4 IT TAKES A VILLAGE

A lot of rural schools say that they don't have the resources for STEM partnerships. We encourage them to look at entrepreneurs and small businesses in their area. We have a couple of schools that have connected with nearby universities.

—MEGHAN MCFERRIN,
DOE STEM/STEAM PROGRAM SPECIALIST, ATLANTA, GEORGIA

DRIVING QUESTIONS

- What is the role of partnerships in building a STEM Lab?
- Where can partnerships be found?
- How do you know if the partnership is a good fit?
- What can parents contribute to your STEM Lab?

PARTNERSHIPS AND THE STEM LAB

In Chapter 1 we presented a formula for successfully building a STEM Lab that included developing ideas, fueling your passion, and searching for opportunities. The opportunities that we are referring to are partnerships within and outside of your community. With a focused vision in mind, begin to network and to develop your radar for potential STEM Lab resources in the form of partnerships.

A partnership is a mutually beneficial relationship, wherein each side contributes something and benefits in a particular way. Some partnerships are a source for equipment and materials, teacher training, or programs and activities for students. Partnerships can also be a source for funding. When the funder and the school share a common vision, the funder has an advisory role, and the funder is looking for a sustained relationship, it is more likely to create a partnership, or even a sponsorship, than a simple donor-and-recipient connection.

What are the strategic benefits of partnerships? First, a partnership with a respected organization and institution reinforces the value of your vision to your stakeholders. It sends the message that your school is not alone in its quest for transformational education. Second, your partner may be able to supply mentors, speakers, volunteers, or even the imprinted swag that adds to the success of a single school-wide STEM event or ongoing programs. Finally, a trusted partnership may provide you with opportunities to take advantage of particular kinds of business expertise (Figure 4.1). For example, the UA Maker Academy, a career technical education high school, has representatives from the design industry on its advisory board, and professionals from that industry serve as mentors for students.

FIGURE 4.1 Examples of the STEM Lab Partners at A.D. Sullivan include the Latinas in STEM, Liberty Science Center, Society of Hispanic Professional Engineers, and PicoTurbine.

ISTE STANDARD
SYSTEMS DESIGNER

Leaders build teams and systems to implement, sustain and continually improve the use of technology to support learning. Education leaders:

5d. Establish partnerships that support the strategic vision, achieve learning priorities and improve operations.

Partnerships with local science centers, colleges, universities, local government, and community businesses can provide STEM expertise, grants, professional development, and many other resources for your STEM Lab.

FINDING PARTNERS

Martha describes finding partners as her superpower, suggesting that within five minutes of conversation with a stranger she can ferret out partnership opportunities. Happily, finding partners is a superpower that anyone can cultivate by focusing on a few key steps:

- Listen carefully when people introduce themselves and ask questions about their work and area of expertise.
- Make your message portable. Refine your vision and goals into an "elevator speech" that can be presented in under a minute.
- Let your passion shine through. Positive energy sells the message.
- Look for the win-win. Partnerships are about mutual benefit. You know what you need for your STEM Lab, but what can a partner receive in return? Possible answers include access to a student target group, community service opportunities, a place to donate used or no longer needed equipment, and attention to a pipeline for future employees.
- Be flexible. Ask whether the business or organization has had experience partnering with schools? Would they be interested?

- Follow through. Frequently the initial conversation is a brief one. Make sure to share contact information and then to reach out in a follow-up email, text, or telephone call, depending on the nature of the connection.

In truth, finding partners is not really about random encounters. It is important to put yourself in places where you can encounter potential partners. This section will describe different sources for partnerships and where to find them.

LOCAL BUSINESSES AND INDUSTRY

You don't have to look too far to find businesses that can support your STEM Lab. STEM fields are growing and businesses are looking for a robust pipeline for future workers. Here are a few resources that can help with your search:

- Research your state Department of Education. Does it have a STEM Forum or another framework for connecting schools with businesses and industry?
- Check with your local Chamber of Commerce.
- Connect with business or industry networks or trade associations.

Dave Janosz, Supervisor of the Technology and Engineering Department of a public high school, recommends this practical approach:

> *The best strategy that I found, as an educator, is to try to plug yourself in. You can't expect business and industry to come to you offering their advice. Some large corporations might have STEM Outreach Programs, but most small or mid-sized companies don't have that kind of capacity. It's really up to you to make your own connections and recognize the value that business and industry can bring to your program. In my district we're not going to business and industry to fund our programs. We're going because we understand that they have something to say and they have good advice to give on our program development. They ask us: What's included in your program? Are the students writing? Are they doing technical writing? Are they researching? What are the projects that the students are working on? What are the skills that they're learning throughout the program? That is the value that business partners bring.*

For example, the A.D. Sullivan School launched their STEM Lab with the help of a local business. The science supervisor introduced Martha to the owner of PicoTurbine, a tech startup company in the community. PicoTurbine wanted to develop clientele that would call upon their business as a provider of STEM programs and professional development. Their goal was to build connections in the local district by working with a cohort of schools. With funding from the district, PicoTurbine provided teachers and students at A.D. Sullivan hands-on training in Tinkercad and 3D printing.

Because of this initial connection, PicoTurbine also became involved in building the STEM Lab. Personnel from PicoTurbine helped the school leaders design and organize the STEM Lab. PicoTurbine donated two custom-designed maker tables, installed shelving units to hold the 3D printers, created a dry erase board for one wall of the room, and donated a hydroponic station for the lab. The conclusion: Business partnerships can grow in unexpected directions.

UNIVERSITIES AND COLLEGES

Universities and colleges are excellent candidates for partnerships in STEM education and in your STEM Lab. Here are a few ways to connect with universities and colleges:

- Research STEM Education, Educational Technology, and other related departments in local universities, colleges, and community colleges. Introduce yourself to the director of the department and express that you are interested in having the university do research in STEM education in your school. (Note: Research proposals need to be approved by the Institutional Review Board of the university and, in the case of public schools, by school leaders and the Board of Education.)
- Find out if the higher education institutions have outreach projects for local schools and get your name on the mailing list.
- Find out if the higher education institution recommends or requires that their students get involved in community advocacy or service projects in their field of study; make friends with the campus coordinator for these activities.
- Look into the honor societies, fraternities, and sororities that may be looking for volunteer projects.

Higher education is a rich resource for partnerships because its leaders care about STEM education for the same reasons that we do; they are involved in grant-funded educational research and need access to K–12 students as study subjects; and most universities encourage both the students and the faculty to volunteer for community service projects. These institutions are also home to honor societies and other organizations that might be a fruitful source for volunteers. The first step in creating these partnerships is to reach out and introduce yourself.

For example, the Stevens Institute of Technology in Hoboken, New Jersey, and the New Jersey Institute of Technology (NJIT) in Newark, New Jersey, both offer a variety of workshops that are open to the community. These programs are provided by student societies and organizations within the college or university. Student chapters of the Society of Hispanic Professional Engineers (SHPE) are an example of organizations that offer special events and programming at these academic institutions. The goal of these programs is to expose middle and high school students to the various fields of engineering, such as civil engineering, mechanical engineering, computer engineering, and chemical engineering. At SHPE-sponsored events, students learn about the science of making ice cream, coding, and building structural designs using design thinking. These types of partnerships can pique the interest of students and expose them to potential STEM majors at an earlier age.

Campus organizations such as SHPE provide a bridge between K–12 education and higher education by exposing K–12 students to local colleges and universities and by offering STEM role models for younger students. Some of these organizations have K–12 outreach programs and support a local K–12 chapter. A.D. Sullivan is one of the schools with a SHPE junior chapter. Members of the SHPE Executive Board at NJIT visit the school and meet bi-weekly with the SHPE junior chapter members. The young learners are exposed to design thinking and STEM challenges, and they have the opportunity to learn from college students.

There are professional organizations for individuals in the STEM workforce that also offer programs for K–12 students. For example, Ruby Romero, a member of the SHPE New Jersey Professionals, works for Turner Construction. In February 2018, Ruby reached out to the school leadership team at A.D. Sullivan School to propose an event aimed at exposing young girls to engineering. Turner Construction sponsored the program, in which several female STEM professionals facilitated an engineering design challenge for the girls, followed by a panel discussion.

NONPROFIT ORGANIZATIONS, SCIENCE MUSEUMS, COMMUNITY AND LIBRARY MAKERSPACES

Nonprofit organizations, science museums, museums with makerspaces, and community and library makerspaces are potential partners, because they can help to enrich the STEM culture in the school and support the work in your STEM Lab. They can be a source of grants, off-site programs for students and parents, ideas, and personnel. Here are a few ways to identify prospective partners in your community:

- Research local resources online.
- Reach out and introduce yourself, and ask to be put on the mailing list of local organizations.
- Attend and volunteer your support for community events—these are great networking opportunities.

For example, the Latinas in STEM Foundation is a national, nonprofit organization whose mission is to encourage middle- and high-school-aged girls to pursue careers in STEM fields. This organization provides workshops for students and parents in underserved communities, with the ultimate goal of increasing the number of Latina women pursuing STEM careers and creating a network to support women in STEM. Girls Who Code is another example of a national nonprofit organization with the mission of encouraging girls to excel in STEM. Girls Who Code offers free after-school clubs for girls in Grades 3–12. This organization will also lend support to local STEM conferences, such as the annual Girls in Technology Symposium sponsored by Hudson County Community College, in Jersey City, New Jersey.

The Liberty Science Center (LSC) is a science museum and learning center located in Jersey City, New Jersey. The LSC applies for grants to support educational outreach programs in the community. Under a grant from the Clare Foundation, students in early childhood participate in hands-on exploration with experts from LSC during the course of three years. The services provided through this grant follow the students from year to year, beginning in prekindergarten and ending in Grade 1. The funding provides teachers with an opportunity to engage in professional development with experts in the field. The grant also includes admission for the school community, including the parents, to visit the science center.

A community makerspace is a workshop or lab supported by its membership. There are approximately 500 such makerspaces in the United States (Lou & Peek, 2016). Community makerspaces are also potential partners for school-based STEM Labs. The San Joaquin County Office of Education Fab Lab, a regional school STEM Lab, partners with the community Fab Lab in Stockton, California. These two labs share equipment and expertise, and welcome visitors from each other's catchment area. The Bergen County Makerspace in Hackensack, New Jersey, offers professional development programs and workshops for the area's teachers.

The Idea School high school is located in the education wing of a Jewish Community Center (JCC). Various groups use the building, including a preschool, a special needs program, and a senior adult community. In partnership with the JCC, the Idea School offers use of the school's STEM Lab "as a multigenerational makerspace" and invites participation from all of the resident communities.

TRYING PARTNERSHIPS ON FOR SIZE

A partnership is a purposeful relationship between people or organizations that reflects a commitment to a common goal. There are many different kinds of partnerships. The guidelines for productive partnerships may not be the same in every case. For example, in a long-term partnership, planning together at the outset is a good investment of time. A school that rents space from another organization or plans to share its STEM Lab with the larger community is an example of a long-term partnership. In a short-term partnership, such as a one-time event or a limited grant-funded program, getting to know the organization and engaging in strategic planning is not realistic. With this in mind, there are several generally accepted principles that can help you effectively navigate partnerships:

- **SHARED VISION:** Every decision and action that you take in building a STEM Lab should be measured with the yardstick of your vision. Partnerships are no exception. The purpose of a partnership is to help you achieve specific goals. So at the outset you need to ask: How will this partnership help us achieve our goals?
- **CLEAR ROLES AND RESPONSIBILITIES:** Make sure that expectations are clearly stated. The culture of a school is very different from that of other kinds of businesses and organizations. Partners will need to understand that they do not have full autonomy when working with students, either on- or off-campus. They must abide by the established policies and rules of the school.

- **MUTUALLY ACCEPTABLE GROUND RULES:** In addition to creating an understanding about in what form and how often communications between the partners should take place, establish a game plan for dealing with unexpected issues or grievances that may arise.
- **FLEXIBILITY:** Expect that things might change over time or because of a single event, such as a major budget cut. As the serenity prayer suggests: Accept those things you cannot change. Be prepared to re-envision some of the moving parts of the partnership if necessary.
- **A NURTURED RELATIONSHIP:** Mutual respect is a starting place, but an ongoing partnership between organizations requires an investment of time and effort. Get to know the culture of your counterpart, establish opportunities for interaction, and celebrate partnership achievements (Effective Partnerships, 2014).

Although the partnerships bring many benefits, there are occasional pitfalls to consider. For example, when working with colleges and universities, you need to keep in mind that the academic calendar at a university will differ from the K–12 school calendar. College mentors may be unavailable during winter and spring breaks. Similarly, college students may require a flexible schedule during finals and midterms to accommodate their testing schedule. With adequate communication and flexibility these challenges can be overcome.

Another aspect to consider is that although the college mentors have technical expertise, they may lack teaching experience. These students are not necessarily certified teachers. At A.D. Sullivan School, the college mentors teach alongside certified teachers during the after-school program. This model has worked particularly well. We have found that the combination of content and curriculum, or pedagogy, specialists is a complementary one.

PARENTS AS PARTNERS

Parents can serve as valuable partners in building a STEM Lab. Access to expertise is one reason to involve parents. As Rabbi Gary Menchel notes: "We have a number of parents who are very involved in technology. We call on their ideas and expertise because they are out there working in the real world. Our program benefits from their expertise" (interview, May 13, 2018). A quick parent survey using Google Forms is one way to find parents with professional STEM qualifications. Parents can be invited to serve as guest

speakers on a STEM Career Day and can help find potential venues for STEM internships for high school students. One parent at the A.D. Sullivan School, who is a medical doctor, purchased DNA kits for second-grade students and then co-taught a hands-on lesson on extracting DNA from a strawberry. In many cases, the Parent Teacher Organization helps to grow and sustain the STEM Lab with fundraising.

Parent involvement in STEM and support for the STEM Lab, however, is not a given. Many parents are unfamiliar with the acronym, may have limited background or experience in STEM, or may feel uncomfortable helping their children with STEM homework or projects. Overall, parent engagement needs to be cultivated. The goals of STEM "professional development" for parents are to: develop awareness of the importance of STEM in their child's education and future; increase their understanding of and comfort level with STEM through hands-on experiences; and feel encouraged to support STEM learning outside of school hours.

The A.D. Sullivan School adopted the Latinas in STEM approach to parent education, which promotes parent involvement in special STEM events, such as the STEM 101 Conference. At the conference, students participate in a variety of hands-on STEM activities, while their parents attend workshops. As a bilingual magnet school, A.D. Sullivan serves a population that is 30 percent Spanish speaking; therefore parent workshops are offered in both English and Spanish. First, parents are invited to attend an introduction to STEM workshop. Next, financial literacy workshops encourage parents to begin planning for their child's college education. Coupled with this workshop, parents learn about STEM careers and pathways for pursuing STEM education in a small career fair featuring representatives from STEM organizations and local colleges. The STEM 101 Conference ends with a collaborative engineering challenge, in which parents and children apply design thinking and experience the excitement of project-based learning.

The STEM 101 Conference is not the only opportunity for parent participation and learning. Over the course of the year, parents are invited to accompany their children to off-campus activities at local colleges, the science museum, or other places that host STEM events. Overall, the goal is to increase the parents' knowledge and awareness, so that they will seek out extracurricular activities for their children, such as a STEM summer camp, community-based activities on weekends, and projects that can be done at home.

STEM 101 Conferences, field trips, STEM career fair, engineering challenges—what do these have to do with the STEM Lab? If you have begun to suspect that the STEM Lab is one tool, albeit an important one, for creating a strong STEM culture in the school, then you have discovered the big idea within this effort. The STEM Lab is a location for STEM learning, but not the only one in a school. It should be an engine for change encouraging STEM exploration throughout the school, an environment that encourages interdisciplinary, project-based learning, and an exemplar of digital age education at its best.

Another approach for involving parents is to invite them to visit their child's classroom for a few hours on a specific day of the month. Celebrating Parent's Day on a monthly basis is a wonderful way to maintain a positive rapport with parents. If designed properly, it's also a means of engaging the parents with the content. This is a good way to promote interest in STEM, if during these visits parents are invited to the STEM Lab to engage in hands-on exploration with their children.

STEM LAB STORY
STEM/STEAM GEORGIA, ATLANTA, GEORGIA

STEM/STEAM Georgia is an arm of the Department of Education (DOE) with responsibility for developing effective STEM education in Georgia's schools. One of the goals of the Georgia DOE is to encourage schools to develop a strong STEM culture to support learning. The Georgia DOE encourages K–12 schools to apply for the state-sponsored STEM or STEAM certification. Currently, about 70 Georgia schools have STEM certification and seven have the more recently available STEAM certification.

The applications for STEM/STEAM certification (stemgeorgia.org) outline the essential elements of a strong STEM program. Certification is offered for elementary, middle school, and high school levels. Each application is a ten-page questionnaire that asks for documentation of a school's STEM/STEAM vision and culture, relevant modes of instruction, content knowledge and professional development, STEM/STEAM integration into the overall curriculum, the presence of STEM/STEAM Labs, and active community, business, or higher education partnerships. As Meghan McFerrin, the Georgia STEM/STEAM Program Specialist, explains:

> *We want our schools to develop what STEM or STEAM really means for them and for the students at their school in their community, and how that connects to local business and community partnerships. That is the big piece. It's all about the application of (STEM/STEAM) and preparing students for careers (interview, June 11, 2018).*

STEM/STEAM Georgia provides each participating school with guidelines for the required partnerships and specific definitions for a partner's involvement in the school. Involvement is measured at three levels: support, interactive, and advocate (Principles of Effective Partnerships, n.a., p.1). The level of participation is determined by the type and frequency of participation by the partner. "No two schools are alike and no two partnerships are alike. It depends upon the school and the capacity of the partner," offers Felicia Cullen, the DOE's other STEM/STEAM Program Specialist (interview, June 11, 2018).

A partner may:

- Contribute expertise, content, or materials to the school's STEM/STEAM curriculum and instruction, which is structured as project-based learning;
- Serve as a host for "student field trips, job shadowing, or internships";
- Mentor students in the process of designing solutions for real world problems;
- Sponsor STEM/STEAM competitions;
- Provide PD for teachers; and
- Make donations of funds or hardware.

(Georgia DOE, n.a., para. 1)

It is interesting to note that STEM/STEAM certification also requires evidence that the partnership is promoting a STEM/STEAM culture in the school. This references the quality of the relationship, describing an active and visible role for the partner in the day-to-day life of the school.

Here are a few examples of STEM/STEAM partnerships in Georgia schools:

- Approximately one-third of Georgia's students attend rural schools (Sampson, 2016). A recently certified school in the Blue Ridge Mountain district of northern Georgia has a partnership with a local apple orchard. The orchard business has moved some of its research to the school, where students help them to determine the best time of year to grow different varieties of apple.
- Warner Robins, Georgia, which lies about 90 miles southeast of Atlanta, is home to the Museum of Aviation, a United States Air Force aerospace museum. The Museum of Aviation partners with local middle schools on a variety of aerospace engineering projects. One recent museum-based event that included a rocket-building competition, was sponsored by the Society of American Military Engineers (SAME). SAME President Colonel Jim Hickman describes the goal of this program: "By partnering with local schools, we can reach out to youth and enhance their knowledge in (STEM) fields . . . and hopefully inspire them to pursue careers in those fields and potentially cultivate talented, engaged future Reserve Citizen Airmen" (Ebarb, 2017, para. 3).

- The addition of STEAM certification was in large measure due to the tremendous growth of the film business in Georgia (private conversation, June 11, 2018). Georgia now ranks as the third largest film production location in the U.S., after New York and Los Angeles (Dominey, 2018). The Georgia Film Academy (GFA), established by the University System of Georgia and Technical College System of Georgia in 2015, provides training for the thousands of jobs that support film production. Toward this goal of creating a pipeline of workers for the industry, GFA also actively partners with schools in a statewide program that provides PD for film teachers and a film production curriculum for high schools (Brett, 2017).
- Many schools in rural Georgia that do not have access to partnerships with industry must use available local resources, which are typically related to agriculture. These schools get support from small businesses, civic organizations, and local farmers. According to STEM/STEAM Georgia, the focus on agriscience also highlights an important career pathway. McFerrin acknowledges: "Agriscience is a huge industry. Many of our students have a negative perception of what agriculture is and aren't aware that they can make a good living by working in agriscience. Schools in Ware County have been able to tap into the large agriculture department at Fort Valley State University and embed agriculture instruction in their STEM programs" (interview, June 11, 2018).

Regarding parents as partners, the STEM/STEAM certification process includes feedback from parents. The DOE is interested to know how STEM/STEAM learning affects home life. Cullen relates: "We hear about the positive impact from the parents of students from many different backgrounds. They say things such as: 'My child comes home and now things that we would have thrown out otherwise become building tools.' 'The kids are always asking questions about why and how.' The big change they observe is from kids sitting in front of the TV to wanting to teach their parents how to garden. STEM/STEAM education has had a very powerful impact" (interview, June 11, 2018).

CHAPTER 4 RECAP

Community partnerships are a valuable tool for building a successful STEM Lab. A few of the key points regarding partnerships as opportunities are:

- Strategic partnerships can support your vision, increase capacity, and build sustainability.
- Seek and you will find. There are endless possibilities for establishing partnerships within and outside of your community beginning with local businesses, industry, and local colleges and universities. It all begins with networking.
- Look for the win-win. Partnerships are about a mutual benefit.
- The benefits of partnerships can come in the form of grants, professional development, programs, materials, and resources.

From an in-depth discussion of external partnerships in this chapter, the focus of Chapter 5 will be your most important partners within the school: the teachers. Without a doubt, ongoing support and training for teachers fuels the STEM Lab engine.