STEMCC Partnership Toolkit

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LEARNING ABOUT YOUR STEM ECOSYSTEM

PRACTICE BRIEF 1

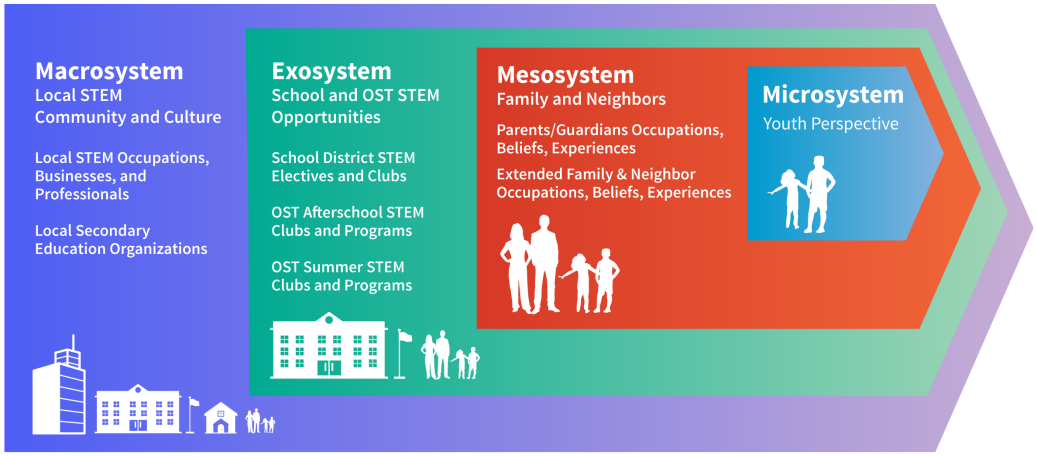
STEM CAREER CONNECTIONS

Action Steps:

- Create a community asset map to explore your STEM ecosystem.
- Make a list to track STEM opportunities already present in your community.
- Identify the strengths of current STEM offerings, and look for gaps that could lead to new opportunities.

An "ecosystem" is a useful metaphor to describe the groupings of STEM learning opportunities. Using an ecological perspective allows us to position different learning environments in relation to each other (see Figure 1) and better support youth as they move through this dynamic system. A STEM learning ecosystem comprises diverse resources within a community— beyond what the school provides. Youth develop an understanding of STEM interests and participation pathways while traversing the STEM learning ecosystem.

STEM Ecosystem



A STEM ecosystem comprises four layers. At the center is the youth perspective of STEM - the Microsystem level. The STEM knowledge and experience shared by youths' family, friends, and direct community comprise the Mesosystem level. The larger Exosystem layer encompasses the educational setting where youth engage with STEM, such as their school and after-school or summer programs. The outer Macrosystem layer holds the larger STEM community (e.g., STEM businesses, secondary educational institutions, and local STEM culture). The youth is served through all layers of the ecosystem.

Strategies to Make it Happen:

Discover Your STEM Ecosystem

A STEM learning ecosystem encompasses schools, out-of-school time (OST) community organizations (such as after-school and summer programs, libraries, science centers and museums), informal STEM experiences at home, and professional STEM environments (such as local businesses) that are the sources of STEM learning opportunities for youth. By coordinating with people and organizations across your STEM ecosystem you can create pathways to diverse STEM settings. These pathways enable young learners to

[1]Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective.

become engaged, knowledgeable, and competent in STEM disciplines as they progress toward their life and career goals[2,3].

Identify the Strengths and Opportunities for STEM Learning Available in Your Community

Help strengthen the STEM pathways for youth by first identifying **what** key opportunities there are for STEM learning in your community, along with **who** is involved, **when** they are offered, and **why** those opportunities are valued. A good first step is to survey the landscape and identify what partnerships and programs are already in place. Learn about the work currently underway by entities in your community to ensure that you are not duplicating efforts, but instead supporting or expanding those efforts.

It is also important to learn about the history and nuanced relationships of current and past partnerships between schools and other members of the STEM ecosystem. Have there been changes to otherwise successful STEM programs due to shifting priorities, funding, or leadership? Are there opportunities to revitalize programs or fill gaps in your project? If you are a STEM program provider or researcher, learn all you can by engaging with different levels at the school district (i.e., central administration, building administration, teachers). If you are a science coordinator, learn about the outreach goals of entities within your STEM ecosystem. Be on the lookout for opportunities to make connections and have discussions about mutually beneficial partnerships.

Consider the following:

What are the STEM learning opportunities available in your community?

- Learn about the formal STEM classes and after-school or community events available at all age levels.
- Search community calendars for classes, workshops, or festivals focusing on STEM, keeping in mind that STEM may be offered by various entities, including: libraries, community centers, governmental agencies, non-profit organizations, and businesses.
- Consider online STEM offerings, such as STEM-oriented podcasts, apps, or social media that may be popular in the community.

Who supports the STEM learning opportunities and how are they involved?

- What businesses with a STEM focus engage in outreach with the local schools or community? How are they involved?
- What businesses with a STEM focus are not currently engaging in outreach that could be potential new partners?

When have these STEM learning opportunities been offered?

- Understand the scheduling constraints and opportunities STEM providers are working under. For example, schools offer STEM primarily during the school year. Some providers focus on times when families are more available, such as during school breaks.
- Note any opportunities that were offered in the past but are no longer available. This will help you understand what makes existing STEM work successful and where there are barriers.

Why is this entity offering STEM learning?

- Review "about" sections of websites and mission statements to better understand goals.
- Consider whether there are requirements from funders or sponsors that might influence the scope of STEM programming being offered.
- Identify how youth benefit from these offerings.

[2]Dierking, L., Falk, J. H., Shaby, N., & Staus, N. L. (2021). Thriving STEM learning ecosystems—for all. *Connected Science Learning*, 3(6).
[3]Shaby, N., Staus, N., Dierking, L. D., & Falk, J. H. (2021). Pathways of interest and participation: How STEM-interested youth navigate a learning ecosystem. *Science Education*, 105(4), 628-652.

Remember that relationship-building will be an ongoing process and that people can sometimes be complex. Embrace the challenges and look for opportunities to build on and make connections between the existing STEM program offerings and partnerships. Identify ways your project or program can become something of value to both the partner and the youth your program serves. For example, your project could help connect a local business to youth by developing a STEM mentoring program. Even after your work is underway, be open to inviting new organizations and individuals to get involved and find room for them to add their unique offerings to the goals of your partnership.

Tool: Community Asset Mapping
The Community Asset Mapping facilitator guide provides step-by-step instructions and examples for creating a local asset map representing different aspects of STEM in your community.

Tool: STEM Learning Providers in my Community
Use this table to keep track of STEM learning opportunities already present in your community and to help identify gaps.

STEM Career Connections Spotlight:

Discovering the STEM Ecosystem as an Outsider

In our project, discovering the STEM learning ecosystem was an ongoing process. As outsiders to this rural community, we relied upon the initial partners to introduce us to the organizations and people that are most influential within the STEM ecosystem. We initially partnered with the local school district. One of our participating STEM teachers introduced us to a local organization that provides after-school STEM programs. We quickly realized that our goals aligned with this organization and a new partnership developed - we wanted to bring rich STEM programs and computing technology to underserved youth in the community and they wanted to use STEM experiences to develop environmental stewards within their community. We provided professional development for their education staff to implement sensor technology in their after-school programs, along with sensor technology equipment and ongoing teacher support during implementation. Our team also worked closely with the STEM coordinator to design a unit to help youth address a local engineering problem. Furthermore, the relationships between this well established local organization and the community helped us access other parts of the STEM ecosystem, which resulted in partnerships with STEM mentors who worked closely with youth on STEM projects. By discovering this local organization, we were able to develop a rich Community STEM education partnership (CSEP) and gain access to the STEM learning ecosystem.

Reflection Questions

- In what ways will knowledge of your STEM Ecosystem support your efforts to build community partnerships?
- What other information could you collect to help you understand the experiences of youth as they navigate STEM learning opportunities in your community?

Next Steps

Practice Brief 2 - Laying the Foundation for Community STEM Education Partnerships

LAYING THE FOUNDATION FOR COMMUNITY STEM EDUCATION PARTNERSHIPS

PRACTICE BRIEF 2

STEM CAREER CONNECTIONS

Action Steps:

- Create a flier summarizing your project goals.
- Identify the key organizations involved with STEM in your community and contact them.
- Prepare for initial meetings with potential partners using an agenda-building template.

Partnerships with entities that complement the skills, expertise, and energy of your project are key to creating rich STEM experiences for youth. It is important to prepare how you will communicate about your project before contacting potential community partners. Most importantly, remember that building partnerships is about relationships and relational connections between entities.

Strategies to Make it Happen:

Define Your Project Goals

Before you reach out to potential partners, you will want to come up with concise wording to communicate your project goals. Keep your audiences and the preexisting relationships in your target community in mind as you define your key talking points. Creating a flier that describes and communicates your intentions can help facilitate your initial meetings with potential partners. Share this flier when you first reach out to potential partners to give them a well-crafted introduction to your project.

Tool: Creating an Introductory Flier

Summarize what you can offer to your STEM learning ecosystem as a concise, one-page flier. Use this flier to introduce your project to a particular audience (i.e., potential partners, collaborators, researchers, policymakers, or families).

Identify Key Players in the Community

How do you identify which community members to reach out to? While you can certainly start by cold calling or emailing local businesses and organizations that work in science, technology, engineering, and math fields (think about who you identified as part of the STEM Ecosystem from Practice Brief 1), in our experience, you will have more success building upon relationships that already exist between STEM program providers and the community.

Enlist others to help identify potential community STEM education partnerships (CSEPs)[1] and plan for a broad initial reach. Find out from STEM educators or the local school district what organizations or individuals already engage in STEM-related community outreach, such as school field trips, guest speaking, internships, or STEM/job fair participation. Ask about sponsors, businesses, and local government organizations that have a presence in the school community. Reach out to organizations and individuals

[1]Community STEM education partnerships (CSEPs) are long-term collaborations between organizations and project participants that coordinate and leverage expertise and resources to improve STEM learning opportunities for youth.

with whom STEM educators have already had positive outreach experiences. Don't be afraid to ask school leadership to make the first introductions between your project team and contacts they have worked with successfully before.

The table below shows examples of entities where you might find people with STEM careers (engineers, scientists, technicians, etc.). Consider reaching out to service-providing organizations like these in your community.

ENTITIES WHERE YOU MIGHT FIND STEM CAREERS	
Education and community-focused organizations	• Libraries • Science Centers • Offices in charge of environmental programs and initiatives • Community College, University, or extension offices
Local, state, regional, and federal agencies	• State Parks • Fire department • Department of Transportation • Local environmental stewardship, sustainability organizations • United States Forest Service • Utility companies • Department of Wildlife • Water and wastewater services
Local Government Organizations	• River districts or agencies that do water measurement for reservoirs and streams • Environmental Health Department for the local county • Members of environmental or sustainability-focused advisory committees • Offices in charge of county environmental policy, county climate action plans, or natural disasters
Businesses	• Businesses that specialize in construction, building, architecture, or design • Graphic design or website design businesses • Businesses that have a presence in outreach or sustainability • Composting, recycling providers • Civil, environmental, and structural engineering firms • IT support or security businesses • 3D Printing and architectural modeling firms • Restoration or environmental clean-up businesses • Mining company • Medical research organizations • Solar energy company • Regional airport technicians

While it is certainly easier to approach an organization where you have a contact, do not rule out potential partnerships with new entities that could add valuable experiences for youth. If you are making a cold call, ask to be connected with anyone involved in community outreach at the organization. This is where having your introductory flier will be helpful.

In some situations you might find it useful to also build partnerships with individuals and organizations from outside the community. This can increase the reach and exposure for youth, allowing them to engage with STEM careers and opportunities that are absent from the community (for example, connecting students from an inland community to marine biologists or coastal researchers). If virtual experiences will be part of your program, activating your network from beyond the local community is a great way to expand youth experiences.

Tool: Potential Community Partner Template
Use this template to track organizations and businesses you identify as having potential alignment with your project. Keep track of who you have contacted and when to follow up.

Reach Out to STEM Related Organizations in Your Community and Invite Them to Meet with You
Contact individuals and organizations from your list of potential community partners. At this stage, the main goal is to gain an audience with them to introduce your project and look for ways that a partnership might be mutually beneficial.

Reach out to leaders at different levels. For example, speak with the central administration of a school district, as well as the building administration, teachers, subject coordinators, and career counselors. Reach out to entities across various sectors – governmental, private businesses, and non-profit organizations. Connect with community members who provide STEM learning opportunities outside of school to learn about their goals and needs.

If you don't get a response right away, don't get discouraged. Professionals are often busy, and their lack of responsiveness should not be assumed to mean a lack of interest. It's okay to 'ping' your contact, especially as project deadlines come into play.

Planning for Your Initial Meetings with Potential Partners:
Be intentional when planning the initial meeting, as it will lay the groundwork for building the partnership. When building new relationships, first take on the role of a learner. Think about information you want to gather and what questions will help you gather that information. Be prepared to provide a concise introduction to your project, paint a picture of what the youth will be doing, and offer suggestions for how this entity could be involved. Create an agenda and notes document to help facilitate your first meeting with a potential partner.

Here are a few topics to consider including in an introductory meeting with potential partners:

- Introduce your project goals and paint a picture of what the youth experience will look like.
- Inquire about the partner's involvement and interest in youth outreach and STEM in the community.
- Discuss the key strengths and opportunities for working together and look for alignments between goals.
- Provide specific information about what roles this entity might assume in a partnership with you (e.g., collaborative project partner, educator, STEM mentor, community STEM partner, etc.).
- Ask about their capacity to assist in your project so that you can determine what responsibilities they might be able to take on.
- Be clear about what you are asking them to prepare and do, and how much time you are asking them to invest. Provide a potential schedule for their participation in the project.
- Ask about ideas and needs that the partner identifies and be willing to update your plans accordingly.
- Explain how you can work with and support this partner.

By the end of the first meeting, you may or may not have a concrete way forward. In some cases, your contact may need to have internal conversations with their leadership to determine whether they can participate. Or it may not be a good time for them to participate based on current situations like staffing and workload. If you feel the partnership is worth pursuing, check in periodically and keep them informed about project work by sharing periodic newsletters (see Practice Brief 6), as interests and capacities can change over time.

Tool: Meeting Agenda Template
Use this meeting agenda template to ensure you focus the conversation on a) learning about this entity and b) uncovering potential ways to build a mutually beneficial partnership.

STEM Career Connections Spotlight:

A Service Project for the Community Garden

One of our community partners during the project was the local community garden. We met with the garden's director to identify our common goals and plan how youth could engage with the gardens. Our project aimed to introduce youth to a community problem that could be solved using programmable sensor technology. The community garden wanted to grow more food to better serve the community by providing access to local, nourishing, and sustainable food resources. We explained how youth could program sensors to help monitor conditions in the garden to satisfy the director's interest in collecting real-time data, including soil moisture, temperature, carbon dioxide (CO_2), and light levels for each garden plot. Access to this data would help them determine where to plant certain vegetables, when to water each garden bed, and where to install wind or shade structures. Youth successfully completed this service project during the summer program, collecting data and participating in garden chores during a field trip to the community garden, and then later analyzing and sharing the data they collected.

The garden director summarized the mutual benefits of this partnership, as well as the coordination required to make it successful:

> *"I think that something like this is the exact thing that needs to stick for the kids who are like, Why would I need to know that? Why would I need to know the moisture of the soil? Why would I need to know about the atmosphere? I think this was really useful in terms of making everything very practical, because it's food, it's gardening, and not just a passion. It is something people need to do…farmers can use this data. So, I feel that bringing the data into a real-world application is absolutely awesome."*

> *"The coordination with the program was huge, like figuring out the logistics of how this would work and then being able to carry that forward for other events. That was very valuable, and I am just excited to get to do it again."*

Reflection Questions

- What are your main goals for this partnership?
- How can you best communicate what your project is about?
- Who are the key people and/or organizations you should contact about joining the partnership?
- How can you best align your partner's goals with your project goals?

Next Steps

Practice Brief 3 - Building Community STEM Education Partnerships

BUILDING COMMUNITY STEM EDUCATION PARTNERSHIPS

PRACTICE BRIEF 3

STEM CAREER CONNECTIONS

Action Steps:

- Make an effort to develop mutually beneficial relationships with each partner.
- Establish communication routines and tools right away.
- Leverage existing partnerships to provide access to new potential partners.

STEM professionals have a wealth of experiences that they are often happy to share with young people. Through community STEM education partnerships (CSEPs)[1] with STEM organizations in your community, you can unleash this expertise and provide opportunities for youth to learn about STEM careers. Building meaningful relationships in any context takes time and acknowledgement of the dynamic needs of each organization.

Strategies to Make it Happen:

Invest Time and Effort to Build Real Relationships

At the heart of any strong relationship is commitment. Therefore, we have found that it is best to start small - it's worthwhile to invest time in getting to know your new partner. In building new relationships, you should take on the role of a learner. In doing so, you will likely learn about each organization's unique context, such as specific words, phrases, and acronyms used; work environment; and authority structures ranging from hierarchical structures with specific leadership roles to a single owner who can make all of the decisions.

Be mindful of how much time the partnership is requiring and acknowledge that availability can change throughout the year. Consider offering different ways for the partner to be involved that represent a range of commitment levels. For example, a quick win activity with a short-term commitment could be for STEM professionals to participate in a career fair or share about their careers in a STEM class. Another activity with longer-term commitment could be for them to be STEM mentors that meet regularly with youth over several weeks.

Work Towards Mutual Benefit

As CSEPs develop, mutual benefit to both your project and your partners will hopefully become obvious. It is important that you work to understand their needs and priorities so that you might identify ways to address those needs that are mutually beneficial. Keep in mind that partners have priorities based on their mission and goals, which may or may not align with your project objectives. Look for opportunities to adapt your STEM programming to incorporate contributions partners are willing to make (learn more about adapting your project in Practice Brief 5a), and highlight how this will help all parties achieve their goals.

Establish Communication Routines

It is a good idea to establish communication routines early on in your interactions with partners.

[1]Community STEM education partnerships (CSEPs) are long-term collaborations between organizations and project participants that coordinate and leverage expertise and resources to improve STEM learning opportunities for youth.

Specifically:

- Determine the best mode of communication (i.e., phone, email, video conferences, or in-person meetings).
- Identify one point of contact between your project and the partner.
- Establish expectations about the regularity and frequency of communications.

Depending on the nature of your partnership, consider using shared communication tools (such as shared cloud drives, documents, or calendars) for keeping track of conversations and co-developing youth activities. Shared tools are important for building efficient partnership processes and institutional memory within successful research-practice partnerships (Frumin, 2019[2]).

Use a Snowball Strategy to Gain Introductions to New Potential Partners

Enlist others to help grow your CSEP network and plan for a broad initial reach. Ask your initial partners to suggest where you should go next. Perhaps they have had positive experiences with organizations or businesses that offer guest speakers or internships, or that participate in school field trips, STEM festivals, or job fairs. Ask about sponsors, businesses, and local government organizations in the school community. Each time you gain an audience with a new potential partner, ask who else they suggest you contact. Thus the snowball begins to form.

Don't be afraid to ask your new partner to make the first introductions between your project team and contacts they have worked with successfully before. Keep track of these connections by building a network map to identify which partners are "hubs" for connection with the community.

Tool: Network Map Creation Guide

A Network Map is an internal tool to track how your relationships are developing and how they are connected. This guide provides step-by-step instructions and examples for creating a map that identifies different partners and networks you have developed and partners that are yet to be contacted.

Note: The Network Map differs from the STEM Asset Map (Practice Brief #1) in that a Network Map shows relationships and connections between partners rather than simply identifying them.

STEM Career Connections Spotlight:

Partnering with a well-connected organization resulted in our first round of STEM mentor connections.

During the first year of our STEM Career Connections (STEMCC) project, we found one of our initial partners, the local school district, to be invaluable in helping us make connections throughout the community. The assistant superintendent, our first point of contact, introduced us to the STEM teachers who first agreed to implement our curriculum, STEM mentoring, and career connections activities. One was an experienced teacher working in the district for over ten years. While trying to identify local STEM

[2]Frumin, Kim. (2019) Researchers and Practitioners in Partnership: Co-Design of a High School Biology Curriculum. Paper 1: Nurturing a Niche: Research-Practice Partnerships and School Reform. (Unpublished Doctoral Dissertation). Harvard, Cambridge, MA.

mentors in the community during our first year, this teacher introduced us to a local sustainability and education organization. We scheduled meetings with this sustainability and education organization and continued discovering mutual benefits that evolved into a new partnership. This new partner made direct introductions to their network of STEM professionals and shared our introductory flier, helping to jumpstart even more new connections and leading to a pool of STEM professionals to serve as youth mentors. After the first year of partnership building, we were able to use the relationships we had built to continue supplying us with enough mentors to support the project. Through this process, we developed a well-connected network of partners that we continued expanding each year. The snowball strategy we adopted began with relationships from within the local school district that expanded into a more exhaustive network-building process.

Reflection Questions

- Why is it important to create awareness about your project with STEM organizations from your community?
- What steps can you take to build or rebuild relationships with organizations in your community that could benefit your project?
- In what ways will joining your project mutually benefit both your partners and the project?
- What type of communication structures (i.e., mode, frequency, tools) should you set up for each partnership?

Next Steps

Practice Brief #4 - Putting Your Partnerships to Work

PUTTING YOUR PARTNERSHIPS TO WORK

PRACTICE BRIEF 4

STEM CAREER CONNECTIONS

Action Steps:

- Invite STEM professionals from your community to be STEM mentors.
- Plan your youth-mentor interactions to match goals and availability.
- Provide orientation for STEM mentors to prepare them to work with youth.

Create opportunities for youth and STEM professionals from the community to engage in project work, data collection, and career experiences. These types of activities are highly engaging and create unique shared experiences to build relationships. Modeling professional skills like problem-solving and critical thinking in authentic settings is a valuable experience for youth.

Strategies to Make it Happen:

Recruit Mentors

Invite STEM professionals from your pool of community partners to serve as STEM mentors. Choose partners who work in fields or have skills that directly connect to what youth are doing in their STEM lessons. In some cases, youth or interns at more advanced STEM education levels can also be great near-peer mentors. The goal is for mentors to work alongside youth and help them connect their STEM lessons to real-world applications within their community.

Have a conversation to get to know each potential mentor, learn what their career entails, and how that could connect with what youth would be doing. We recommend asking the mentors about their goals for their time with the youth. This can help as you plan how to structure the youth-mentor interactions.

Design your youth-mentor STEM learning interactions

Consider the needs and interests of the youth, educators, and STEM mentors and schedule a series of in-person, virtual, or hybrid interactions. Be sure to adhere to guidelines that your district or program has for adults interacting with youth. It takes time for youth-mentor relationships to establish, and you will find that multiple touch-points result in the highest benefit to youth. But one-time meetings can also be valuable and offer exposure to new ideas and STEM career pathways. Examples of the different mentor-youth interactions we tested out in our project are explained in the Mentorship Typology tool (below).

Be open to adapting your activities and structure to accommodate a promising mentor, but keep your overarching goals in sight. Most times, your mentors are volunteering their time and can be hard to come by, so you should allow them to participate as long as they can provide a meaningful experience for the youth. Communicating expectations for mentors, educators, and youth in advance can help ensure the mentor meetings are a positive experience that accomplishes your goals.

No matter how the youth-mentor meetings are structured, youth will have an easier time engaging when

there is a clear and meaningful reason for meeting with the mentor. The mentors should share skills or knowledge directly applicable to the youth's work. Further, be sure to build in time for icebreaker activities and socializing. Learning about interests, hobbies, and life experiences helps youth and mentors connect as people and helps the mentors discover ways to engage with youth around their interests. Encourage follow-up email exchanges to help build the relationships between youth and their STEM mentors.

Tool: Mentorship Typology
Use this tool to help you determine what kind of youth-mentor interactions are best suited for your project.

Tool: Tips for a Successful Youth-Mentoring Program
This handout provides helpful tips to follow as you design your youth-mentor experiences, based on our experiences.

Prepare youth to meet their STEM mentors
We recommend that you spend some time preparing the youth to meet with the mentors, including introducing the concept of mentoring if this is new to your group. It can be helpful to have someone designated to facilitate the youth-mentor meetings, especially if they take place over video conferencing. The facilitator can introduce activities and discussions, facilitate transitions between breakout rooms, and be a timekeeper. This leaves educators free to assist youth and handle any classroom management issues. Consider creating an agenda for the meetings (sample agenda from our project) and sharing it with mentors and educators in advance.

We found that virtual mentor meetings benefited from additional structure. Educators and mentors appreciated agendas, and tips for engaging with middle schoolers can also be helpful (see tools below). Youth benefited from more advanced preparation for meeting with their mentors, such as constructing questions in advance and creating a worksheet for youth to share updates on their project work. When youth and mentors were able to meet in person, many of these supports seemed too rigid and unnecessary.

Facilitate an orientation meeting for your STEM Mentors
Orient mentors to each other, the project, the team, and their responsibilities through a one-hour orientation meeting to discuss what the mentors should expect when they meet with the youth, such as what the youth are working on in their STEM program and where they are in their learning. Be sure to explicitly describe what types of interactions are appropriate to foster an inclusive, welcoming environment for STEM learning and provide concrete examples of successful and detrimental interactions. Use the mentor orientation checklist (below) to help you plan your orientation meeting.

Other topics we recommend discussing during the orientation meeting include how to craft your story to be engaging for middle school youth and logistics for the upcoming meeting with youth (including a preview of the agenda). Provide additional resources (see tools below) to help mentors understand their role and the impact mentoring can have on youth STEM identity. Communicate what support you can offer, and address the mentors' questions and concerns. This allows your mentors to be ready and confident to interact successfully with the youth.

Holding a virtual orientation meeting will likely allow for higher attendance. Still, meeting in person will allow mentors to meet educators and facilitators, see the space where they will meet with youth, and hopefully allow them to experience a bit of the material or curriculum youth are using.

Tool: Mentor Orientation Checklist
Here is a checklist of topics to include in your mentor orientation meetings.

Tool: Out of School Time (OST) Readings Facilitator Guide
This selection of research-based readings and guide for how to facilitate will help your community partners gain background knowledge about the benefit of mentoring youth, how to activate motivation, and the importance of communicating an attitude of excellence in mentoring interactions.

Tool: Tips for Engaging with Middle Schoolers
This helpful list of tips can support your mentors as they work on building relationships with youth and engaging them to talk about their STEM learning.

STEM Career Connections Spotlight:

The Importance of Mentor Orientation

Through our project, we recruited multiple mentors, involving several types of youth-mentor interactions. During the Summer of 2021, we organized a one-week STEM camp with the local rural youth and recruited local community STEM mentors. As part of the recruitment process, we train mentors to help them succeed in their mentoring experiences and ensure our project goals are met. While all the mentors received training before the summer camp, one mentor - Rob (pseudonym), could not attend the training due to personal obligations. However, he had experience coaching boys' soccer and was confident in mentoring youth. We noticed Rob had different mentoring approaches, which negatively affected the youth and their ability to participate in the camp. For instance, when working with a classroom of about 20 middle school youth, Rob noticed one girl was off-task and leaning over to say something to a young woman sitting next to her as they were discussing a previous activity. Rob noticed and quickly addressed it by asking them to "cut it out." He eventually called out this youth by the shirt she wore because he did not know her name, saying she needed to "act like one [of the older kids in the group]." Disciplining this girl's participation in such a way broke Rob's ongoing narrative discussion about his work. It also exemplified his need for youth to listen to him as the speaker. He was taking power over the ability to choose who could speak and when.

We realized the value of being clear about goals for mentor interactions and the need to convey the type of communication space we created for mentors and youth to feel comfortable. Hence, a big takeaway from this experience was that structured mentor training could combat STEM professionals' previous experiences as guest speakers and may frame their mentoring approaches, especially when working with youth from underserved and less-represented backgrounds.

Reflection Questions

- Why is it important to take the time for you to get to know the STEM prospective mentors?
- Review the different mentor typologies (see TOOL). Which type of mentoring interaction will best fit the goals of your project?
- What are the most important characteristics of good mentor/youth engagements?
- How might you structure the mentor training to meet the goals of your project? What are the most important things you want to accomplish in mentor training?
- After reading the Spotlight, there are negative consequences for having mentors not aligned with your project's philosophy. How can you proactively prevent a negative mentor/youth engagement?

Next Steps

Practice Brief #5a - Adapting and Evolving As You Go: At the Youth Implementation Level

ADAPTING AND EVOLVING AS YOU GO: AT THE YOUTH IMPLEMENTATION LEVEL

PRACTICE BRIEF 5A

STEM CAREER CONNECTIONS

Action Steps:

- Roll out your programming in stages to allow for troubleshooting at a smaller scale.
- Support learning facilitators to adjust their implementation in real-time.
- Provide ways for learning facilitators, mentors, and other partners to share ongoing reflection throughout implementation.

Because of the nature of collaborative and iterative design, the project will undoubtedly move in directions that were not predicted. Keep true to your model, integrating Community STEM Partnerships (CSEPs)[1] to provide career and community experiences through youth project work, but leave space for new content and opportunities.

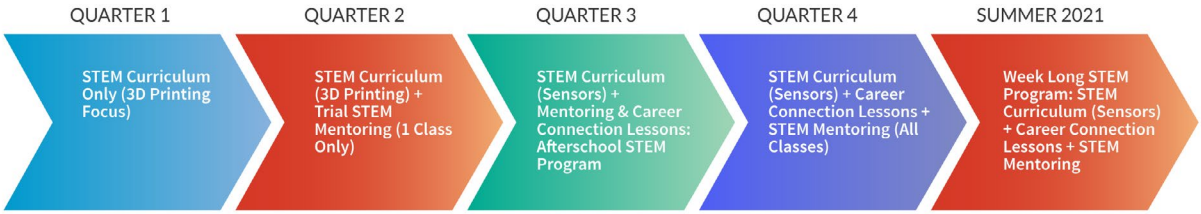
Strategies to Make it Happen:

Allow the program to evolve along the way

Roll out your programming in stages to work through the inevitable obstacles at a smaller scale.

- Consider the scale of change you are implementing. For example, if teachers are instructing new curricula and learning new technology for your project, perhaps gaining confidence with these items is enough for the first roll-out — save the mentoring and community experiences for next time.
- Learn what support mentors need and how youth like to interact by starting with just one group (one class, for example) before scaling the opportunity to your entire group. This will allow the teachers, mentors, and the project team to discover what works well and where more support is needed.
- Iteratively refine and scale your project as you learn (see the timeline below for the STEMCC project roll-out during year one).
- Establish strong communication practices between all partners. Depending on the number of youth engaged in your program, the coordination and scheduling can be quite a large endeavor. Communicate clearly and frequently to address changes that come up along the way. Use communication routines that are familiar to your partners.

Overview of how the STEMCC program evolved during Year 1



[1]Community STEM education partnerships (CSEPs) are long-term collaborations between organizations and project participants that coordinate and leverage expertise and resources to improve STEM learning opportunities for youth.

Support learning facilitators to make adjustments in real-time

The program facilitators should be empowered to make adjustments based on youth interests and needs during implementation. They might need to adapt the curriculum to strengthen youth engagement, or to accommodate changes to the school calendar. They might want to integrate other lessons or activities within the STEM curriculum to attend to their overall scope and sequence. Be willing to support these types of adjustments as they come up. These changes allow for opportunities to evaluate the effectiveness of different implementation methods and for each teacher to match your project to their existing instructional routines, which increases the likelihood that they will continue to integrate your educational model long term (see the STEMCC Model for more information on our curriculum and practices).

As you evolve and move forward, plan strategies to recruit new partners to serve as mentors. STEM experts with an established interest in outreach and education will be obvious choices for partners. Still, if your program serves a sizable amount of youth, you might find that you have a significant need for mentors. Survey your parent and caregiver population for potential mentors. Ask existing partners to suggest others you might contact and look for opportunities to expand partnerships with entities your partners have worked with before. Individuals or businesses that have provided skilled labor in fields that connect to youth project work (e.g., construction, utilities, waste management, and other community services) could become new partners that expand youth knowledge of STEM careers in their community.

Build in opportunities for ongoing evaluation

Provide ways for learning facilitators, mentors, and other partners to share ongoing reflection and feedback throughout all stages of your project.

- Invite learning facilitators and mentors to share feedback about implementation ideas; they might lead to some authentic connections.
- Hold regular check-in meetings with learning facilitators to debrief successes and challenges and help keep everyone on track for your implementation timeline.
- Act on the information you receive to ensure youth have a positive experience and reach out to youth who stop showing up without a communicated reason.
- Collect feedback directly from youth using interviews, surveys, and exit tickets (quick reflections completed at the end of a lesson).
- Survey mentors following their first interaction with youth to provide actionable information.
- Be aware of introducing survey fatigue with your participants, especially with youth who may respond less enthusiastically if you survey them too frequently.
- Build in time to revise activities with partners to integrate lessons learned as you move throughout the project.

Tool: Mentor Reflection Survey

Use the sample mentor survey to evaluate the mentor experience so that you can adapt the youth-mentor interactions as needed. Survey each mentor at least once, but potentially more than once. The mentor reflection survey is a Google form — make a copy and adapt to suite your project needs.

STEM Career Connections Spotlight:

The STEM Career Connections researchers worked closely with our partner (a summer camp provider) to design a one-week STEM camp offered at two different site locations during the summer of 2021. During the implementation period, the research team collected data about the program from a variety of sources, including: surveys, informal debriefs with teachers and site coordinators, teacher and youth interviews, and meetings with summer program staff. After the summer program wrapped up, the research team and summer program staff used the information obtained from these sources to structure a SWOT (strengths, weaknesses, opportunities, threats) analysis intended to inform planning for summer camp in 2022. Many of the identified strengths of the 2021 summer camp were continued the following summer. Likewise, weaknesses and threats were identified as areas for improvement, and opportunities were viewed as new ideas that could be tried out the following summer. The summer camp 2022 program hailed new successes, and new opportunities for growth, as a result of this evaluation.

Example comments from the Summer Camp 2021 SWOT that informed Summer Camp 2022 planning

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
• Prioritizing the hands-on STEM experiences that used sensors • Enrichment activities • Use of LiveBinder for organizing resources for facilitators • Working with STEM mentors from the local community • Flexibility in implementation.	• Career activities should be more integrated with youth interests, mentors, and sensors. • The project portion of the week wasn't structured enough for the instructors to support the youth in this type of open engagement.	• Integrate & stretch out the sensor curriculum across the other weeks. During service week, youth were out in the community, and during Social/Emotional week, they did a career focus - how could we integrate STEM and sensors work with these experiences? • Youth are going out to meet STEM professionals in the community.	• Instructors reported that they would have liked more training, though they acknowledged that a balance between protecting their summertime and camp obligations made it tough to do more training.

Reflection Questions

- What are the advantages and disadvantages of rolling out your programming in stages?
- What strategies do you anticipate needing for good communication between teachers, facilitators, and mentors to address changes along the way?
- At what point along your implementation timeline is evaluation necessary? What evaluation tools do you have in place or need to develop?
- How can you use formal/informal meetings to receive feedback and plan for possible adaptations to your programming?

Next Steps

Practice Brief #5b - Adapting and Evolving As You Go: At the Partnership Level

ADAPTING AND EVOLVING AS YOU GO: AT THE PARTNERSHIP LEVEL

PRACTICE BRIEF 5B

STEM CAREER CONNECTIONS

Action Steps:

- Look for new ways to engage partners that will allow relationships to evolve.
- Create small working groups within your partner network to develop shared resources.
- Build opportunities for ongoing evaluation to understand how the partnership is doing with the shared goals.

Given enough time, most collaborative partnerships transition through predictable phases. It is essential to allow partnerships to change as the community's needs are highlighted and relationships within the community progress.

Strategies to Make it Happen:

Allow Partnerships to Evolve Along the Way

The partnership typology diagram below helps to visualize the evolution of your collaborative partnerships. The first community STEM education partnerships (CSEPs)[1] you engage for your project will likely be afforded through previously established relationships (Opportunity-based partnerships). As relationships grow to include additional partners, often sharing tools and strategies to achieve common goals, they become more collaborative (Collaborative partnerships). Eventually the relationships may become so intertwined that all parties succeed and are lifted up in the community as a result of the partnership (Interconnected partnerships). When partnerships become intimately dependent on each other to provide opportunities for success, the partnership is moving toward becoming a transformational partnership that can enact change across the community. Community STEM education partnerships are formed around the STEM opportunities or knowledge each partner brings to the table and how they support and complement each other in their efforts to support youth.

Partnership Typologies (revised from Allen et al., 2020[2]; Noam & Tillinger, 2004[3])

OPPORTUNITY-BASED

Discovering overlapping interests

Member organizations maintain their autonomy. Collaboration is seen as functional. Members network to share knowledge and resources.

COLLABORATIVE

Joining forces

Member organizations develop common goals, benefit from one another's strengths and experiences, and establish some accountability.

INTERCONNECTED

Developing an inclusive system

Member organizations develop clear communication and a level of intimacy. They engage in joint decision-making, shared programming, and group celebrations of accomplishments.

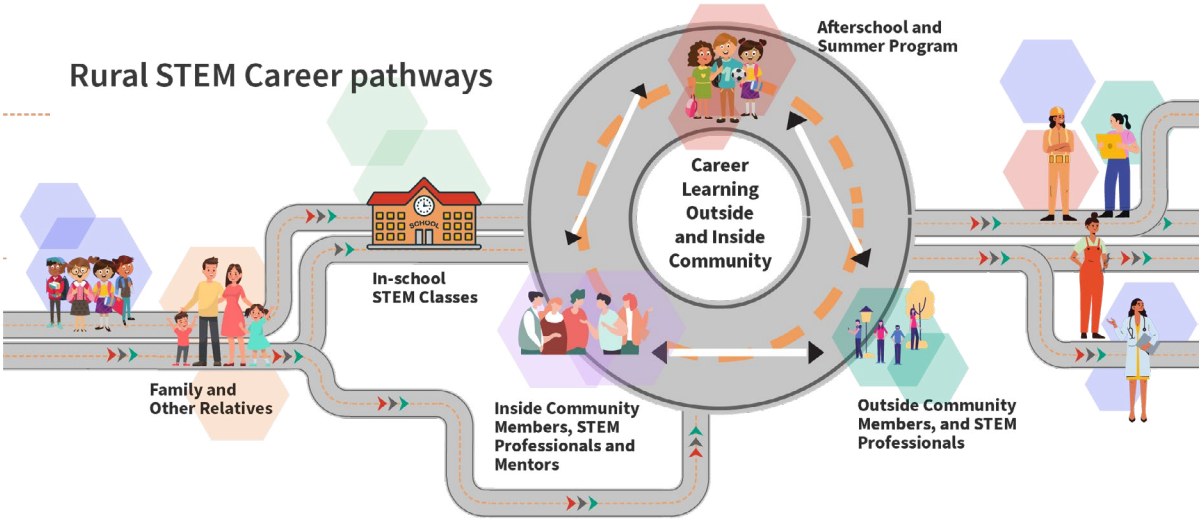
TRANSFORMATIONAL

Changing all partners

Member organizations accomplish more together than they do independently. Relationships are equal, not hierarchical.

[1]Community STEM education partnerships (CSEPs) are long-term collaborations between organizations and project participants that coordinate and leverage expertise and resources to improve STEM learning opportunities for youth.[2]Noam, G. G., & Rosenbaum Tillinger, J. (2004). After-school as intermediary space: Theory and typology of partnerships.

Expand partnerships by working with your initial partners to connect with other potential partners, which can lead to further connections within the community. This "snowball" approach (described in Practice Brief 3) can provide opportunities for partner relationships to develop more organically. Engage your network of partners to work together on creating something meaningful for youth in their community, such as creating STEM pathways. From that point, consider how to begin transferring ownership to committed partners so as to sustain the community partnership work you have begun.



Form Working Groups to Help Partnerships Evolve

Forming a STEM community partnership group is one way to focus efforts on creating STEM pathways for youth. Invite community members from a wide variety of backgrounds to give voice and representation from all levels, classes, races, and ethnic backgrounds within the local community. Include interested parents and/or older students to contribute from their perspectives. The community partnership group is different from an advisory board, which traditionally exists to give input and advice but does not necessarily have a stake in the process. This group should become an invested central stakeholder who is sharing the work of identifying, creating, and connecting STEM pathways for youth in the community. This role ought to be owned and led by individuals within the community.

First meetings are primarily about participants getting to know each other, understanding organizational priorities in local STEM education, and identifying STEM organizations that should have a seat at the table. The first few meetings must focus on understanding the local STEM landscape and discovering the interests and values of the participants. Consider creating a STEM community asset map (described in practice brief 1) as an activity for your partnership group.

Once you have facilitated a few meetings, identify group members who are interested in helping plan, lead, and facilitate future meetings. This allows the focus of future meetings to be determined by the stakeholders and can lead to slowly transitioning full ownership of the initiative to partners in the community. Work with this core group to draft a set of community-based goals (See example goals from the STEMCC community partnership group below).

At each meeting, take extensive notes during large and small group discussions so that the meeting minutes, discussions, and decisions are recorded and communicated to all those unable to attend. Meeting notes can be used to build out action items for future meetings.

EXAMPLE GOALS FROM A RURAL STEM COMMUNITY PARTNERSHIP GROUP

1. Understand the STEM landscape in the community – past, present, and future.
   - Explore the history of STEM careers and career pathways in the community.
   - Determine existing STEM touchpoints and gaps for youth (ES-MS-HS) in the community.
   - Imagine the possible future STEM opportunities and landscape in the community.
2. Co-define strategies that develop and enable community partnerships to support youth exploration of locally relevant STEM and computing career Pathways.
   - Explore the past and present STEM partnerships and strategies that have worked well in the community.
   - Inform existing and future STEM experiences by, and for, youth.
3. Increase youth awareness of and access to STEM opportunities in their local community.
   - Promote the development of equitable opportunities for youth to engage with STEM in their local community.

After setting goals and creating the STEM asset map, you will want the group to think about how youth engage with the STEM opportunities that are already available in the community. One way to accomplish this is to develop example profiles representing youth in the community. Ask group members to consider the opportunities and barriers that exist for youth to engage in STEM in the community right now. Then have the group brainstorm ideas to expand STEM opportunities and create deeper engagement moving forward. Synthesize these ideas into a list of actionable directions the group could take. Survey your group to gain consent around which actions to prioritize. The results from this survey can be used to create working subgroups, each with a specific sub-goal or resource that the group will focus on creating.

The working groups create meaningful ways for your partners to collaborate with each other and establish or evolve their relationships, beyond the work they might be doing for your project. As partners become more interconnected they are able to accomplish more towards supporting STEM learning opportunities for youth in the community.

Build in Opportunities for Ongoing Evaluation

As the partnership develops and matures over time, it is important to evaluate progress made towards the shared goals. Consider both the perspectives of the partners and the research team to see if the partnership is realizing mutual benefit and value. Use a reflective memo to elicit responses to four ideas about collaborative community partnership development (Yurkofsky et al., 2020):

- **Bridging**: facilitating connections with initiatives and other operating parts of the partner organization.
- **Buffering**: creating protective spaces for those working on the project that keeps possible contradictory guidance, policy, or leadership at bay.
- **Shared tools**: developing shared tools that allow for asynchronous, ongoing collaboration, including capturing decisions and feedback for improvement.
- **Informal support**: Ongoing work that helps partners as they implement youth learning experiences that are not captured in other representations of the partnership, such as helping with a technological issue.

Invite each team member to complete a reflective memo quarterly or after major project activities. Then, convene a meeting with team members and facilitate whole-group reflection and synthesis on the partnership, project goals, and partnership development. This reflection allows the team to make necessary adjustments and changes to ensure that all partners and stakeholders are heard and realize mutual benefit from participating in the project.

Tool: Reflective Memo Template

Use the reflective memo as a tool for both internal project members and external partners to evaluate how your project is progressing.

STEM Career Connections Spotlight:

In our partnership, our research team planned the first few STEM community partnership meetings and presented the goals described above to the participating members. After the first two meetings, some individuals were central to the partnership and had taken on leadership roles within the group. We invited these individuals to join us in the planning meetings. Over many meetings, these individuals took on more leadership both in planning for the partnership meetings and in facilitating portions of the meetings themselves. This allowed our research team to step back and provided a path for the participating community members to have more ownership over the partnership group helping guide the direction the group went. This was important as our team was not a part of the local community, and our project was only funded for a few years. This transfer of ownership to the local community members builds in sustainability and investment beyond our team's time working in the community so that the STEM partnership group would continue to exist into the future beyond our project and would continue to support the development of STEM learning opportunities and STEM career pathways in the local community.

Reflection Questions

- Which typology best describes your current partnerships? What evidence do you have to support your answer?
- Why is it important to make reflection an essential part of your ongoing work to grow and sustain partnerships?
- How can you facilitate working groups to connect partners to youth opportunities?
- Do you anticipate any need to create "protective spaces" for participants in the project?
- How have you been successful in using "shared tools" for ongoing collaboration, making decisions, and sharing feedback?

Next Steps

Practice Brief 6: Keeping It Going and Looking to the Future

KEEPING IT GOING AND LOOKING TO THE FUTURE

PRACTICE BRIEF 6

STEM CAREER CONNECTIONS

Action Steps:

- Create a community asset map to explore your STEM ecosystem.
- Make a list to track STEM opportunities already present in your community.
- Identify the strengths of current STEM offerings, and look for gaps that could lead to new opportunities.

As you implement and evolve your project, build connections and strategies that will continue to develop your community STEM education partnerships (CSEPs)[1] even after your project ends. In particular, what aspects of the partnerships or programs will continue once your project ends? What parts of the work have become particularly meaningful for the community? What partnerships and funding are available to continue to support those elements?

Strategies to Make it Happen:

Maintain Connections

Devote time and energy toward maintaining connections over the long term. Consider which communication methods established over the course of the project can be maintained long-term. Sending a periodic newsletter to collaborators (see below) is a great way to keep current partners, and even those who may have faded into the background, informed of accomplishments. Maintaining a list of your partners and their contact information, including a note about who helped facilitate your connection to each partner, is highly recommended. Send your newsletter or updates to everyone on your contact list, and remember to build onto this list as you connect with more community partners.

Connect to established communication methods within the community, such as a STEM community calendar, family activity guide, school newsletter or other communication platforms like social media, and see if your project can contribute to them. If your partners and audiences are part of different networks, consider organizing efforts to establish new ways to connect.

If the relationship is meaningful to the partner, they will likely return. Reflect on successful partnerships and look for individuals and organizations with the potential to engage in new ways as your project evolves. Give them opportunities to engage with your programming at different stages and capacities. Co-design programming with your partners to capitalize on the unique opportunities they can provide for youth. Establish good communication with your partners, ask for their feedback along the way, and respond to that feedback by adapting your project to ensure mutual benefit.

Tool: Creating a Newsletter to Share with Collaborators

Create a newsletter to build trust and inform collaborators about the project's progress and next steps.

[1]Community STEM education partnerships (CSEPs) are long-term collaborations between organizations and project participants that coordinate and leverage expertise and resources to improve STEM learning opportunities for youth.

Continually adapt your program to be relevant

How your program is implemented and how you engage your partners depends on the objectives, setting (i.e., in-school classroom or after school), and format (i.e., in-person, remote, or hybrid). Over time you may need to adjust your programming based on evolving needs of youth, partners, teachers/facilitators, leadership, or funders. Allow your program to evolve to meet the needs of the community, while continuing to meet your project goals and maintaining access to your partners. Look for opportunities to move your CSEPs to the next level within the partnership typology (see Practice brief 5b). For example, find ways to engage multiple partners that do not already work together around a specific initiative or task, like holding a STEM career fair or supporting an after school STEM program with a design project.

It is ok to make even drastic changes to your programming or to the way your partnerships work, as long as the changes align with your project goals. Consider how the model of technology curriculum supported by community partnerships with integrated career experiences is supported with any programmatic changes. For example, if changing from in-school to a summer program setting, you may find that youth activities need to be completely redesigned to be more fun and informal. You may need to switch from paper-based to interview based methods to evaluate youth engagement and learning.

As you consider how to adapt your program while continuing to meet your goals, ask yourself:

- How much time do we need to prepare for the new implementation?
- Does technology integration need to change for my new context? (e.g., gauge the type of technology needed, how it will work in different settings, and getting participants up to speed on the technology)
- How do I continue to integrate partners and focus on STEM career pathways? (e.g., explicitly having mentors share their career path, connecting with school/district initiatives on career education, working with guidance counselors to develop career interest assessments, making explicit connections between competencies and skills while working through STEM activities)

Plan for Sustainability and Empower Partners

Work with a local foundation to secure funding over a long period of time. To do this, you will need to document and present impact based on your evaluation findings (see Practice Brief 5b). If you have working groups, is there a way to shift responsibility to those in local leadership (i.e., district superintendents, guidance counselors, or community college/university leadership)? Technology coordinators in the school district can be engaged to provide technology training using the technology and provide support and coordination for materials across multiple schools/after-school locations. Consider the workload required to support the project after its initial phase. Ask what is realistic regarding the amount of time and work needed to sustain the program and how this work benefits learners and all involved.

Reflection Questions

- Why is it important to create awareness about your project with STEM organizations from your community?
- What steps can you take to build or rebuild relationships with organizations in your community that could benefit your project?
- In what ways will joining your project mutually benefit both your partners and the project?
- What type of communication structures (i.e., mode, frequency, tools) should you set up for each partnership?