AIMS RESEARCH FELLOWS: SUMMARY OF PROFESSIONAL DEVELOPMENT, RESEARCH, AND SCHOLARSHIP

The California Statewide Early Mathematics Initiative (CAEMI) is an ongoing effort to provide professional development (PD) and support for directors, coordinators, and teacher leaders in early childhood education settings across California. Emphasizing children's assets for learning and making space for cultural and linguistic diversity, the program centers on the importance of early mathematics and science education for all children. The overarching goal of the program is to improve early mathematics education across the state.

A COLLABORATIVE EFFORT

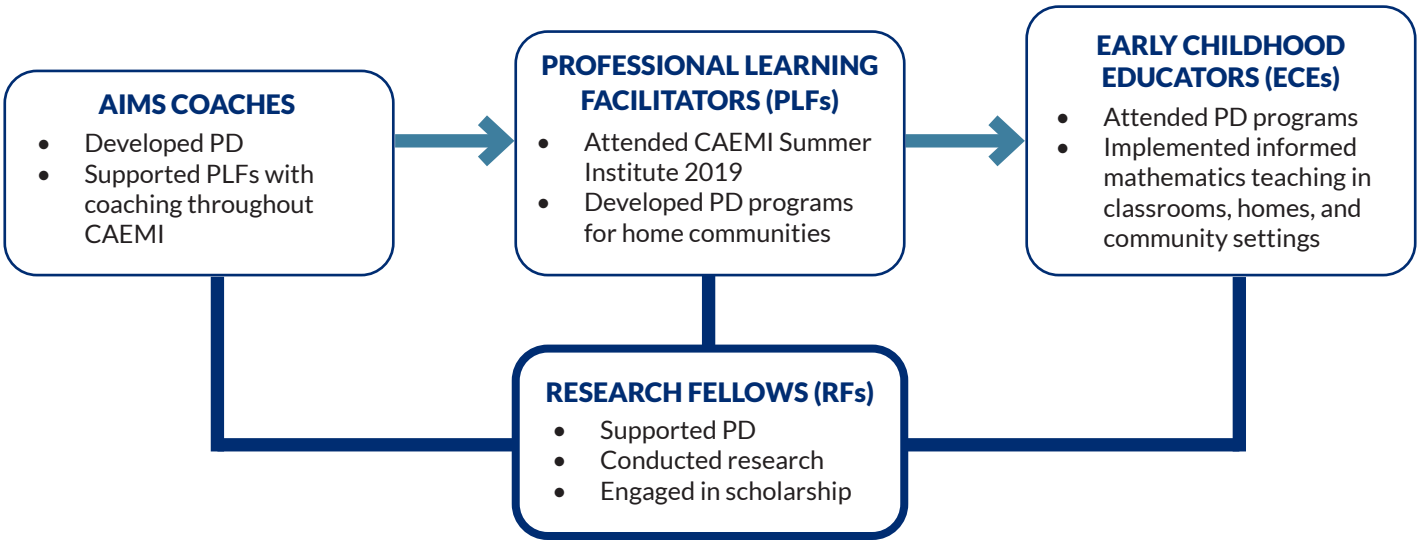
The professional development and coaching components of CAEMI are a collaborative effort between a variety of stakeholders across California. Below are descriptions of the groups involved:

AIMS COACHES: A group of five individuals from the AIMS Center who specialized in mathematics and science education. They helped develop the PD for the initiative and provided ongoing coaching to the directors, coordinators, and teacher leaders in early childhood education settings.

RESEARCH FELLOWS (RFs): A group of five doctoral students from 3 different research universities in California. The RFs supported AIMS with developing and facilitating the PD for the initiative, conducted research, and engaged in scholarship through conference presentations and publications.

PROFESSIONAL LEARNING FACILITATORS (PLFS): A group of 100 directors, coordinators, and teacher leaders in early childhood education settings across California. These individuals worked directly with the AIMS Coaches and RFs as they attended the CAEMI summer institute and developed PD programs to implement in their home communities.

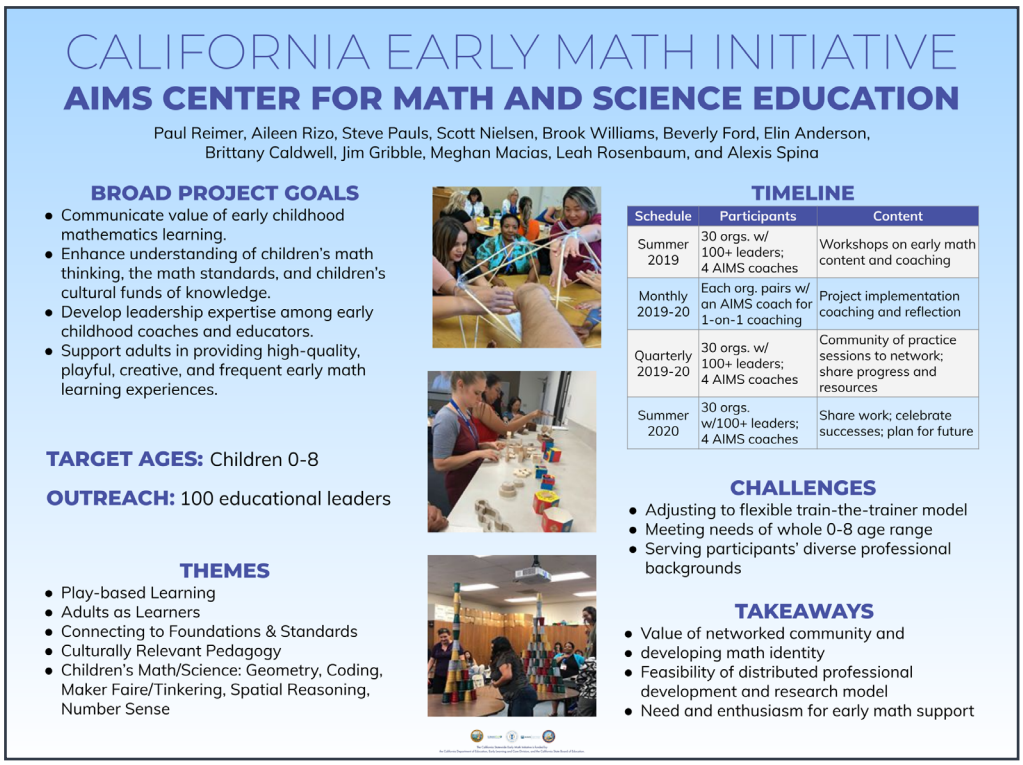
EARLY CHILDHOOD EDUCATORS (ECEs): Practitioners across California that received PD from the PLFs and worked directly with children and families to implement informed mathematics education.



Throughout the early phases of CAEMI, AIMS collaborated with a group of Research Fellows (RFs) to aid in the development and explore the impact of the initiative. Although each of the RFs studied and specialized in unique areas, all of the RFs shared a common interest in supporting mathematics and science education for young children. This summary overviews the contributions of the RFs to the professional development aspects of CAEMI, outlines the research that was conducted, and identifies the scholarship of this group through the dissemination of presentations and journal articles.

PROFESSIONAL DEVELOPMENT

Related to professional development, the RFs were involved with the creation and facilitation of the CAEMI summer institute, worked closely with AIMS coaches, and supported focal groups of participants. During the development phase of the CAEMI summer institute, RFs assisted AIMS with brainstorming session topics, structuring the institute, and creating sessions specifically related to individual expertise of the RFs. For example, one RF specialized in computer coding in their doctoral program and used this to create a breakout session that centered on robot coding with children. Another RF studied early mathematics with diverse populations and drew on this expertise to co-design and facilitate a breakout session on culturally responsive mathematics teaching centered on everyday mathematical practices in community settings.



CALIFORNIA EARLY MATH INITIATIVE

AIMS CENTER FOR MATH AND SCIENCE EDUCATION

Paul Reimer, Aileen Rizo, Steve Pauls, Scott Nielsen, Brook Williams, Beverly Ford, Elin Anderson, Brittany Caldwell, Jim Gribble, Meghan Macias, Leah Rosenbaum, and Alexis Spina

BROAD PROJECT GOALS

- Communicate value of early childhood mathematics learning.
- Enhance understanding of children's math thinking, the math standards, and children's cultural funds of knowledge.
- Develop leadership expertise among early childhood coaches and educators.
- Support adults in providing high-quality, playful, creative, and frequent early math learning experiences.

TARGET AGES: Children 0-8

OUTREACH: 100 educational leaders

THEMES

- Play-based Learning
- Adults as Learners
- Connecting to Foundations & Standards
- Culturally Relevant Pedagogy
- Children's Math/Science: Geometry, Coding, Maker Faire/Tinkering, Spatial Reasoning, Number Sense

TIMELINE

Schedule	Participants	Content
Summer 2019	30 orgs. w/ 100+ leaders; 4 AIMS coaches	Workshops on early math content and coaching
Monthly 2019-20	Each org. pairs w/ an AIMS coach for 1-on-1 coaching	Project implementation coaching and reflection
Quarterly 2019-20	30 orgs. w/ 100+ leaders; 4 AIMS coaches	Community of practice sessions to network; share progress and resources
Summer 2020	30 orgs. w/100+ leaders; 4 AIMS coaches	Share work; celebrate successes; plan for future

CHALLENGES

- Adjusting to flexible train-the-trainer model
- Meeting needs of whole 0-8 age range
- Serving participants' diverse professional backgrounds

TAKEAWAYS

- Value of networked community and developing math identity
- Feasibility of distributed professional development and research model
- Need and enthusiasm for early math support

The RFs each facilitated breakout sessions during the summer institute. These sessions included robot coding, embodied geometry, science practices, culturally responsive teaching, and children's mathematics thinking/number progressions. Additionally, the RFs worked closely with AIMS coaches throughout the initiative as the coaches provided ongoing support to participants.

Each RF worked with a focal group of participants from areas across the state. Drawing on individual expertise and interests, the RFs were involved in both the overarching vision for the professional development and in more focused ways with facilitating workshops and working with the different groups involved with the initiative. Their involvement with the professional development linked relevant research from the university with the practical application of supporting individuals working with children across California.

RESEARCH

A major contribution from the RFs was adding a research element to the initiative. This involved collaborations between AIMS and the RFs to develop and carry out the research agenda. The RFs conducted an overarching study of CAEMI through the lens of implementation across focal groups as well as smaller studies carried out by individuals and smaller groups of RFs. The overarching study explored the ways the focal groups drew on the themes from the CAEMI summer institute to develop and carry out their own professional development programs with their home communities. To collect data for this study, RFs conducted focus group interviews, observations (summer institute, community of practice meetings, coaching sessions, and the professional development sessions given by the PLFs), and interviews of AIMS coaches. Other studies conducted as a part of this initiative included an exploration of robot block-based coding in preschool settings and a study on leveraging equitable teaching practices to support early mathematics in Head Start preschools.

Research fellow Leah Rosenbaum designed interactive exhibits such as this wind tunnel for family engagement at the Lighthouse for Children Child Development Center.

While other evaluators explored the effectiveness of the CAEMI institute, the RFs offered a research perspective that both aligned with and contributed to the current field of mathematics and science education. From these studies, the RFs wrote a set of journal articles and practitioner articles and shared this work at various conferences and university research days. These works are described in more detail in the following section.

SCHOLARSHIP

The RFs collaborated on many conference presentations, university-based research day presentations, journal articles and practitioner pieces. An in person presentation was given at the Erikson Institute Promising Math Conference in 2019. Papers were accepted to present at American Educational Research Association's (AERA) Annual Conference 2020 and at the Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020, although these conferences were cancelled due to COVID-19. Similarly, an accepted presentation at the Psychology of Mathematics Education, North American Chapter (PME-NA) 42nd Annual Conference 2020 was postponed and reformatted to an online conference. The works of the RFs were also accepted at university-based research day conferences at both University of California, Santa Barbara and University of California, Berkeley.

In addition to presentations, the works of the RFs have been published in conference proceedings (PME-NA and ICLS). One paper is undergoing revisions for a publication in a practitioner journal, Science and Children. There are also other papers in progress that will be submitted for review to journals such as Mathematics Teacher Educator and American Educational Research Journal (AERJ). For a full list of accepted papers, presentations and works-in-progress, please see the last page of this document.

FINAL REFLECTIONS

This summary overviews the contributions of the RFs to CAEMI through their involvement with the PD, research, and scholarship. In many ways CAEMI also created opportunities for the RFs to utilize their connections to research universities, draw on their expertise from their doctoral studies, and develop as emerging scholars. One RF reflected:

> *I have two major takeaways from this project. First, this is a great opportunity to develop my research skills and highlight them. All the researchers have something to bring to the table and I feel that our expertise was aligned but different enough that we could all contribute. Second, the overall feel of the relationship with everyone (researchers, AIMS coaches, and those we met through the institute) is amazing. [...] I see lifelong connections being formed and I am happy to be a part of it.*
>
> *(AIMS Research Fellow Survey Response, 2020).*

The collaboration between the RFs, AIMS, and the other partner organizations involved with CAEMI fostered new professional relationships and opened many doors for new research. The CAEMI project brought together organizations and the RFs in ways that were new and meaningful that fostered collaboration and growth for everyone involved.

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PAPERS AND PRESENTATIONS

ACCEPTED

Caldwell, B., Gribble, J., Macias, M., Reimer, P. N., Rosenbaum, L. F., & Spina, A. (2019, November). *Fostering responsive, play-based learning as part of California's Statewide Early Math Initiative*. Promising Math 2019: Early Math Learning in Family and Community Contexts. Chicago, IL.

Gribble J., Reimer, P., Rizo, A., Pauls, S., Caldwell, B., Macias, M., Spina, A., Rosenbaum, A. (2020). Robot block-based coding in preschool. In M. Gresalfi & I.S. Horn, (Eds.), *The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020, Volume 4* (pp. 2229-2232). Nashville, Tennessee: International Society of the Learning Sciences.

Macias, M., Spina, A., & Reimer, P. N. (2020). How facilitators define, design, and implement effective early childhood mathematics professional development. In A.I. Sacristán, J.C. Cortés-Zavala & P.M. Ruiz-Arias, (Eds.). *Mathematics Education Across Cultures: Proceedings of the 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Mexico* (pp. 1890-1894). Cinvestav / AMIUTEM / PME-NA.

Macias, M., Spina, A., Rosenbaum, L. F., Caldwell, B., Gribble, J., & Reimer, P. N. (2020, May). *Professional development aligned with leaders' goals in early childhood STEM education: A collaboration between researchers and practitioners.* Building Interdisciplinary Community: GGSE Research Symposium. UC Santa Barbara, Santa Barbara, CA.

Reimer, P. N., Rizo, A., & Pauls, S. (2021, June). *Remote engagement in early mathematics professional development: Using tangible artifacts to mediate participation.* Poster to be presented at 42nd Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Mexico.

Rosenbaum, L. F., Caldwell, B., Gribble, J., Macias, M., Spina, A., & Reimer, P. N., (2020). *Efforts to support and study early math professional development through a research-practice partnership*. Poster presented at the 2020 Research Day Conference. Berkeley, CA. *Conference cancelled due to COVID-19 pandemic.

Spina, A. D., Macias, M., Rosenbaum, L., Gribble, J., Caldwell, B. & Reimer, P.N. (2020, April). *Professional development for leaders in early childhood STEM education: A collaboration between researchers and practitioners* [Paper Session]. AERA Annual Meeting San Francisco, CA http://tinyurl.com/v8hcw37 *Conference cancelled due to COVID-19 pandemic.

IN-PROGRESS

Caldwell, B. (In Progress) Leveraging Practices from a State-Wide Mathematics Initiative to Support Equitable Teaching in Head Start. To be submitted to Mathematics Teacher Educator.

Caldwell, B., Gribble, J., Macias, M., Reimer, P. N., Rosenbaum, L. F., & Spina, A. (In Progress) Implementing Mathematics Professional Development for Early Childhood Educators: Strengths and Challenges Across California's Diverse Programs and Contexts. To be submitted to American Educational Research Journal.