carry out their plans for training and coaching within their agencies.

The initiative served a large, diverse group of early childhood educators across California.

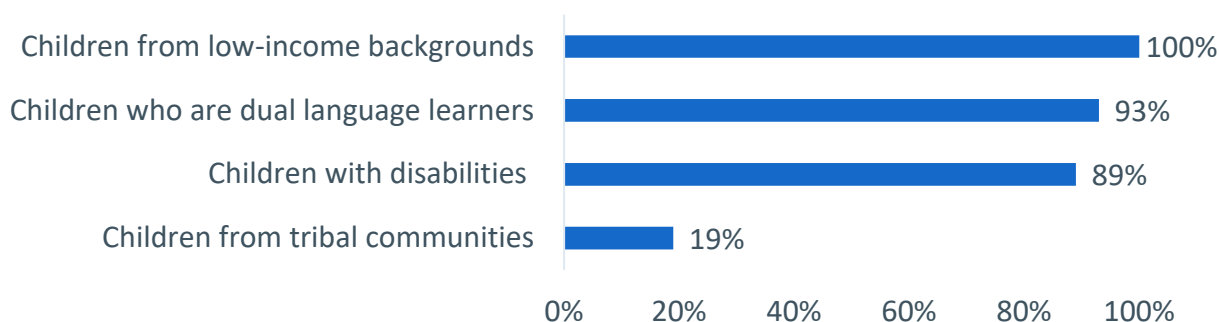
The 30 agencies engaged 1,411 early childhood educators from various settings. Almost all of the agencies reported working with educators from early care and education center-based programs (93 percent), and about half reported providing training and coaching to educators working in an elementary school (50 percent) or in a family child care program (43 percent). Exhibit 17 shows the percentage of agencies that served educators of children across the birth-through-eight continuum, with preschool teachers being the primary target group.

Exhibit 17. Percentage of Agencies Serving Educators of Children Across the Birth-Through-Eight Continuum



The number of children served by the initiative varied from 110 to 2,500 children in each agency, totaling at least 17,377 children reached through the initiative. More importantly, many of these agencies serve California’s most vulnerable children and families (see Exhibit 18).

Exhibit 18. Percentage of Agencies Serving California's Most Vulnerable Populations



Overall, agencies met or exceeded the grant requirements for number of professional learning sessions and educators served.

The grant required agencies to provide educators three professional learning sessions and six coaching sessions in early math to at least 20 participants. Out of the 30 agencies, the majority of them (87 percent) either met or exceeded the grant requirement of three training sessions. The four agencies that were unable to meet the three-session requirement reported that they had to postpone their remaining sessions until schools reopened due to the COVID-19 pandemic. On average, each agency offered four to five professional learning sessions to anywhere from 15 to 181 educators across California for a total of 140 sessions (346 hours).

The majority of agencies (86 percent) also provided coaching to all of the educators who participated in the professional learning sessions. Due to capacity, some agencies provided coaching to only some of the professional learning participants. Each agency engaged between 8 and 127 educators in coaching sessions, totaling 748 educators across the state.

Although the grant required a minimum number of professional learning and coaching sessions, it allowed the agencies to decide how to provide professional learning and coaching in their communities. The CAEMI coaches provided agencies individualized guidance, including ideas for content and delivery; however, the agencies planned the sessions, decided how many educators to include, and scheduled the professional learning and coaching sessions based on local needs. As a result, agencies offered a varying number of sessions to a varying number of educators on different schedules, yet the majority met or exceeded the grant requirements.

Agency facilitators typically engaged educators face to face prior to the COVID-19 pandemic and pivoted to virtual delivery during the pandemic.

Agencies delivered most of their professional learning sessions and coaching sessions in person. Out of the 122 professional learning sessions that agencies reported on, facilitators conducted

86 percent of the sessions in person prior to the COVID-19 pandemic. They conducted the remaining professional learning sessions (14 percent) virtually. Facilitators within an agency provided coaching sessions in both modes, face to face and virtually. Almost all of the agencies (96 percent) reported that they provided coaching sessions in person. Most also offered and delivered sessions virtually (75 percent). Some agencies reported that they made the switch from in-person coaching sessions to virtual sessions due to the COVID-19 pandemic. In addition, agency facilitators also reported coaching through emails (61 percent), phone calls (36 percent), and text messages (29 percent).

Furthermore, agencies engaged educators in coaching through different group sizes. The majority (75 percent) of agencies reported that they provided small group coaching (two to four participants) and/or one-on-one coaching (61 percent) to educators. Less than half of the agencies (43 percent) provided large group coaching sessions (five or more participants).

Facilitators used a range of research-based coaching strategies, including observations.

During the coaching sessions, agencies reported engaging educators by using the following coaching strategies. The majority of agencies reported that they

- provided feedback to educators (96 percent);
- sparked reflection from educators (93 percent);
- planned jointly with educators (82 percent);
- modeled a teaching practice or an activity (75 percent); and
- observed educators (75 percent).

Even though the CAEMI coaches did not observe most of the facilitators (CAEMI coaches conducted observations in 43 percent of the agencies as reported in survey 4), the majority of the agencies did conduct observations of the educators they coached and used these observations to support them in various ways. As reported in the agency questionnaire, agencies that conducted observations of educators ($n = 21$) reported that their observations included providing feedback to individuals (86 percent), planning support and explanations for how to use materials and resources (52 percent), and a demonstration lesson or modeling a teaching practice or an activity (10 percent).

Twenty-four percent of the agencies that conducted observations reported that they used technology for conducting observations or providing feedback, such as having educators video record themselves teaching a math lesson for the facilitator to provide feedback. A total of 459 educators were observed through the initiative.

Although the evaluation team did not assess why facilitators conducted observations of educators, several possible explanations can be extrapolated. For example, facilitators may have already engaged in observations as part of their ongoing coaching approach in their agency and continued using this strategy as part of the CAEMI. Additionally, facilitators may have had existing relationships or were geographically closer to educators, which would allow them to more easily plan for and conduct observations. Another potential explanation may center around facilitators' desire to provide educators hands-on support in implementing new math teaching practices. Being actively engaged in educators' settings may have allowed the facilitators to model new practices, ask questions, and offer suggestions in real time.

Agencies reported that professional learning and coaching sessions addressed the needs shared by the local educators.

As reported in the agency questionnaire, the majority of the agencies (64 percent) conducted a needs assessment through surveys, observations, and/or discussions to learn about child-related or agency local needs prior to implementing their plan for professional learning and coaching. Overall, agencies that conducted a needs assessment ($n = 19$) reported that the educators in their agency expressed the need for

- more materials, resources, and/or ideas for activities (42 percent);
- expanding their knowledge on how young children develop math concepts and what math concepts they should focus on (42 percent);
- learning strategies for how to introduce more math in their settings or classrooms and/or how math could be infused across all aspects of children's environments (37 percent);
- delving deeper into the math standards and foundations (26 percent); and
- learning effective teaching practices and how to introduce math language to the classroom (26 percent).

Findings from the agencies' needs assessments highlight that the local needs did not fall into one specific area. Instead, local needs covered a range of topics related to learning about math development and teaching practices, as well as access to the appropriate materials, resources, and activities to support early math learning.

Professional learning and coaching sessions focused on the desired objectives of the initiative: building educators' early math knowledge, teaching practices, and confidence in math.

An analysis of the objectives and content addressed in the professional learning and coaching sessions across agencies indicated the professional learning and coaching sessions addressed

the needs identified by educators. The flexible grant requirements allowed agencies to address the needs in their communities, resulting in varying objectives geared toward building educators' early math knowledge, teaching practices, and confidence in math. In the agency questionnaire, agencies reported on the objectives and specific math areas they focused on in each of the professional learning sessions they offered to educators. An analysis of all the objectives reported by the agencies indicated that the agencies' professional learning sessions focused on three key objectives:

- Early math development
- Early math teaching practices
- Participants' confidence and attitudes toward math

Regarding educators' knowledge of early math development, 66 percent of agencies reported focusing on math content knowledge and development trajectories in early math. A large number of the agencies (59 percent) reported learning objectives that specifically focused on the math foundations or standards. In addition to developing educators' early math knowledge, agencies also focused on strengthening educators' early math teaching practices. Agencies provided professional sessions with learning objectives that focused on teaching practices (55 percent), play-based learning (52 percent), and professional noticing (48 percent). The agencies also followed the initiative's lead by bolstering educators' confidence and attitudes toward math (34 percent) and by providing them resources or ideas for activities (31 percent).

An analysis of the math areas addressed in the professional learning sessions, as reported by the agencies, suggested that the majority of agencies covered all math areas (see Exhibit 19 and Exhibit 20).

Exhibit 19. Percentage of Agencies Addressing the Math Areas from the California Early Learning Foundations

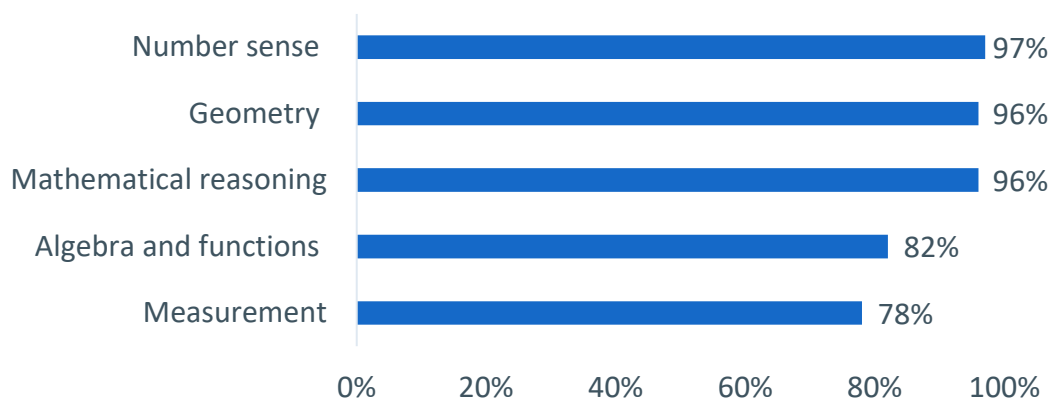
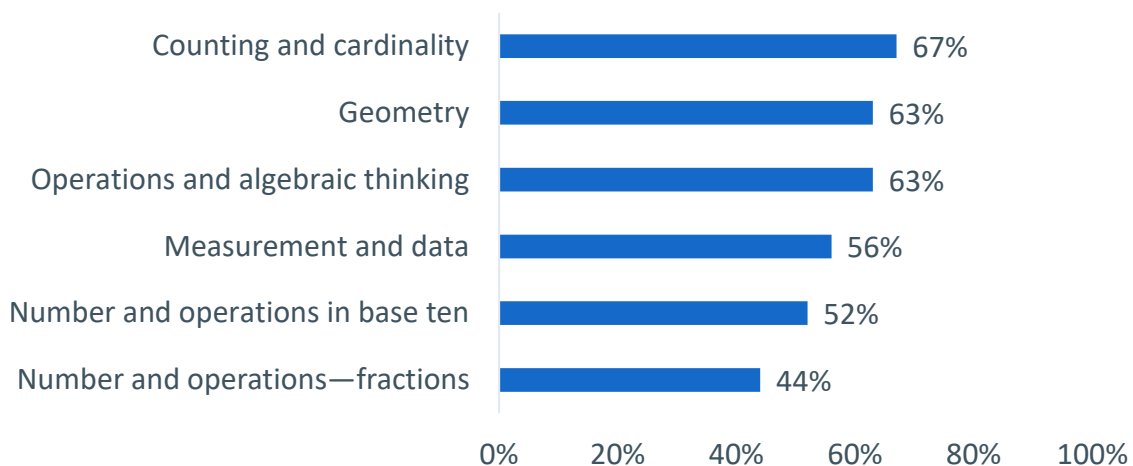


Exhibit 20. Percentage of Agencies Addressing Math Areas from the Common Core State Standards



In addition to professional learning sessions, agencies reported providing comprehensive, in-depth support during their coaching sessions. The most common learning objectives and goals for the coaching sessions reported by the agencies included implementing what was learned in the professional learning sessions (41 percent), engaging educators in reflection (37 percent), and supporting educators in implementing and integrating math into their learning setting (33 percent).

To support their objectives and goals, agencies covered a multitude of topics during their coaching sessions such as the implementation of math teaching practices and reviewing what they learned in their professional learning sessions (66 percent); early math activities, resources, and materials (59 percent); planning and child assessment (41 percent); a wide range of math areas (41 percent); the foundations, frameworks, and guidelines (17 percent); child engagement, learning, and individualization (17 percent); and responding to educators' needs (7 percent). Overall, local agencies appeared to have received comprehensive and in-depth support on a wide range of topics.

Agencies reported using a variety of CAEMI resources and activities to build educators' capacity during their professional learning sessions.

Agencies reported using activities offered by the initiative in specific math areas, such as geometry (48 percent), number sense (45 percent), patterning (7 percent), measurement (7 percent), and STEAM (21 percent). For example, agencies used Froebel's gifts from the CAEMI Summer Institute 2019 as well as the tangram puzzles and AngLegs from the COPs. The agency facilitators had the opportunity to engage in these hands-on activities as part of the CAEMI. They then introduced these same activities to build educators' capacity to support children's geometry skills. They also utilized resources related to professional noticing

(41 percent), learning theory (24 percent), and bringing math into everyday activities (nature or community walk; 17 percent).

In addition, agencies integrated training and coaching resources offered by the initiative into their professional learning and coaching, such as articles, handouts, and/or resources (45 percent) and PowerPoints (41 percent) focusing on overall training skills and practices (28 percent), standards and frameworks (21 percent), and math identities (14 percent). The wide range of resources and activities agencies adopted in their implementation plans suggested that facilitators found them useful and relevant to their work.

Facilitators reported on educators' high attendance, positive feedback, and engagement during the professional learning and coaching sessions.

During the midyear check-in, three facilitators cited the high attendance at their professional learning sessions and others commented on their ability to address a wide range of ages from birth to age eight. In total, 18 percent of the facilitators' responses mentioned receiving positive feedback from educators about the professional learning and coaching sessions through the initiative. For example, one facilitator commented in survey 3: "Educators are excited about coming to the next session, presentation was hands on, and they took home some food for thought on how they present math experiences." Educators appeared to be excited about what they were learning in professional learning and looked forward to their continued participation in the initiative.

During the midyear check-in, agency facilitators also reported on local educators' excitement around math and early implementation of practices in their classrooms. Almost half of the facilitators' responses cited the educators' interest and excitement in relation to the early math coaching and professional learning, especially the early math activities and resources the facilitators shared in the sessions. Furthermore, facilitators reported that many of the educators had already begun implementing hands-on early math activities with the children in their settings. These data indicated that, by the midyear check-in, the CAEMI was gradually making progress toward the goal of building educators' positive attitudes toward math and teaching practices.

“The impact from participating in these activities was so amazing, that the teachers found it difficult to stop working on the activities. It was quite amazing to see educators enjoying themselves in these math activities. What I noticed was our group was able to bring to our [professional learning] PL session the joy of play and learning from our experience in Fresno, to our teachers.”

Agency Facilitator, Survey Response, December 2019

For more information on the positive impact on educators, see Chapter 4. Building Local Educators’ Early Math Capacity.

Local implementation promoted collaborations and continuity in math education.

The CAEMI promoted collaboration among agency facilitator teams and educators in local communities. In survey 3, 12 percent of the facilitators mentioned the importance of collaborations among themselves as implementation teams and suggested that bringing together facilitators with different roles improved their work in delivering high-quality professional learning and coaching. Similarly, several CAEMI coaches cited in a focus group how the team composition for each agency enhanced collaboration and created coherence across the different ages and grade levels. The initiative brought together educators who normally would not have worked together and unified those with a range of expertise to work together on a joint set of goals for their agency.

Facilitators also mentioned the importance of collaborations among educators. Over one third of the posters in the CAEMI Summer Institute 2020 mentioned collaborations as key takeaways of the initiative. Agencies highlighted cross-grade communication and collaboration between educators, and how these supported educators’ understanding of the continuum of math concept development (e.g., the early math continuum from preschool to transitional kindergarten and to kindergarten).

“There are three of us working together to provide the training and I feel we are working very well together.”

“Participants really enjoyed themselves and many of them communicated with other grade level educators.”

Agency Facilitator, Survey Response, December 2019

“I remember hearing from one [educator] that this was the real first time that they had been able to talk about early mathematics and to think about what does this look like from infant and toddler ages up through early elementary grades, and how could they begin to have more conversations about coherence across those grade levels?”

CAEMI Coaching Team, Focus Group Response, March 2021

Overcoming Challenges During Implementation

The evaluation gathered information about challenges of implementation at different points throughout the course of the initiative. Prior to implementation, through survey 1 and focus groups during the CAEMI Summer Institute 2019, agency facilitators shared anticipated challenges and concerns related to implementing early math professional learning. In November and December 2019, the facilitators reported in survey 3 on the status of their implementation and the challenges from the first four to five months of implementation. Finally, at the end of the initiative, the facilitators shared overall challenges during the poster sessions at the CAEMI Summer Institute 2020 and in two focus group sessions in March 2021.

Many of the facilitators’ anticipated challenges of time, educators’ buy-in and needs, and their own limited capacity came to fruition during implementation.

Prior to the initiative, the facilitators anticipated challenges related to time and workload, educator buy-in, and their own abilities to individualize professional development to diverse educators. In survey 1 and facilitator focus groups, they also expressed some concerns related to their personal knowledge and skills in early math and their capacity to engage educators in sustained and meaningful professional learning.

Many of the facilitators’ anticipated challenges and concerns aligned with the barriers agencies reported during implementation. Exhibit 21 presents the barriers to implementing professional learning and coaching for early math facilitators identified at the midyear check-in.

Exhibit 21. Barriers Faced by Facilitators' Agency in Implementing Professional Learning and Coaching on Early Math in Early Implementation

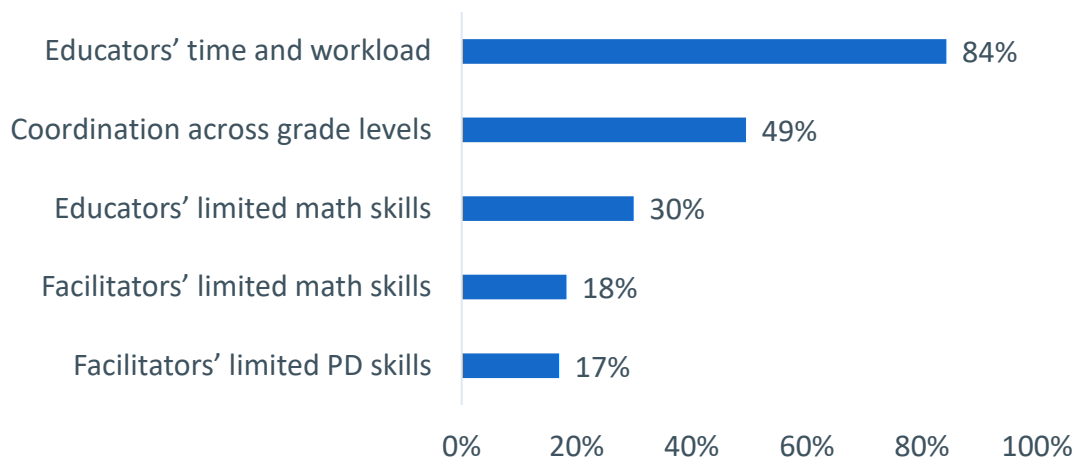


Exhibit Note: The sample size for the percentage of facilitators reporting on barriers faced was 76–77. PD = professional development.

Time as a Challenge

Agency facilitators reported a lack of adequate time for professional learning and coaching as an ongoing challenge for educators. As shown in Exhibit 18, 84 percent of the facilitators reported that *educators' time and workload* was one of the biggest barriers faced by their agency in implementing professional learning and coaching on early math. Some facilitators specifically mentioned that the educators had other competing initiatives and priorities that added immediate and pressing concerns.

Time was also reported as a big challenge for the agency facilitators themselves. In the survey 3 (midyear check-in) open-ended question on challenges and lessons learned ($n = 46$), almost half of the facilitators' responses mentioned the lack of time to plan and implement training and coaching sessions. The facilitators' responses in survey 3 and their reports in the CAEMI Summer Institute 2020 poster sessions highlighted these challenges related to scheduling time for training or coaching and coordinating time for follow-up meetings and observations with educators.

Educators' Buy-In and Diverse Needs

As shown in Exhibit 18, 30 percent of the facilitators expressed that *educators' knowledge, skills and interest in math* was a barrier while implementing their professional learning and coaching. One concern related to educators that facilitators anticipated prior to implementation was lack of buy-in (20 percent in survey 1). As reported in survey 3, and later, in the CAEMI Summer

Institute 2020 poster sessions, educators' lack of buy-in was a challenge as anticipated and one that persisted over the course of the CAEMI. In particular, they shared challenges related to educators' low interest and commitment, negative attitudes, and lack of acknowledgment of the importance of early math learning.

Similarly, facilitators anticipated a challenge in addressing the diverse needs of educators due to their varying levels of knowledge, professional backgrounds, and large age/grade span of children served. In survey 3, almost half of the facilitators selected coordination across grade levels as a barrier in implementation. Others reported, as one of their successes, the ability to meet the needs of educators serving a wide age range (birth to grade 3) and from different settings (early childhood teachers, family child care providers, early elementary teachers).

Addressing the needs of educators continued to be a challenge throughout the yearlong implementation. At the end of the initiative, about one third of the posters in the CAEMI Summer Institute 2020 reported on challenges related to accommodating educators' individual needs. They also reported the challenge of catering to a wide range of communities and to various program models served by educators (centers, family child care programs, elementary schools).

"Group coaching is a challenge. How can I differentiate the group coaching sessions to be sure I am meeting each participant's needs?"

"It is a challenge (but doable) to provide professional education that is simultaneously relevant to the educators working with the large grade spans included in our grant (0–8)."

Agency Facilitator, Survey Response, December 2019

Finally, as reported in survey 3, staffing issues served as another implementation challenge related to educators. A few facilitators reported teacher turnover, limited substitute teachers, or being short staffed as barriers to implementation. Some facilitators also mentioned accommodating educators' high demand for training and coaching in early math as a related challenge.

Facilitators' Lack of Early Math Knowledge and Experience

As shown in Exhibit 18, during midyear check-in, 18 percent of the agency facilitators referred to their own limited expertise in early math knowledge and to their lack of experience in providing professional development as their biggest barriers to implementation. Although the facilitators gained confidence in their early math knowledge and practice over the course of the initiative, concerns related to their personal knowledge and skills in early math was an ongoing challenge for some facilitators. In survey 3, as well as at the CAEMI Summer Institute 2020, facilitators specifically reported on their limited experience with coaching, lack of experience in

early childhood education, and lack of confidence in their ability to deliver math professional learning as challenges.

Overcoming the Challenges of the COVID-19 Pandemic

During the CAEMI Summer Institute 2020, over half of the agencies shared the impact of the COVID-19 pandemic on their professional learning and coaching. The COVID-19 pandemic posed many unforeseen challenges, including difficulties navigating new technologies, such as Zoom. Agencies worked diligently to shift to online professional learning and coaching and provide at-home math resources to educators and families.

Results from the agency questionnaire suggested that over half of agencies had not yet completed the minimum grant requirements of three professional learning sessions and six coaching conversations prior to COVID-19 school closures in March 2020. These data suggested that a majority of agencies needed to adjust their implementation plans in light of the new circumstances. Agencies pivoted in a number of ways, including offering remaining professional learning sessions and coaching virtually and postponing or canceling the remaining implementation plan activities.

Many of the agencies that had not completed the grant requirements reported offering professional learning and coaching in an online setting. The CAEMI coaching team's virtual delivery of professional learning and coaching prior to the school closures served as a model for how the facilitators could engage educators in professional learning during the pandemic. Facilitators could use their experiences with CAEMI coaches to help plan for the remaining professional learning and coaching sessions.

In the face of efforts to pivot virtually, reflections from the poster sessions revealed a shift in the agencies' priorities and means of supporting educators and families. Programs participating in the initiative cited prioritizing health and safety during this time and had less time to devote to math-related professional development. The facilitators had many competing priorities prior to the school closures, and this only intensified during the pandemic.

In addition, while some programs remained open, others offered distance learning. The wide range of contextual factors programs faced created additional challenges for agencies as they navigated which supports would best meet the needs of individual programs. Facilitators described in the agency questionnaire engaging educators through phone calls, emails, and Zoom to provide individualized resources that were aligned with each programs' unique learning environment and circumstance.

Despite these challenges, facilitators and educators remained committed to the initiative. Educators put more of an emphasis on supporting math learning at home. Educators supported at-home math learning in several ways, including the following: held weekly

Zoom calls with children to engage in math activities; created a website for parents with math games; sent home math materials; and suggested at-home materials that could be used for math learning.

“We are very fortunate that we were able to provide and meet the three professional learning sessions prior to the shelter in place. However, given the COVID-19 situation we decided to provide a training around family engagement and math to all Early Learning Specialists so that they would be able to share simple and fun activities with teachers to share with families.”

Agency Reflection, Agency Questionnaire Response, July 2020

Drivers of Effective Implementation in Local Communities

Overall, findings indicate that despite challenges of local implementation, the agencies overcame barriers and made progress toward their goals. Implementation science suggests that effective implementation requires drivers or supports for effective implementation. For example, implementation requires competent staff, supportive leadership, and organizational structures and processes to facilitate implementation (Metz et al., 2013). In the case of the CAEMI, building the agency facilitators’ competence to provide professional learning and coaching in early math was critical, yet other drivers were pivotal for effective implementation of the initiative within local communities.

The facilitators leveraged the agencies’ existing infrastructure for professional learning and coaching. Building on agencies’ networks of connections and existing relationships with local educators allowed the facilitators to reach a diverse group of local educators with relative ease during the early stages of implementation. The facilitators from the county offices of education, for example, had access to a range of programs serving children across the birth-through-eight continuum (preschool programs, family child care providers, elementary schools). The agencies’ existing network of connections also fostered the facilitators’ collaborations with other teams, agencies, or departments within their agency over the course of the initiative.

Furthermore, the agencies’ reach to diverse groups of educators led to collaborations among educators from different programs (e.g., early childhood education programs and elementary schools) and facilitated communication and continuity in early math education from birth to age eight. Other agency-related drivers that may have contributed to effective implementation include the support of the agency’s leadership and the facilitators’ access to the resources needed to carry out their implementation plans, such as spaces large enough to hold educators for professional learning.

In addition, facilitators’ personal strengths likely served as drivers of effective implementation. The facilitators’ experience with professional learning and coaching and their existing knowledge and skills in early math likely played a role in promoting effective implementation of

the initiative. In the focus groups during the CAEMI Summer Institute 2019, the facilitators specifically referred to their personal professional development experience and knowledge as strengths they brought that can help them succeed in their role as early math facilitators. Within their teams, the facilitators often had diverse professional backgrounds and skill sets, allowing them to build on each other's areas of strengths and to form effective collaborations.

Finally, many of the facilitators used data to guide implementation and to inform improvement of their practice. They conducted a needs assessment with the educators to inform their planning of early math professional learning. Some facilitators also collected feedback from educators on their training and collected examples of ways in which the educators implemented early math learning experiences within their settings. This strategy may have allowed the facilitators to adapt their training and coaching based on educators' input and to provide targeted support based on the educators' levels of knowledge, needs, and the age levels they serve.

In summary, drivers related to the agencies' existing infrastructure along with the facilitators' capacity to form collaborations and support the diverse needs of educators all contributed to the successful implementation of the CAEMI within the local communities.

Conclusion

Multiple data sources reveal that participating agencies made progress toward goals that were aligned with goals from the initiative. The 30 agencies engaged a large, diverse group of educators who worked in a range of settings. They also built on their existing strengths and infrastructure to plan and implement professional learning and coaching in their communities. Many of the professional learning and coaching sessions included CAEMI activities and resources, suggesting that the tools provided to facilitators translated into their local communities.

Nevertheless, facilitators faced a few challenges in their implementation, such as limited time, educators' buy-in and diverse needs, as well as their own limited knowledge and experience. Although the data suggest these challenges persisted over the course of the initiative, many agencies met or exceeded the grant requirements and addressed many of the needs shared by local educators. The success of agencies' implementation provided a foundation to build educators' early math knowledge, teaching practices, and confidence in math.

Chapter 4. Building Local Educators' Early Math Capacity

The CAEMI aimed to reduce educators' math anxiety, increase confidence and knowledge, and expand the use of practices to support children's early math development. Through their local implementation of professional learning and coaching with educators, the agency facilitators reported on how they supported educators in a number of these outcomes. Based on facilitator report and some educator self-report, this section summarizes how educators began to develop more positive math mindsets and strengthened confidence in using new teaching practices to support children's math learning.

Research suggests that early math skills predict later academic success, even more so than early reading skills do (Duncan et al., 2007; Pagani et al., 2010; Romano et al., 2010). Yet many early childhood educators report that they are uncomfortable with math and lack confidence in their math teaching skills (Carpenter et al., 1983; Hyson & Woods, 2014). They also report less knowledge about math than other areas of learning and development, such as language or social-emotional development (Hyson & Woods, 2014).

In addition, educators' low levels of confidence in their own math abilities and teaching skills can influence children's attitudes and beliefs about math (Stipek et al., 2001). For example, elementary school girls taught by highly math-anxious female educators showed increased levels of math anxiety; consequently, these girls also had lower levels of math achievement (Beilock et al., 2010). Similar studies have shown how high levels of math anxiety experienced by educators can be transferred to the children in their settings (Sloan et al., 2002; Vinson, 2001).

Furthermore, when educators have negative attitudes toward math, they are less likely to spend time teaching math (Varol et al., 2012). In fact, young children seldom receive adequate instructional support in math in their early childhood programs (Varol et al., 2012). As such, professional development for educators on early math may serve to address this issue. Professional development has been shown to build educators' positive math identities, math content knowledge, and teaching practices, which each have the potential to promote children's positive math outcomes (Sarama et al., 2008).

Evaluation Question

This chapter of the evaluation report reviews how the professional learning and coaching in local communities began to change educators' mindsets on math and strengthen their early math knowledge and teaching practices. This chapter addresses the following evaluation question:

5. How did the CAEMI influence local educators' early math confidence, knowledge, and teaching practices?

First, this chapter highlights the facilitators' overall perceived level of impact on educators' confidence, knowledge, and teaching practices. Next, this chapter describes how raising awareness of early math and promoting positive math identities built educators' confidence. Lastly, this chapter includes some examples of how the initiative developed educators' knowledge and teaching practices.

Overview of Methods and Sample

To answer the evaluation question, this chapter draws on data collected from the agency facilitators, including from survey 3 ($n = 81$ facilitators), the agency questionnaire ($n = 28$ agencies), posters ($n = 30$ agencies) from the CAEMI Summer Institute 2020, two focus groups with facilitators ($n = 12$ facilitators), and one focus group with the CAEMI coaching team ($n = 6$ coaches) in March 2021. Within the agency questionnaire, facilitators also reported on any data they collected from educators, such as surveys or observations; the evaluation team utilized these data to show examples from individual educators within their agencies.

In addition, the case studies within two agencies gathered data directly from educators and facilitators to illustrate the initiative's impact on educators' math confidence, knowledge, and teaching practices. Data collected from the case studies included interviews with the facilitators, observations of selected professional learning sessions, document review of professional learning materials, educator surveys, and educator interviews. In Case Study 1: Spatial Reasoning for All, educators who completed the surveys included family child care providers ($n = 27$), early childhood teachers ($n = 14$), and elementary school teachers ($n = 9$). In Case Study 2: Coding and Beyond, educators who completed the survey comprised all state-funded preschool teachers ($n = 28$) within the county. Examples from Case Study 1: Spatial Reasoning for All and Case Study 2: Coding and Beyond will be reported on throughout this chapter.

For more information on the case study implementation plans and educator outcomes, see [California Statewide Early Math Initiative in Local Communities: Building Educator Math Capacity](#).

Key Findings

This section reports on key findings on the initiative's impact on educators' confidence, knowledge, and teaching practices in early math.

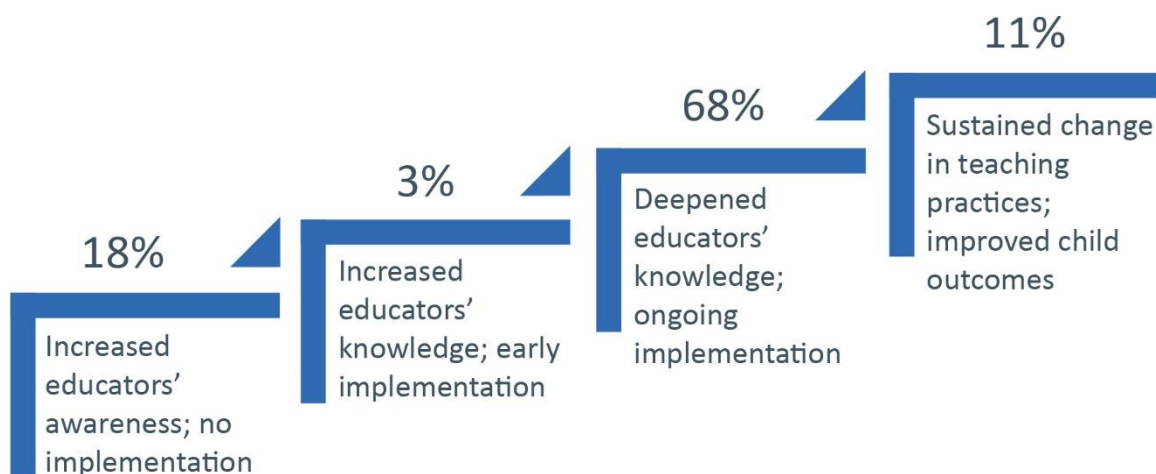
Most agencies reported that educators deepened their early math knowledge and engaged in ongoing implementation of math teaching practices.

In the agency questionnaire, 28 agencies reported on the perceived level of impact their professional learning and coaching had on the participating educators. Agencies selected which of four levels of impact applied to a majority of the educators they worked with:

1. Educators increased their awareness of the importance of early math. They understand that opportunities for supporting children's early math happen all throughout children's play, activities, and routines. They may not have yet begun implementing new activities or strategies in their early learning setting.
2. Educators increased their knowledge of early math and how to support it. They occasionally implement new math activities or strategies with children in their early learning setting.
3. Educators gained a deeper knowledge of early math and how to support it. They implement activities or strategies in an ongoing way in their early learning setting.
4. Because educators have changed their math teaching practices in an ongoing way, our agency has seen improved child outcomes in the area of early math in assessment data.

Many of the agencies selected more than one level of impact relevant to the participating educators within their agency. Exhibit 22 below represents the highest level selected by the agencies.

Exhibit 22. Agencies' Perceived Level of Impact on Educators' Math Knowledge and Practice



Overall, the agencies' responses indicated that they perceived the majority of educators moving beyond a level of awareness and a basic knowledge into developing deeper knowledge of early math and how to support it. The following sections provide examples of how educators began to develop early math capacity through their participation in the CAEMI.

Educators increased their awareness of and confidence in early math.

Developing a Positive Math Identity

Before diving into early math content and teaching practices, some agencies chose to focus on developing educators' positive math identities. During the CAEMI Summer Institute 2020 poster sessions, a few agencies referenced the importance of developing educators' positive math mindsets as an integral part of their implementation. Facilitators within these agencies suggested that building a strong math identity served as a necessary step to allow for further capacity building to take place. One agency that collected data on educators' math identities reported that by the end of the initiative, "Most of the participants strongly agreed that they are a math person."

Some agencies shared how building educators' positive math mindsets would help create a positive association with math that would then transfer to children and the overall classroom culture. Facilitators participating in focus groups at the end of the initiative reiterated how the experience helped educators feel more empowered to support math in their classrooms.

Raising Educators' Awareness: The Importance of Early Math

During the CAEMI Summer Institute 2020, a few agencies mentioned how recognizing the importance of early math helped educators see the value in strengthening their math teaching

practices. Facilitators also shared in the poster session how educators began to see connections between children’s early exposure to math and their long-term school success. The importance of math also surfaced in facilitator and CAEMI coaching team focus groups in March 2021. Facilitators from four agencies and one CAEMI coach discussed how educators recognized the importance of introducing math early and providing children with positive early math learning experiences.

“I know that these teachers are taking it back to their classrooms. I don’t get to see the direct results all the time, but through the conversations that we’re having and just sharing of pictures, I know that now, at least in some of our county, it’s at the forefront of ... their day-to-day planning, how they’re going to arrange our classrooms and what they’re going to offer.”

Agency Facilitator, Focus Group Response, March 2021

Case Study 1: Spatial Reasoning for All offers an example of how facilitators integrated the importance of early math into their professional learning and coaching. In this agency, the facilitators defined the following goal: “Understand the importance of spatial reasoning as it relates to children’s success in school.” The agency emphasized the significance of early math, specifically spatial reasoning, throughout their implementation by sharing research findings and facilitating discussions about how spatial reasoning relates to future development. During interviews, educators expressed how much they appreciated learning about the “why” of engaging children in spatial reasoning. Learning about the “why” helped them make spatial reasoning a priority during daily routines and activities and become more intentional in their interactions with children.

Raising Educators’ Awareness: “Math is everywhere”

At the CAEMI Summer Institute 2020, about one third of the 30 participating agencies shared how participation in the CAEMI helped increase educators’ awareness that “math is everywhere.” Facilitators shared that educators had become more aware of the math learning that can be supported within all areas of the curriculum. Educators also communicated this theme in surveys administered by the facilitators. For example, one educator shared, “I realized I’m doing a lot of math without knowing it.” Additionally, in the focus groups, facilitators from four different agencies mentioned educators’ increasing realization that math is around us. These examples showed educators’ growing awareness of opportunities for early math in their daily routines and how they began to more intentionally engage in early math interactions with children.

In both case studies, educators also described how their experiences with the CAEMI opened their eyes to the many ways math is used in daily life. In Case Study 1: Spatial Reasoning for All, teachers and family child care providers discussed how they began to see opportunities to

support children’s spatial reasoning all throughout the daily routines and activities. For example, an elementary teacher talked about how children in earlier grades use spatial reasoning to fit their belongings in their desks or to write letters and words that fit on lined pages. The educators also used spatial language with children during routines (e.g., mealtime), indoor play with manipulatives, outdoor gross motor play, and small- or whole-group activities.

In Case Study 2: Coding and Beyond, educators moved beyond offering math at a single math center or activity to using it all throughout the classroom. They also reported that, at the outset of the CAEMI, it was hard to see how the math portion of the Desired Results Developmental Profile (DRDP) fits into their daily routines and activities; however, by the end of the initiative, they had gained advanced knowledge on how to incorporate math into many activities, such as in the block area or when riding bicycles. Both case studies highlight how educators’ participation in the CAEMI illuminated new ways of identifying and supporting math in children’s everyday environments.

“It was very eye opening that there are a lot of math activities we can do. It’s not just one table activity. We can do math in the block area. We can do math using books, songs, and movement.”

Preschool Teacher from Case Study 2: Coding and Beyond, Interview Response, May 2020

Increasing Educators’ Interest and Confidence in Supporting Early Math

Through their participation in ongoing professional learning and coaching, facilitators reported on educators’ growing interest and excitement with learning about and how to integrate math into their settings. In survey 3, by midway into the initiative, 82 percent of the 78 facilitators reported that they *agreed* or *strongly agreed* that educators in their community are excited and motivated in the early math training and coaching conversations. The open-ended survey data suggested the facilitators observed educators’ excitement and high levels of interest in the early math content, in the professional learning and coaching sessions, and in the materials, activities, and resources they received.

This willingness and enthusiasm continued through the end of the initiative. In the CAEMI Summer Institute 2020 poster sessions, around 20 percent of agencies reported on educators’ excitement and interest in early math professional learning. Additionally, in focus groups toward the end of the initiative, facilitators mentioned that educators began to see how easy it was to implement math activities into their settings. Overall, with educators’ growing excitement around early math, there was also growth in their interest and confidence to implement early math activities as part of their work.

“We are seeing our cohort become empowered as math leaders in our county. They are growing a lot in just a few months, excited about each opportunity. We’ve held three trainings and three coaching sessions with 100% participation.”

Agency Facilitator, Survey Response, December 2019

For some agencies, facilitators conducted observations to examine educators’ progress. Upon reflection, a facilitator wrote, “It makes me feel very satisfied as a supervisor to walk in the classroom and see how the teachers are implementing what we learned in the sessions. Teachers are focusing more on play-based learning, which the children really enjoy.” The educator anecdotes, pictures, and surveys or observations conducted by the agencies revealed for the facilitators the impact of their local implementation on educators’ teaching practices and children’s engagement and learning.

Facilitators also reported an increase in educators’ confidence in supporting children’s early math learning. Of the 24 agencies reporting on an open-ended question in the agency questionnaire, one third of the agencies suggested that educators increased their confidence and reduced math anxiety after having participated in the initiative. Facilitators reported that educators felt more confident in applying math strategies and using materials to support math learning. Some facilitators reported on educators’ reduced phobias or anxiety in math as they became more confident in their skills.

Results from the case studies provided evidence for how the initiative increased educators’ confidence in supporting early math. For example, Case Study 1: Spatial Reasoning for All revealed statistically significant increases in educators’ self-reported confidence to support spatial learning over the course of the initiative. At the start of the initiative, most of the educators felt only *slightly confident* in their abilities to support children’s spatial learning. After having attended professional learning and receiving coaching on this math area, they reported feeling *very confident*. This significant growth in confidence was reported by family child care providers, early childhood teachers, and elementary teachers.

Similarly, in Case Study 2: Coding and Beyond, preschool teachers reported on the question, “Overall, how would you rate your confidence in supporting children in early math after participating in math training and coaching?” In the post survey, educators rated their confidence on a scale of 1 (*not at all confident*) to 5 (*extremely confident*). About 22.22 percent of teachers reported feeling somewhat confident, 70.37 percent reported feeling very confident, and 7.41 percent reported feeling extremely confident. In open-ended responses to the post survey, teachers described how the new activities, ideas, and tools helped them feel more confident in supporting early math.

“I was second guessing my knowledge or how well I taught inside the classroom. However, when we did these trainings, I learned a new style of teaching mathematics and the terminology as well as the science behind math in preschool. I feel that helped solidify my confidence in the classroom.”

Preschool Teacher from Case Study 2: Coding and Beyond, Survey Response, July 2020

Educators deepened their knowledge of early math through ongoing professional learning and coaching.

As educators attended professional learning and coaching sessions, facilitators began to notice educators’ increased knowledge in early math. Of the 24 agencies reporting on an open-ended survey question in the agency questionnaire, 6 of the agencies mentioned that educators increased their knowledge in supporting children in early math. Facilitators shared in the agency questionnaire and in facilitator focus groups the kinds of knowledge gained by educators, such as

- an understanding of early math and how children learn;
- increased familiarity with the California Preschool Foundations and Frameworks; and
- strategies they could implement immediately.

The case studies also offered evidence of how the initiative supported growth in educators’ knowledge in early math. Educators in both case studies, despite the variation in implementation plans, reported an increased knowledge of children’s development in several math areas. Educators in Case Study 1: Spatial Reasoning for All reported on their knowledge before and after the initiative. Results indicated statistically significant increases in their self-reported math knowledge in general, with the greatest reported increase being in the area of spatial reasoning, the math area targeted by the agency.

Likewise, in Case Study 2: Coding and Beyond, educators reported their knowledge in pre- and post-surveys. From the beginning to the end of the initiative, educators reported statistically significant increases in all math areas, with the largest increase in coding, a new area for this agency. Educators’ reported growth of knowledge in both case studies, across all math areas, suggests that the professional learning and coaching was successful in raising awareness and in promoting growth in math knowledge.

Educators incorporated their early math knowledge into their teaching practices.

Educators' Promotion of Math Exploration Through Play

Facilitators learned about play-based approaches to math during the CAEMI Summer Institute 2019, and agencies shared how they infused these concepts into professional learning and coaching sessions. Data from the agency questionnaire suggested that play-based learning was included in 52 percent of the learning objectives and goals reported by 29 agencies. Results from the educator surveys and observations that were conducted by facilitators suggested that some educators increased their use of manipulatives and allowed more open-ended exploration throughout the day. Educators also made play-based materials, such as blocks and other building materials, more accessible to children throughout the day.

Educators shared their successes and how the children benefited from the new math strategies and materials being implemented. In surveys collected by facilitators, educators would share stories and pictures of the activities they had implemented. Many of the activities mentioned were initially shared by CAEMI coaches, such as Counting Collections and hands-on activities using math concepts. Other examples of activities included

- planting a garden and using measuring tools to see how plants grow and then measuring the weight of the vegetables they planted and comparing sizes;
- using circle time, such as letter or number of the day, to create groups of objects to engage children in subitizing skills;
- creating obstacle courses to engage children in the use of positional vocabulary;
- playing “I Spy” shapes in a virtual environment and allowing children to look for different shapes at home; and
- filling a jar with items and having children estimate the number of items inside.

Additionally, in surveys and observations that facilitators conducted, they noted that educators were using more open-ended questions during play to engage children in math learning. For example, one facilitator noticed in reviewing lesson plans that educators included math-specific open-ended questions during story time. Other facilitators observed that educators seemed more comfortable asking open-ended questions during play. The combined use of play to explore math and the questions posed by educators were designed to bolster children’s early math development.

Educators' Expansion of the Use of Math Vocabulary in Their Settings

In addition to the play-based strategies, facilitators reported on educators’ use of math vocabulary with young children. Of the 24 agencies in the agency questionnaire that reported

on educator outcomes in an open-ended question, four agencies explicitly discussed the increased use of math language in their settings. Facilitators mentioned how educators had expanded their own knowledge of math vocabulary. They also described educators' use of math language in their daily interactions with children and during play.

Similarly, in both case studies, educators reported the use of more spatial vocabulary for both themselves and children. In Case Study 1, educators and children used spatial vocabulary when engaging in routines, such as setting the table, washing hands, or lining up. They also integrated positional vocabulary as children navigated their bodies through obstacle courses, both indoors and outdoors. Related, in Case Study 2, educators noticed that children used more spatial vocabulary, both during math activities and in their everyday routines. During one educator interview, the educator described instances in which children drew arrows on paper, or with chalk outdoors, to guide people where to go. Additionally, one parent told teachers that children pointed out arrows on their way to school.

Conclusion

Multiple data sources suggested that participation in agencies' professional learning and coaching supported educators' math confidence, knowledge, and teaching practices, regardless of the content of the agency facilitators' implementation plans. Through educators' participation in ongoing early math professional learning and coaching, educators began to develop positive math identities, expanded their awareness of the math all around them, and focused on early math's importance for children's future learning and development. The educators also increased their knowledge of early math pedagogy by studying how children learn about math and building an early math toolbox of activities and strategies to support young children.

Finally, the initiative reinforced math teaching practices and implementation in various settings, such as family child care programs, preschool classrooms, and elementary schools. Notably, facilitators reported on the expanded use of math vocabulary and math exploration through play, both practices that were originally explored at the outset of the initiative at the CAEMI Summer Institute 2019.

The evaluation results related to educator outcomes illustrated that the agency facilitators embraced the initiative's approach to early math in their work with educators. For example, the CAEMI approach embedded themes such as "math is everywhere" and the importance of positive math identities throughout the summer institutes and COPs; agency facilitators then utilized these same themes to build educators' capacity. The math themes reiterated by agency facilitators and educators show how the CAEMI extended beyond the facilitators' capacity and began to permeate local settings. The early evidence of educators' growing math capacity demonstrates the initiative's early success in supporting agency facilitators to further develop educators' math capacity in their local communities.

Discussion

Overall, the evaluation findings indicated that the CAEMI successfully achieved its goals to increase the agency facilitators' awareness of the importance of early math and to build their confidence and capacity to support children's early math learning. Utilizing a train-the-trainer approach, the CAEMI provided professional learning and coaching to the agency facilitators who were then required to provide professional learning and coaching to educators in their local communities. The CAEMI coaches regularly engaged the facilitators in hands-on, active learning experiences to build their knowledge of math concepts and activities that support educators and children from infants through early elementary grades.

The agency facilitators consistently reported positive feedback on all components of the professional learning and coaching model, including the summer institutes, COP sessions, and coaching. Analysis of the data showed a significant decrease in agency facilitators' negative feelings toward math after participating in the CAEMI. The data also indicated an increase in the facilitators' confidence in their knowledge of children's math development and math teaching skills, and in their math training and coaching skills. This significant growth was evident on most outcomes, regardless of the facilitators' previous experience providing early math training and coaching.

In addition, the 30 participating agencies across California successfully implemented early math training and coaching with a range of early childhood educators in their local communities. The majority of agencies met or exceeded the grant requirement for the number of professional learning sessions and educators served. Using a variety of resources and activities offered by the initiative, the locally implemented professional learning and coaching sessions aimed to build educators' early math knowledge, practice, and confidence. Local implementation varied across agencies in the number and type of educators engaged, the math content addressed in professional learning and coaching, and the schedule and delivery of professional learning and coaching sessions throughout the year.

Despite these differences in local implementation, the reported positive impact on educators was similar across agencies. Most agencies reported that educators deepened their early math knowledge and engaged in ongoing implementation of early math practices. They also reported observing educators' increased awareness of and confidence in early math and improved ability of educators to implement newly acquired early math teaching practices in their settings.

Drivers of Effective Implementation: Structural Aspects of the Grant

The CAEMI's lead, Fresno County Superintendent of Schools, and its partners have made strategic decisions about the implementation of the grant, including the age range of children served by this initiative, the number of participants from each agency, and the requirements for funded agencies. These decisions represented structural aspects of the grant that were pivotal for the successful implementation of CAEMI in local communities.

Flexibility of the Grant Requirements

Although all agencies were expected to engage at least 20 educators in three professional learning sessions and six coaching conversations, agencies had flexibility in how they implemented professional learning and coaching in their communities. This structure of the grant allowed agencies to meet their unique local needs—such as their capacity to deliver early math professional learning and coaching, the programs they served (e.g., family child care, preschool centers, early elementary schools), and the age range of children in programs—and led to rich variation in implementation plans.

Most agencies conducted a needs assessment to learn about their educators' needs and priorities and to guide their plans for professional learning and coaching. Implementation plans, therefore, varied in the range of math content covered and the timing and sequence of professional learning and coaching. For example, one agency provided professional learning and coaching to educators working with children birth to eight years and made a local decision to focus on the math area of spatial reasoning. Another agency decided to provide professional learning and coaching to educators serving preschool children. They introduced teachers to innovative ways of engaging children in coding and robots in addition to covering other math areas. The flexibility of grant requirements not only allowed agencies to tailor their implementation of the CAEMI according to their local needs but also provided opportunities for creativity and innovation in local plans.

Addressing the Birth-to-Eight Continuum

The CAEMI's partners intentionally selected a range of agencies serving children across the birth-to-eight age range. Covering this full continuum created opportunities for cross-age collaboration. The agencies' teams of facilitators often had a range of expertise, covering early childhood and early elementary math. This team composition allowed local implementation to address the full birth-to-eight continuum while also focusing on specific age levels. Furthermore, collaboration among the team members created opportunities for cross-age articulation and coherence across the different ages, from infancy through early elementary. Facilitators who normally would not have worked together collaborated and discussed ways to support educators' understanding of the early math birth-to-eight continuum.

Recruiting a Team of Facilitators at Local Agencies

Recruiting a team of facilitators within each agency seemed to contribute to successful local implementation. Each agency had a team of two to four facilitators who were invited to participate in the CAEMI professional learning experiences. The team of facilitators shared ideas, learned from each other, and collaborated on implementing their plans for professional learning and coaching in early math. Research on effective professional development in early math suggests that engaging a team of colleagues is more likely to result in positive educator outcomes (Brenneman, 2014). Furthermore, research highlights the positive impact of collaboration among colleagues in professional development (Zaslow, 2014; Zaslow et al., 2010).

Working in teams not only enabled collaboration among facilitators but also likely allowed them to overcome challenges related to time by distributing the workload. Additionally, a team of facilitators working with different program types across the birth-to-eight continuum expanded the network of connections with local educators and the buy-in of a range of educators within local communities. Finally, training and coaching a group of facilitators to lead early math professional learning helped build local leadership and sustainable supports that can extend long after the initiative.

Drivers of Effective Implementation: Professional Learning and Coaching Approach

In addition to the structural aspects of the grant, key characteristics of the professional learning and coaching approach delivered by the CAEMI coaches fundamentally supported the successful implementation of the initiative.

Employing a Professional Learning and Coaching Model That Is Ongoing and Collaborative

The initiative utilized a professional learning and coaching model grounded in research-based principles of adult learning and professional development in early math. The model allowed for ongoing adult learning throughout the yearlong initiative, starting with the five-day summer institute and continuing with quarterly COP sessions and monthly coaching sessions between the CAEMI coaches and each agency team. Each of these professional learning experiences provided opportunities for the facilitators to build relationships with their CAEMI coach and peers, and to connect, collaborate, and learn from each other. During the COP sessions, for example, the facilitators appreciated learning about the planning and implementation strategies of other groups from across the state as well as engaging in the interactive activities in base group breakout sessions.

Employing a Professional Learning and Coaching Model That Utilizes Playful, Hands-On Math Learning Experiences

Engaging the facilitators in hands-on, playful math experiences for adults was another key component of the CAEMI's professional learning and coaching model. The CAEMI coaches intentionally engaged the facilitators in playful math experiences to support the facilitators' professional learning and to help them better understand the perspectives of children as learners of math. The facilitators highly valued the hands-on active learning experiences offered during the summer institutes and the COP sessions, and many reported using these activities with educators in their locally planned professional learning sessions. This playful, hands-on approach to early math professional learning likely served to build the facilitators' positive feelings toward math and helped them see learning from a child's perspective.

Offering Virtual Professional Learning and Coaching

The initiative's virtual professional learning and coaching allowed for a wide-reaching early math support system. The CAEMI featured a hybrid of in-person opportunities, complemented with virtual experiences for the agency facilitators, including quarterly virtual COP sessions and monthly virtual coaching sessions with the CAEMI coaches. The virtual model helped the initiative extend its outreach and make professional learning accessible to facilitators statewide. For the virtual COP sessions, the CAEMI coaches intentionally created opportunities for the facilitators to share and connect with peers in breakout rooms. They also engaged the participants in hands-on, playful activities using materials that they sent the facilitators in advance of each session.

The offering of training and coaching virtually throughout the yearlong initiative helped when facilitators made a switch from in-person to virtual training and coaching during the COVID-19 pandemic. They could adapt the format and strategies the CAEMI coaches used when offering virtual professional learning and coaching to educators. Furthermore, the facilitators reported adapting the activities offered online by the CAEMI coaches and using them in their online sessions with educators. These online math activities were especially useful as examples of how educators can support at-home math learning through Zoom sessions and other resources for families.

Recommendations

Amidst the drivers of effective implementation, as well as positive reported outcomes from the CAEMI, the evaluation team has the following recommendations to inform the future implementation of the CAEMI.

Provide additional tools and concrete guidance on planning and implementing local professional learning and coaching for agencies with higher levels of need.

Although the flexibility of the grant allowed agencies to design and implement professional learning and coaching that met their local needs, for some agencies, especially those who had limited experience in providing professional learning and coaching and/or knowledge in early math, this flexibility presented a challenge. They expressed the need for more direction and concrete guidance on how to implement the initiative. For example, one of the agency facilitators shared in a survey response that they had been given too much autonomy and would have liked having more concrete requirements for trainings other than the minimum number of hours.

Furthermore, some agencies lacked clarity on how to determine what math areas they should focus on and used different approaches for making this decision. In Case Study 1: Spatial Reasoning for All, the facilitators decided to focus their professional learning and coaching on the math area of spatial reasoning. They assumed they had to choose one math topic area that is suitable for educators working with children birth through age eight. In Case Study 2: Coding and Beyond, the agency used a range of data sources, including classroom observations, DRDP data, and a needs assessment survey, to make their decision. They also found coding and robots of particular interest at the CAEMI Summer Institute 2019 and decided to incorporate coding into their implementation plan. Eventually, however, they selected a breadth of math areas, including number sense, geometry, and coding and robots. The two case studies illustrate the various ways agencies approached selecting an area of focus for professional learning.

While providing the agencies flexibility in grant requirements allowed for local autonomy and led to a rich variation in implementation plans, guidance from the initiative can support a more systematic approach for selecting the areas of focus for local implementation. The agencies would benefit from more structured guidance and tools on how they can use data (e.g., DRDP, observations, surveying educators). The initiative can also suggest ways in which agencies can use the *California Preschool Learning Foundations*, the *California Infant/Toddler Learning and Development Foundations*, and the Common Core State Standards in making local decisions on areas of focus for professional learning and coaching in early math.

Ensure professional learning fully addresses the birth-to-eight age range and provide guidance and resources to promote articulation and continuity in math learning across age groups.

The wide age range of children served under the initiative posed opportunities for cross-age collaborations but also challenges for the implementation of professional learning and coaching for agency facilitators and educators. Although the CAEMI sought to provide comprehensive

professional learning that covered the entire age range, facilitators reported a need for more content on children of specific ages such as infants and toddlers or those at the elementary school level. The facilitators also expressed their own challenges of fully embracing the birth-to-eight continuum while individualizing professional development based on the age level of children the educators serve.

Furthermore, although some facilitators within local agencies discussed the full continuum of early math development from infancy through early elementary, articulation across age levels was not addressed systematically by the initiative. The CAEMI partners may consider being more intentional in how the initiative supports early math development across the entire age range, including the infant and toddler years and early elementary grades. Additionally, there is more room for the initiative to intentionally facilitate cross-age articulation in learning expectations and provide resources to support alignment and continuity in early math learning across age levels. A focus on cross-grade articulation can enhance children's school readiness and facilitate transition to kindergarten.

Deepen the facilitators' understanding of early math content knowledge, developmental progressions, and teaching skills while engaging them in hands-on, playful math experiences.

The engagement of facilitators in hands-on, playful math experiences for adults has likely served to build the facilitators' positive mindsets toward math and provided concrete ideas for activities that the facilitators could directly implement in their professional learning for educators. However, the professional learning sessions were heavily activity driven and primarily focused on the act of engaging the facilitators in the specific hands-on math activities.

For example, during the summer institutes, facilitators had minimal opportunities to discuss how to apply the hands-on activities to the agencies' local contexts or to draw the connections to the foundations and standards in early math. In addition, during the COP sessions, although playful math activities were accompanied by discussion questions about the math concepts in the activities, facilitators had little time at the end of the breakouts to fully discuss the developmental progressions of the concepts across the birth-to-eight continuum and how the same activities would apply for young learners.

In their feedback, some facilitators specifically pointed out that they would have liked deeper early math content as part of the professional learning sessions. The hands-on, playful activities could have been better utilized as stepping stones for more nuanced understanding of the math concepts in the CAEMI early math activities. Furthermore, richer engagement around the math concepts would have likely enhanced the facilitators' understanding of concepts described in the *California Infant/Toddler Learning and Development Foundations* and in the Common Core State Standards for elementary students. It would also build the facilitators'

competence to plan their own early math activities or extend and adapt the CAEMI activities based on children's age and development.

Although the initiative's approach to professional development was effective in increasing the facilitators' positive feelings toward math and their confidence in their math knowledge, teaching skills, and early math training and coaching skills, future implementation of the CAEMI would benefit from being more explicit and intentional about what facilitators (and educators) need to know and practice to improve math teaching and support children's math learning. Research on effective professional development identifies three components of high-quality professional development in early math: the basic concepts of math (content knowledge), children's development of math concepts (the developmental progressions), and pedagogical knowledge, or the use of concrete strategies and tools to teach mathematics (Copley, 2004; Hyson & Woods, 2014). Therefore, the evaluation team suggests consideration of how the initiative can utilize the hands-on, playful approach to early math professional development in ways that more intentionally deepen the facilitators' content knowledge, expand their understanding of the developmental progressions, and build their capacity to use math teaching practices and activities with greater flexibility.

Further tailor the CAEMI professional learning and coaching to participants' diversity.

The CAEMI partners intentionally selected a range of agencies characterized by diversity in program type, age range of children served, and accessibility to diverse populations (e.g., tribal populations, FFN care). As such, programs varied in their capacity, knowledge, and previous experience in early math. About half of the agency facilitators never trained or coached on math-related topics prior to the CAEMI. The CAEMI coaches reported that the agency type seemed related to the level of supports needed. For example, the nonprofit organizations required more intense coaching and support than the county offices of education and school districts did in all aspects of planning the professional learning, including identifying goals, the content to present, and the logistics of a training. On the other hand, some facilitators from county offices of education shared that, although the coaching was helpful for reflection, they did not need the coaching sessions as frequently.

To address these varying needs of participants, the CAEMI implemented a coaching approach that was responsive to the needs, issues, and questions shared by the facilitators. The success of this approach was confirmed by the facilitators who iterated the value of collaboration and guidance from the CAEMI coaches and how they individualized their coaching to the needs of the agency.

However, despite this responsive coaching approach, the initiative's model of professional learning and coaching offered the same kind and frequency of supports for all agencies, regardless of their needs or previous experience with early math. For example, the CAEMI

Summer Institute 2019 and the COP sessions offered the same training to all participants, and the small breakout groups were based on geographical region rather than area of need. Likewise, all agencies, regardless of their previous experience with training and coaching in early math, received monthly coaching sessions.

Future implementation of the CAEMI may benefit from a professional learning and coaching model based on equity rather than equality. A needs assessment of all agencies at the outset of the initiative is recommended to learn about their previous experience in math training and coaching, the age level of children they serve, and their areas of strengths and needs. This information can inform the planning and implementation of the CAEMI's train-the-trainer institutes, COP sessions, and coaching to vary the focus and intensity of supports based on the needs of individual agencies.

Build in additional supports for quality assurance of local implementation, such as observations and review of materials.

Given the wide range in facilitators' previous general experience with training and coaching, and their limited experience with early math, in particular, the facilitators could benefit from more intensive guidance, feedback, and quality reviews of their training materials. The CAEMI coaching used effective research-based practices to coach the facilitators, including joint planning, reflection, and constructive feedback. During the monthly coaching meetings, the CAEMI coaches followed the lead of what the facilitators shared or asked, responded to their questions, and prompted them to reflect on their practice. However, direct observations of the facilitators were not part of their ongoing coaching approach.

Math professional development programs have positively affected math teaching practices when coaching involved in-person observations, in addition to other supports such as reflection and feedback (Rudd et al., 2009; Sarama et al., 2016). Thus, with no observations taking place, and the CAEMI coaches following the lead of what participants asked, the amount of feedback that could have been given was limited—the participants may not have known what questions to bring up with their coach. Furthermore, without direct observation and specific feedback, the quality of information that participants shared with educators in their agencies is largely unknown.

The evaluation team recommends incorporating direct observations of facilitators as part the CAEMI's approach to coaching as well as inviting participants to share their professional learning agendas, presentations, and other materials with the coaches more systematically. Reviews of the facilitators' materials will provide a professional quality assurance that the early childhood content is accurate and developmentally appropriate, and that the delivery methods follow principles of adult learning.

Disseminate the CAEMI resources strategically during Phase II.

During CAEMI Phase I, the partners created a range of early math resources for educators and families: literacy activities to build children’s math concepts, videos to raise families’ awareness of early math, a series of research briefs on early math development, and a compilation of early math resources available online for free (see Appendix A). Over the course of the initiative, the lead partners worked on the development of an early math app—called Count, Play, Explore—to house all the videos and other resources and make them easily accessible to educators and families.

During the course of the initiative, some of the CAEMI’s resources were posted on the AIMS website, and other resources, such as the early math book reviews and related activities, were posted on The Early Math Project website. In addition, some of the CAEMI’s early math resources were shared briefly at the COP sessions, including the research briefs and the children’s book reviews. The CAEMI Phase II can further these strategic efforts to integrate the resources into any continued professional learning, COPs, or coaching sessions to demonstrate to the agency facilitators how to use these resources in their professional learning and coaching with local educators.

Expand the use of the Lighthouse for Children Child Development Center as a demonstration site.

The Lighthouse for Children Child Development Center (the Lighthouse for Children) served as a demonstration site to pilot key components of the CAEMI. Throughout the course of the initiative, the Lighthouse for Children piloted a range of activities, materials, and events to engage families in children’s early math learning. For example, interactive math exhibits set up in the entryway of the Lighthouse for Children invited parents to engage in unique hands-on math activities. A family math night event at the Lighthouse for Children provided families with strategies for engaging children in math at home using the children’s math book reviews and related activities developed by the initiative. The Lighthouse for Children also piloted the Math Activity Take Home (M.A.T.H.) packs with ideas and materials families can use to engage children in playful, hands-on math learning at home. At the onset of the COVID-19 pandemic, the Lighthouse for Children also developed a multifaceted distance learning program with activities, send-home materials, and Zoom sessions to support young children and their families while the center was closed to in-person learning.

The CAEMI Phase II can further use the Lighthouse for Children as a demonstration site for other early childhood programs and agencies across California. For example, there is a plan to develop a guide for early childhood programs on how to implement family math nights, distance learning programs, and interactive early math exhibits for children and families. The evaluation team recommends sharing with other participating agencies examples of successful strategies and lessons learned from pilot activities at the Lighthouse for Children. Embedding

examples from the demonstration site, as part of the initiative's professional learning and coaching sessions, will benefit all participating agencies.

Evaluation Limitations and Next Steps

As illuminated throughout this report, this formative evaluation effectively gathered information about the implementation of the CAEMI professional learning and coaching provided to agency facilitators, as well as the self-reported, pre- and post-outcomes of the facilitators. In addition, the evaluation described the reach and variation of implementation in local communities across California, as well as the self-reported impact on educators.

Yet the current evaluation faced multiple limitations. First, all of the pre- and post-measures of facilitator outcomes were based on self-reported data rather than any direct assessments or observations of facilitators' knowledge, pedagogical skills, or training and coaching skills. Next, the evaluation did not measure fidelity of implementation across the geographic base groups. As the actual implementation of the CAEMI may have varied by base group, the facilitators' experiences may have differed as well. For educator outcomes, the evaluation only collected self-reported data from educators from two county offices of education, and the remaining information on educator outcomes was reported by agency facilitators. Finally, due to the design of the evaluation, facilitators were not randomly assigned to either the initiative group or a control group. Therefore, the current evaluation cannot infer that the CAEMI caused any changes in facilitator outcomes.

Future evaluations of the CAEMI can build upon this formative evaluation as an evidence base for this type of early math initiative as well as consider additional ways to measure both agency facilitator and educator outcomes beyond self-reported surveys. For example, direct assessments of early math knowledge or observations of pedagogical or professional development practices may provide a more accurate measure of participants' knowledge and skills. In addition, more comprehensive data collection from educators will also support better understanding of the impact of the initiative on educators. The CAEMI strives to affect child outcomes, and future evaluations can consider ways to measure child outcomes. In conjunction with the implementing partners, the evaluation team can create a more specific theory of change for how this initiative will lead to improvements in specific child outcomes that could be studied in a future evaluation. Finally, if the delivery approach by geographic base groups continues, future evaluations should gather more systematic, nuanced data on the fidelity of implementation across base groups.

Sustainability of the CAEMI

Overall, the CAEMI built agency capacity and developed concrete math resources that can extend long after the initiative. Agencies developed their capacity to train early childhood

educators using adult learning strategies. Many of the tools that agency facilitators became familiar with through the initiative, such as engaging educators in hands-on math experiences, were implemented in their local communities and can be carried forward to future work to support children's early math. In addition, the early math app and math resources have the potential to provide sustainable support for educators and families to integrate math into their everyday routines and activities.

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Appendix A: CAEMI Resources

These resources are housed on the [Early Math Project website](#) and the [AIMS website](#).

Professional Learning Materials from the CAEMI Summer Institute



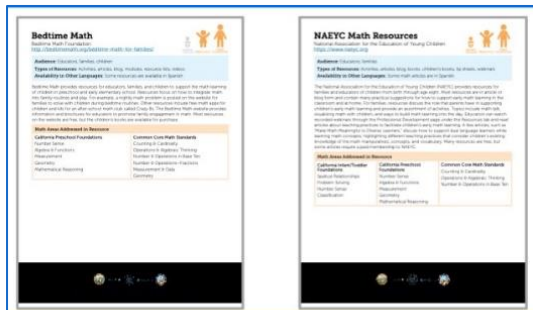
A series of resources developed from the CAEMI Summer Institute 2019 on topics such as professional noticing, learning theory, culturally relevant pedagogy, and children’s learning and development of early math. These resources include presentation slides, hands-on activities, and handouts.

Research Briefs



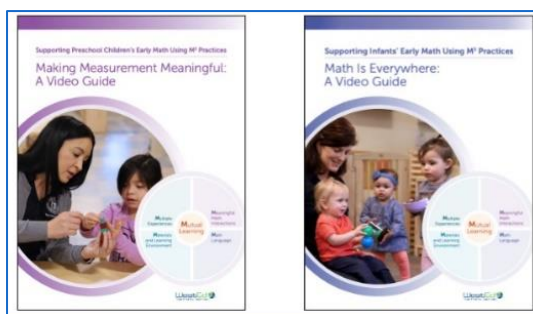
Four research briefs summarize research on children’s learning in early math topics and provide age-specific strategies to support children’s math development. The briefs are available in English and Spanish.

Online Resources



A compilation of free, online early math resources (e.g., articles, activities, videos) that provides information on the resource’s target age level, audience group, and the math areas addressed.

Video Guides



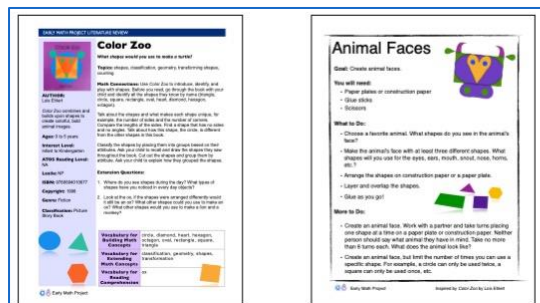
Four videos illustrate effective educator practices to support young children’s math development. Accompanying video guides offer professional development providers with a tool to facilitate discussion and reflection with educators.

“I’m Ready!” Videos



A series of creative videos to raise adults’ awareness of ways they can support children’s math knowledge and skills in daily routines and activities. These videos are accessible in English and Spanish.

Book Guides



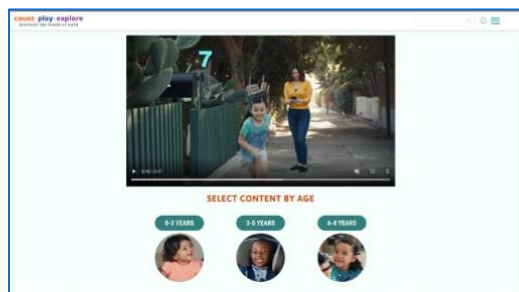
A collection of book reviews to accompany children’s books with early math content. Each book review includes prompts and playful math activities. The book reviews are available in English and Spanish.

M.A.T.H. Packs



The Math Activity Take Home (M.A.T.H.) Pack provides families with a children’s book, an associated book guide, activities, and materials to guide at-home early math experiences.

Count, Play, Explore App



This website houses [resources developed by the CAEMI](#) including the “I’m Ready” videos, the book guides, and the online resources.

Appendix B: Measures from Surveys 1–4

Measures of Facilitator Perceptions of Implementation

For the measures of agency facilitator perceptions of the professional learning and coaching collected in surveys 2–4, the evaluation team averaged multiple items to create composite scores. Composites were formed for participants who had at least 70 percent of complete data for each measure. The evaluation team collected data on these measures at the beginning, middle, and end of the initiative year.

Below is a list of all items that were part of each composite, along with the Cronbach’s alpha for the items within each outcome. Cronbach’s alpha is a measure of internal consistency of items within a scale. Acceptable values of Cronbach’s alpha generally range from .70 to .95 (Tavakol & Dennick, 2011). For those items that were measured at multiple time points, the Cronbach’s alphas were calculated based on the first time the items were presented.

Beginning of the Initiative Year (July 2019)

CAEMI Summer Institute 2019: Effectiveness in building early math knowledge and skills ($n = 80$, Cronbach’s alpha = .87)

This training institute ...

- helped me build my knowledge of how young children develop and learn math skills and concepts.
- increased my understanding of how to support early math learning through play.
- increased my knowledge of how to support children’s math learning through structured math instruction.
- helped me understand how to build on children’s multiple math knowledge bases, including family, community, and cultural experiences.
- strengthened my skills in providing professional development on math.

- offered me specific strategies that will be useful in providing training and coaching on early math.
- helped me develop a plan to engage educators in professional learning on math.
- provided specific materials (e.g., tools, resources) I can use in my work with educators.
- prepared me to support educators who may be anxious about early math.
- provided opportunities to network and build connections with other professionals who do similar work.

CAEMI Summer Institute 2019: Content and delivery ($n = 84$, Cronbach's alpha = .87)

This training institute ...

- addressed content that is relevant to my role working with educators.
- included content that was at the right level for me (e.g., not too challenging, not too easy).
- had engaging materials (e.g., visuals on slides, helpful handouts).
- provided opportunities to interact and learn from one another.
- offered enough time for me to reflect on how to use the information in my work.
- included interesting, engaging activities and experiences to help me make sense of the content.
- was thoughtfully planned and well organized.
- presented content in a logical, coherent way.
- was facilitated by trainers who were knowledgeable and have relevant content expertise.
- was flexible enough to address participant needs (e.g., responding to participant questions, spending more time on areas of challenge for participants).
- was a good use of my time.

Midyear Check-In (November–December 2019)

COP sessions: Content ($n = 74$, Cronbach's alpha = .95)

The community of practice sessions ...

- helped build my knowledge of how young children develop and learn math skills and concepts.
- strengthened my skills in providing training on early math.

- strengthened my skills in coaching on early math.
- offered me concrete ideas to support my agency's implementation plan.
- addressed content that is relevant to my role working with educators.
- featured content that was at the right level for me (e.g., not too challenging, not too easy).
- included interesting, engaging activities and materials to help me make sense of the content.

COP sessions: Delivery ($n = 73$, Cronbach's alpha = .95)

The community of practice sessions ...

- offered enough time for me to reflect on how to use the information in my work.
- were thoughtfully planned and well organized.
- presented content in a logical, coherent way.
- were flexible enough to address my needs (e.g., responding to my questions, spending more time on areas of challenge for me).
- provided opportunities to interact and learn from one another.
- were a good use of my time.

Coaching: Effectiveness of supports ($n = 77$, Cronbach's alpha = .96)

The AIMS coaching sessions ...

- were individualized based on my agency's goals, strengths, and needs.
- supported my agency in planning and implementing professional learning sessions (or training).
- supported my team in conducting coaching conversations with educators in our agency.
- helped my team think through how to integrate the early math training with the coaching conversations.
- provided opportunities for me to share my observations and ideas.
- concluded by summarizing next action steps.
- were a good use of my time.
- I understand the purpose of AIMS coaching.

Coaching: Relationship with CAEMI coach ($n = 76$, Cronbach's alpha = .97)

To what extent do you agree with each statement below?

- I have a positive, collaborative relationship with my AIMS coach.
- My AIMS coach communicates clearly and effectively.
- I feel like my observations and ideas are acknowledged and affirmed by my AIMS coach.
- My AIMS coach is responsive to my agency team's questions and needs.
- My AIMS coach helps my team apply what we learn within our agency (e.g., from the summer institute or community of practice sessions).

End of Initiative Year (August 2020)

COP sessions: Valuableness of elements ($n = 61$, Cronbach's alpha = .86)

How valuable were each of the following elements of the community of practice sessions in supporting your role in this initiative?

- Hands-on activities during the base group breakouts (e.g., Froebel gifts, AngLegs, hole-punch puzzles)
- Discussion about early math concepts and standards during base group breakouts
- WestEd presentations of early math research briefs and resources
- Implementation plan share outs by other agencies
- Initiative updates (where have we been and where are we headed?)

Coaching: Valuableness of elements ($n = 10$, Cronbach's alpha = .94)

Our AIMS coach ...

- prompted me to reflect on my practices.
- provided me with useful, constructive feedback.
- reviewed my agency's professional learning presentation materials (e.g., PowerPoints, agendas, handouts).
- collaborated with me in setting goals and action steps during our coaching sessions.
- helped our team define our coaching approach and strategies.
- modeled an activity and/or strategy.

- observed me in person in my agency or early learning setting (e.g., when training educators, coaching a program director, implementing a math activity with children).
- observed me on video using SIBME or another virtual coaching platform (e.g., while training educators, implementing a math activity with children).

CAEMI Summer Institute 2020: Valuableness of elements ($n = 59$, Cronbach's alpha = .86)

How valuable were each of the following elements of the CAEMI Summer Institute 2020?

- Having to create a poster to share at the institute
- Base group breakouts
- Participating in the poster sessions
- Panel and call to action
- WestEd presentation
- Keynote speaker

Measures of Facilitator Outcomes

For the outcome measures collected in surveys 1, 3, and 4, the evaluation team averaged multiple items to create composite scores. Composites were formed for participants who had at least 70 percent of complete data for each outcome measure:

- Negative feelings toward math (surveys 1, 4)
- Confidence in knowledge of children's math development (surveys 1, 4)
- Confidence in math teaching skills (surveys 1, 4)
- Confidence in general training and coaching skills (surveys 1, 4)
- Confidence in math training and coaching skills (surveys 1, 3, 4)

The outcome measures for negative feelings toward math, confidence in knowledge of children's math development, and confidence in math teaching skills were informed by the Early Math Beliefs and Confidence Survey (Chen & McCray, 2013). Below is a list of all items that were part of each outcome measure, along with the Cronbach's alpha for the items within each outcome. Cronbach's alpha was calculated using survey 1 items from all participants, and, therefore the sample sizes reported below represent survey 1 sample sizes. The complete case sample sizes vary by outcome measure and range from 65 to 67.

Beginning and End of the Initiative Year (July 2019, August 2020)

Negative feelings toward math ($n = 90$, Cronbach's alpha = .83)

- Just the word “math” can make me feel nervous.
- I’m not a “math person.”

Knowledge of children’s math development ($n = 89$, Cronbach’s alpha = .95)

I am confident in my knowledge of ...

- age-appropriate math goals for children.
- California math foundations and standards for young children.
- children’s developmental progressions in early math.

I am confident in my knowledge of how children develop concepts and skills in ...

- number sense (counting and cardinality, addition and subtraction, subitizing).
- geometry (spatial relationships, shapes).
- measurement.
- classification.
- patterning.
- problem solving.

Math teaching skills ($n = 73$, Cronbach’s alpha = .96)

I am confident in my ability to ...

- observe what children know about math.
- translate math assessment data into curriculum plans.
- incorporate math learning and math vocabulary into everyday routines and play (e.g., mealtime, dramatic play).
- plan curriculum activities to help children learn math.
- further children’s math knowledge when they make spontaneous math discoveries or comments.
- make sense of children’s attempts to solve problems or common math errors.
- differentiate math instruction based on children’s individual strengths and needs.
- use culturally responsive practices to teach math.

I am confident in my ability to support children's ...

- number sense (counting and cardinality, addition and subtraction, subitizing).
- geometry knowledge and skills (spatial relationships, shapes).
- measurement knowledge and skills.
- classification knowledge and skills.
- patterning knowledge and skills.
- problem-solving skills.

General training and coaching skills ($n = 89$, Cronbach's alpha = .91)

I am confident in my ability to ...

- develop positive relationships with the educators I train and coach.
- communicate effectively.
- plan and facilitate trainings.
- use principles of adult learning in training and coaching (e.g., active learning).
- provide responsive and individualized coaching to educators based on their goals, strengths, and needs.
- support educators to improve their practice through a coaching process (i.e., joint action planning, observation, modeling, feedback, reflection).

Beginning, Middle, and End of the Initiative Year (July 2019, November–December 2019, August 2020)

Math training and coaching skills ($n = 89$, Cronbach's alpha = .90)

I am confident in my ability to ...

- provide effective trainings on math-related topics.
- conduct coaching related to early math development and learning.

Appendix C: Qualitative Analyses

Analysis of Open-Ended Survey Responses

Qualitative analysis of open-ended survey data took place in Microsoft Excel and Dedoose. To analyze this data, the evaluation team followed steps that align with recommendations for thematic analysis (Ritchie et al., 2003). First, the process of familiarization occurred such that members of the evaluation team reviewed each response to each survey question (Ritchie et al., 2003). This insight was used to develop a clear, concise, and objective coding system (Smith, 2000).

The codes were reviewed by a project director to corroborate and clarify the codes. Once the coding scheme was finalized, the evaluation team member coded all survey responses. Again, the coding was reviewed by a project director. When disagreements in code applications arose, consensus was reached among team members through discussion. Throughout the process, new codes emerged and less frequent and related codes were merged. Finally, frequencies of codes were tallied and illustrative quotes were identified.

Analysis of Focus Groups and Interviews

After each qualitative data collection, the participating evaluation team members conducted a debrief session. The debrief session focused on identifying key themes that arose through the discussion.

The analysis of qualitative focus group and interview data continued with data entry and cleaning. First, the focus group and interview notes were cleaned and cross-referenced with the audio recordings, as needed. Then, the qualitative data were de-identified. Focus group and interview data were coded in Microsoft Word and Dedoose.

After the qualitative data were entered and cleaned, the coding process began. First, an evaluation team member underwent the process of familiarization and read the transcripts to gain an understanding of the full corpus of data (Ritchie et al., 2003). During this process, themes were noted. From the initial reading, the evaluation team member identified a set of codes. When relevant, the set of codes were examined in relation to other data sources. For example, when a focus group was conducted at the same time as a survey, focus group and open-ended survey response codes were examined for similarities and differences. When

overlap existed, the same codes were applied across multiple data sources. The coding scheme was reviewed by a project director for corroboration and feedback. Then, the evaluation team member coded the qualitative data source. When applicable, multiple codes were applied to the same excerpts.

Once the coding scheme was finalized, the evaluation team member coded all survey responses. Again, the coding was reviewed by a project director. When disagreements in code applications arose, consensus was reached among team members through discussion. Throughout the process, new codes emerged and less frequent and related codes were merged. Finally, frequencies of codes were tallied and illustrative quotes were identified.

Appendix D: Additional Subgroup Analysis

Regardless of their previous experience training and coaching, facilitators reported significant growth on many outcomes after participating in the CAEMI.

This analysis examined growth in outcome measures for facilitators with varying levels of previous experience providing training and coaching. It included the following subgroups: facilitators who had trained and/or coached for at least five years (more experienced in training and coaching; $n = 38$) and those who had not trained or coached for at least five years (less experienced in training and coaching; $n = 28$).

Exhibit 23 presents facilitators' ratings for all outcome measures by levels of experience in training and coaching. The responses from less experienced facilitators indicated significant increases on all outcome measures, from the beginning to the end of the initiative. The responses from more experienced facilitators also indicated significant increases on all outcome measures, but their increase in confidence with their general training and coaching skills was not significant. Taken together, these findings suggest that both groups made significant gains throughout the initiative regardless of their previous experience in training and coaching.

In addition, at the beginning of the initiative, the less experienced facilitators reported significantly lower ratings than the more experienced facilitators on all outcome measures except for negative feelings toward math. By the end of the initiative, these differences remained significant for all outcome measures except for negative feelings toward math and confidence in math teaching skills. For these two outcome measures, there were no significant differences between the groups in their post-initiative scores. Therefore, although both groups made significant gains throughout the initiative, those with more prior experience training or coaching continued to report higher scores on some outcome measures at the end of the initiative.

Exhibit 23. Table of Pre-initiative and Post-initiative Means by Previous Training and Coaching Experience

Measure	More experienced in training and coaching	Less experienced in training and coaching
Personal feelings toward math	Pre: 2.80 Post: 2.25 ***	Pre: 2.72 Post: 2.11 ***
Knowledge of children’s math development	Pre: 3.93 Post: 4.38 ***	Pre: 3.63 Post: 4.20 **
Math teaching skills	Pre: 4.06 Post: 4.50 ***	Pre: 3.78 Post: 4.30 ***
General training and coaching skills	Pre: 4.42 Post: 4.55	Pre: 3.91 Post: 4.30 ***
Math training and coaching skills	Pre: 4.00 Post: 4.54 ***	Pre: 3.35 Post: 4.22 ***

Exhibit Note: The items within the “personal feelings toward math” measure are negatively worded; therefore, the desired outcome in a pre-post analysis would be a decrease in these negative feelings toward math. **Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .01$. ***Denotes a significant difference between the pre- and post-initiative means at the alpha level of $p < .001$.

