



Early Wins and Lessons Learned: How the Bay Area STEM Ecosystem Engages Families

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Supporting families to find, access, and benefit from informal STEM activities is no easy task. It's typically not a straightforward case of "If you build it, they will come." There are simply too many barriers for too many families.

Success in designing and implementing informal STEM programs requires intentionality, a willingness to listen to families in your community, and a growth mindset for revising when you don't get it right the first time.

In this case study we highlight the work of [the Bay Area STEM Ecosystem](#), which aims to increase equity and access to STEM learning opportunities in underserved communities. First, we lay out the problems they are trying to solve and give a high level overview of the Bay Area STEM Ecosystem's approach to addressing them. Then, based on field observations and interviews, we highlight both the successes and some missed opportunities from the first collaborative program of this Ecosystem. Both the successes of The Bay Area STEM Ecosystem- as well as the partners' willingness to share and examine where they have room for refinements - illustrate the exemplary practice, leadership, and growth mindset of this group.

Barriers to Family Success in Informal STEM

Finding Programs

With the variety of STEM opportunities available in many communities, it can be deceptively easy to believe that all families need to do is find them. Actually, it's not always so simple.

It can be especially difficult for parents who aren't tech savvy or who have limited experience with computer searches to find family-focused STEM opportunities. Searching for STEM programs online is complicated by the fact that there are so many possible terms and a lot of jargon for STEM.¹ Consider, for instance, the acronym STEM! The title of this paper uses this phrase, but this vocabulary is a type of "insider knowledge" that creates an invisible barrier for families who aren't in STEM. In a survey by the Bay Area STEM Ecosystem, of more than 400 community members, 80% did not know the term STEM.

While there are efforts like [The Connector](#), [TechPrep](#) and [Code.org](#) that try to help families find STEM programs in their community, many families are not aware of the sites or are not looking for resources online. There is also a continuing digital divide in California, with Latinx and low-income households substantially less likely to have broadband access or a computer at home.²

Not being connected to networks—both real and virtual—that promote STEM opportunities can limit families' access and ability to apply to them.³ For example, not all families are plugged into a network of friends who could alert them to programs in the community that they would enjoy. Other families may not know anyone in their community who works in the STEM fields.

Some families might not take advantage of STEM programs even if they know about them. There are plenty of factors that can limit their access.

Even after finding available opportunities, it may be difficult for families to choose a STEM program that is a good fit. Here are some factors parents are considering: Which coding camp will be most welcoming for beginners? Which program will be girl-friendly and turn girls on to computer science? Will content be relevant to youth of color? Will a Black or Latinx child be the only one in the course, or will they be in a community of peers?

There are many other factors that create barriers for families such as: costs to participate; transportation; language; and registration challenges, including a shortage of spots that requires parents to be ready to sign up the instant that registration opens.

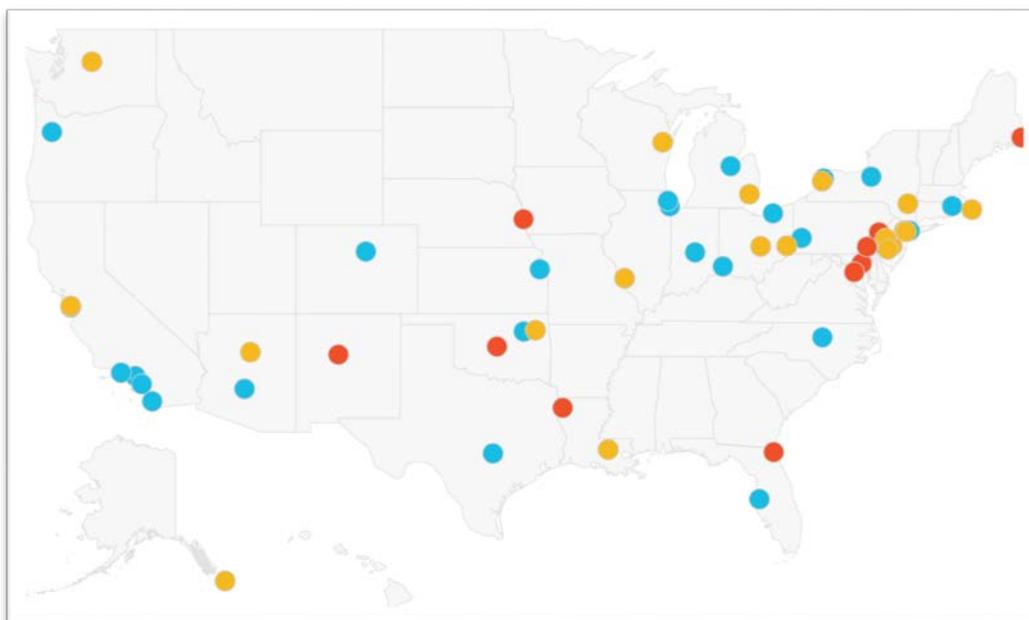
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The Solution – An Ecosystem Approach

STEM Ecosystems Overview

STEM Ecosystems are trying to make it easier for families to learn about and access STEM opportunities. In 56 communities across the country, cross-sector collaborations are creating connected STEM-rich learning opportunities for families from preschool through higher education and into the workforce.



STEM Learning Ecosystem Communities

STEM Ecosystem collaborations support engagement at the local level, both in schools and beyond the classroom at libraries, museums, community centers, afterschool organizations, college campuses and corporations. The ecosystems leverage resources, share STEM goals, and broaden the reach of their STEM outreach with youth and adults. Technical assistance and coaching, along with peer-to-peer learning, keep these ecosystems moving forward to learn and grow together.

So, what's this work look like on the ground? How can organizations come together for the good of families? And how are ecosystems improving over time? Here's how one community took on this challenge.

The Study

The Bay Area STEM Ecosystem is made up of a cross-sector network that includes non-profit education institutions, a school district, after-school groups, a city government, corporations, science museums, foundations, and evaluation firms. When we began our field observations and interviews as part of STEM Next Opportunity Fund's Family Engagement Initiative, members of the Bay Area STEM Ecosystem had been working together for over a year.

In spring 2017, the Ecosystem team held a community listening campaign, coordinated by Americorp staff, that gathered feedback from more than 400 community members, including students, parents and teachers. The team also conducted interviews with cross-sector partners to learn about what partners value about the Ecosystem and how this collaborative work could help support individual institutional goals.

Family engagement emerged out of this listening campaign as a priority. In particular, the Ecosystem heard that parents don't understand what STEM education is, parents feel disconnected from what their children are learning in school, and parents are unsure of their children's potential STEM path or ability to access STEM careers. At the same time, they heard that members of the Ecosystem have great interest in addressing issues of equity and access to STEM learning through the lens of family engagement.

As one of their first actionable goals, the Ecosystem chose to complement other STEM education efforts in the region and support a summer STEM series to meet the need for high-quality, engaging STEM programs in South San Francisco. The series was advertised for families with children ages 3-13 years. Thirteen groups stepped up, designed, and hosted two-hour sessions for kids and families on consecutive Saturday mornings. The groups were varied, including representation from the nonprofit, museum, corporate, private school, and STEM professional outreach groups, along with nontraditional groups including fire and police departments.

Over 700 youth and caregivers participated in the STEM summer series with an average of 70 people attending each of the 10 sessions and with 44% repeat attendees. Americorp staff tracked and confirmed that the demographics of attendees represented the ethnic makeup of South San Francisco and 30% of the youth qualified for free or reduced lunch.

We share some of the Bay Area STEM Ecosystem experiences—successes and challenges—to shed light on the work of collaboration and collective impact of STEM ecosystems.

Notable Wins

Listening. The Bay Area STEM Ecosystem approach is notable for beginning its design phase by asking families about their experiences, knowledge, and needs. Identifying potential beneficiaries within communities, listening to them, and focusing on the demands of those most likely to participate laid a strong foundation for a successful program adoption.⁴ Listening to Ecosystem partners was also a crucial first step to building a shared sense of ownership for the partnership.

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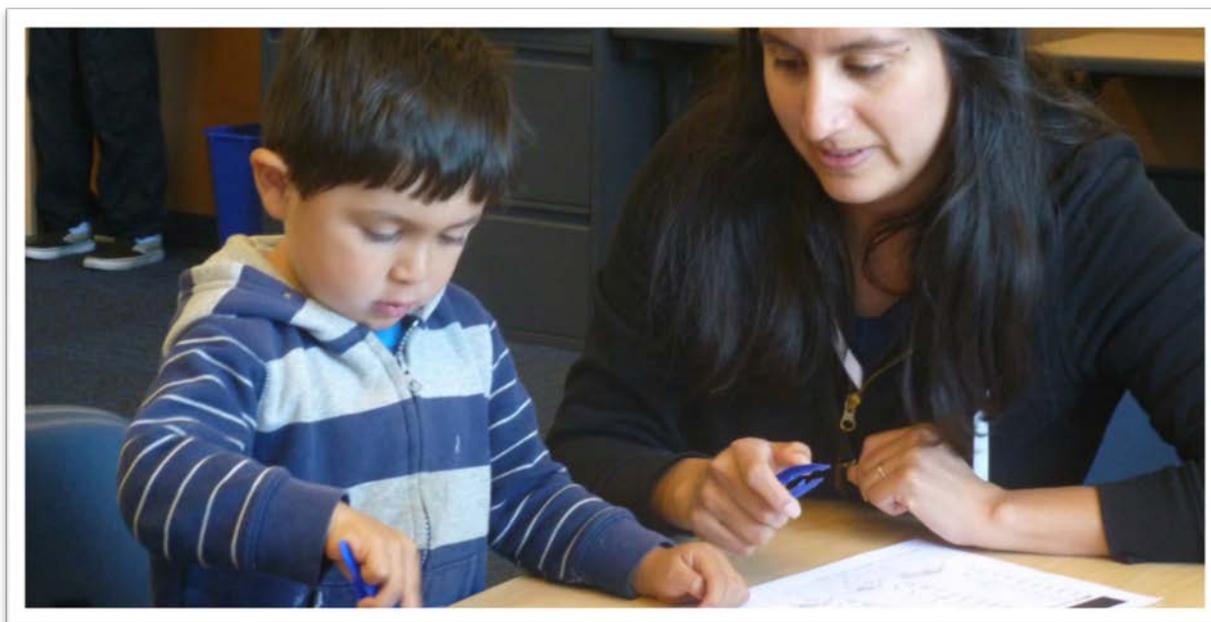


Photo Credit: Bay Area STEM Ecosystem

Collective outreach. This summer series really did take a village to support its success. Neighborhood schools, summer camps, and libraries helped market through flyers, handouts, and social media, thereby extending the reach that any one of the partners would have had.

Free programming. As part of their mission to serve more families who hadn't yet been supported with STEM programs, partners donated time and resources so that the program was free to families.

Dedicated "backbone" coordination. Dedicated management staff provided leadership and oversight that was critical to the successful implementation of the free resources. With support from the [Broadcom Foundation](#), the Bay Area STEM Ecosystem team includes an Ecosystem Lead who plans with and supports the partners, and handles the logistical and administrative details needed for the programs to function smoothly and effectively.

Consistency in location. Rather than ask parents to go to 10 different locations, the Ecosystem made a strategic decision to host the summer series at one centrally located and easily accessible place in the community. The host site, the Community Learning Center in South San Francisco, is a trusted resource for family support and community building that offers after school programs, homework help, parenting classes, and English language classes. Given the level of participation, including repeat attendance, the choice of location clearly made it easier for families.

Flexible age groups. A father shared, "I can bring both kids to the same program." For parents who often juggle competing activities on the weekends, a program that is open-ended for kids ages 3-13 allows the entire family to spend time together. An added benefit is that the entire family could talk about and continue these shared experiences afterwards.

Variety of role models. The program drew from so many organizations across the community so that kids and parents were introduced to many diverse role models, including teens, college students, STEM

professionals, and educators who shared their passion for STEM. These role models showed by their example how age, race, socio-economics, and gender need not limit one's options. This was responsive to a desire expressed by families who felt unsure of their children's potential path or ability to access STEM careers.

Gender unbiasing. There is a gender gap in many summer tech and engineering programs, in large part due to cultural stereotypes.⁵ Sometimes, stereotypes influence parents to believe that their sons are more interested in STEM than their daughters. Sometimes it's because boys ask to attend camps that have historically been designed for and marketed to boys. However, since families came to the series, many daughters were exposed to all the STEM projects. This gave girls and their families the chance to discover they enjoyed STEM, including computer science and engineering activities. In some cases, we observed girls who initially were reluctant to engage overcome their hesitation when they saw a roomful of kids jumping in and having fun.



Photo Credit: Bay Area STEM Ecosystem

All hands on deck. Parents had to put down their cell phones and engage with their kids. For instance, making an LED sock puppet and DNA bracelets and other activities like sewing which required fine-hand coordination nudged parents to get involved and support their child. In some sessions, staff encouraged parents as they arrived to play an active role in the STEM activity with their child. This active encouragement and clarity of expectations was especially helpful with parents who may otherwise have been inclined to watch their child from the sidelines.

The value of volunteers. Volunteers' support for families was essential and multifaceted--guiding them to stations, answering questions, and offering encouragement. Volunteers also benefited. For instance, a parent of a teen volunteer panicked when she was assigned to support a coding activity. She tried to get reassigned to the arts-and-crafts station. When that didn't happen, she hunkered down and did what other families would be asked to do--follow instructions and ask for help. After some trial and error, she mastered the coding activity and felt a sense of accomplishment and confidence. This volunteer even enrolled later in

an [educator workshop at the Computer History Museum](#) to learn computer science activities to bring back to her students in special education.

Challenges and Lessons to Learn

Despite significant wins, the Bay Area STEM Ecosystem had its share of struggles and missed opportunities. The Ecosystem is moving forward to review the summer series and refine the next iteration of programs. By being transparent about lessons learned, the Ecosystem hopes to improve its own practices while also helping to advance the field.

Plan Strategically

Challenge: The abundance of partners offered many resources but the groups were not all on the same page about the exact purpose of the series or the strategies to get there. This lack of clarity around a common agenda showed up in small but important ways. For instance, while some partners supported open-ended explorations, others led prescriptive step-by-step activities with limited opportunities for inquiry or the engineering design process.

Lesson Learned: As partnerships evolve, organizations can strive to move from loosely connected collaboration towards collective impact.⁶ To do so, they need to agree on goals and strategies that allow them to develop a shared measurement system and mutually reinforcing activities. By doing this work in advance, the partners could have collectively decided to use inquiry and the engineering design process to improve families' understanding of what STEM is, the value of STEM careers, and how both formal and informal STEM exploration can lead to STEM careers.

Evaluate early and often

Challenge: It can be difficult to figure out what to measure and how to use data in a collaborative project. The Ecosystem hasn't yet fully developed a shared measurement system for collecting data and holding partners accountable.⁷ However, shared measurement across activities is essential to align activities, track progress towards goals, and learn for continuous improvement. As the series progressed, the Ecosystem Lead began to offer informal feedback by emailing and talking with the partner groups. However, there was variability in how this input was received and incorporated into partners' sessions.

Lesson Learned: At a minimum, we recommend setting up the expectation from the start that standardized debriefs will follow sessions. Common guiding questions can generate data useful for reflection and program refinement. Questions could include: What went well? What was challenging? If you had a do-over, what would you change? What do you wish you knew in advance? What advice would you offer the group leading upcoming sessions?

As partnerships evolve, organizations can strive to move from loosely connected collaboration towards collective impact adoption.





Ideally, collaborative STEM efforts should take a developmental evaluation approach with an evaluation team to help guide early program development and implementation processes - not just outcomes.⁸ Like the engineering design process, evaluation debriefs allow for immediate tweaks to enhance the STEM experiences of families and partners. When it feels uncomfortable, we can remind ourselves that feedback is a gift and move with it.

Be explicit about family engagement

Missed Opportunity: The Summer STEM program flyer described “free drop-in STEM activities for families with youth 3-13 years old, *accompanied by an adult.*” The flyer included photos of children doing STEM but not families. Parents varied in their level of participation in activities. Some partners and volunteers told parents as they arrived that their help was needed, but most didn’t.

Lesson learned: In the future, be explicit and intentional—both with words and photos—that the program is *for families.*

Provide parent education

Missed Opportunity: The Ecosystem could have been more intentional about encouraging partners to offer tips to parents on how to best support their kids in STEM. In one design challenge, a mom and dad were so invested in their own work and so competitive that their daughter was on the sidelines asking what she could do. In another exchange a mother asked her daughter not to ask her questions so they could finish their project. And in another example, a father’s expertise in science made him overly directive and focused on doing science the “right way” and as a result his daughter had less opportunity to think for herself.

Lesson Learned: Anticipate that parents need to be supported in how to model growth mindset behavior that promotes engagement and inquiry.⁹ This involves helping parents understand that intelligence is malleable and that effort and understanding are important. Give parents a handout of questions and phrases that they can use during program activities and at home. For example, a question like “What do you

think will happen?” and a comment like “When you learn how to do a new kind of problem, it helps your brain grow.” encourage youth to reflect on and predict what will happen in their investigations and to persist when things don’t go as planned the first time. And, we would encourage staff and volunteers to look for opportunities to reinforce the positive ways in which parents engage with their children.

Support families to continue learning at home

Missed Opportunity: When a mother saw how interested her daughter was in extracting DNA from a strawberry, she asked for the recipe. It’s great to see parents thinking about how they can follow up and continue the learning. This mother was told to look online and that there are lots of recipes to be found by searching.

Lesson Learned: Prepare handouts ahead of time with take-home activities for families to repeat and reinforce the STEM they started in a program. A one-page flyer could provide the message, “If you like extracting DNA from a strawberry, here’s the lesson to repeat at home. And, here’s an extension with a lesson where you can extract DNA from kiwis and bananas.” When preparing the handout, make sure it is translated into languages spoken in the home and include information about upcoming STEM Ecosystem opportunities or let parents know where they can get more information about your organization.

Take Action

- Start all your family engagement work by getting input from families and other partners. Commit to devoting resources and prioritizing this effort.
- Lay the foundation for impactful collaborative work by facilitating discussion from the very beginning about shared goals.
- Apply a [human-centered design process](#) to develop family engagement work in your ecosystem: Listen, ideate, design, gather real-time feedback, refine.

We are planning more case studies of groups engaged in family engagement—including museums, nonprofits, and funders. With your feedback, we hope to provide case studies and additional projects that lift up promising practices, provoke debate, and generate new goals to move the work along. Send us your comments and questions at info@stemnext.org.



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We would like to thank Emily Dilger of the Bay Area STEM Ecosystem and Katie Levedahl of the California Academy of Sciences for their input on this case study as well as their leadership in the summer STEM series. Their graceful leadership helped guide the partners in the Bay Area STEM Ecosystem, moving the work and the many decisions along without overwhelming partners, and framing issues as opportunities and lessons learned. We also thank Cary Sneider of Portland State University and Alex Zwissler of Einstellung Labs for their review and suggestions on this case study.

References

1. DiSalvo B., Reid, C., & Roshan, P.K. (2014). They Can't Find Us: The Search for Informal CS Education. Special Interest Group on Computer Science Education (SIGCSE), 487-492.
2. DiCamillo, M. (2017). Release #2017-12: Disparities Persist in Californians' Access to Broadband Internet at Home.
3. DiSalvo, B., Khanipour Roshan, P., & Morrison, B. (2016). Information Seeking Practices of Parents: Exploring Skills, Face Threats and Social Networks.
4. Hussein, T., & Plummer, M. (Winter, 2017). Selling Social Change. Stanford Social Innovation Review.
5. Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2016). Why Are Some STEM Fields More Gender Balanced Than Others? Psychological Bulletin.
6. Hanleybrown, F., Kania, J., & Kramer, M. (2012). Channeling Change: Making Collective Impact Work. Stanford Social Innovation Review.
7. Kania, J., & Kramer, M. (Winter, 2011). Collective Impact. Stanford Social Innovation Review.
8. Levin, R., & Preskill, H. (2017). Strengthening a Struggling Collaboration through Evaluation: Lessons from the Robert R. McCormick Foundation. FSG.
9. Edutopia. (2016). Resources for Teaching Growth Mindset.