

## STEM Guides Summative Evaluation

### 2017-2018 Evaluation Activities Report

#### Introduction

The “STEM Guides: Building Coherent Infrastructure in Rural Communities” project aims to increase students’ engagement in out-of-school time science, technology, engineering, and mathematics (STEM) activities by providing opportunities for students in rural areas of Maine to access a network of STEM resources in their local communities. These resources may take the form of events, programs, people, and organizations. Individuals in each community, or hub, served by this project act as “STEM Guides” and facilitate connections between STEM-interested students and such community resources.

During the final year of this evaluation (2017-2018), there were two main hubs operating in the Downeast/Machias area and the Oxford Hills community. As of 2017, the Downeast/Machias hub was expanded to all of Washington County. Our work in the hub originally referred to “Machias” or “Downeast,” so most of the references to this hub will use these names, with Downeast abbreviated as DE. However, some STEM Guides and partners referred to the DE hub as “Washington County,” so when quoted, that name will be used as well to describe this particular hub. This was the third year of operations for the DE hub, and the second year for the Oxford Hills (OH) hub. Over the course of this year, the evaluation team conducted phone interviews with a sample of DE and OH partners, as well as with select MMSA staff and STEM Guides from the Dexter-Dover-Guilford (DDG), Central Lincoln County (CLC), DE, and OH hubs. This report highlights the findings from these data collection efforts, and provides some summative reflections guided by our evaluation research questions.

## Evaluation Questions and Methods

In order to evaluate the effectiveness of the STEM Guide program, the summative evaluation team has focused on three evaluation questions:

- 1) Have the STEM Guides – using the STEM Resource Bank – been successful in connecting youth in their communities with a coherent pathway of STEM experiences?
- 2) Has interaction with STEM Guides significantly boosted youth's and parents' awareness and utilization of out-of-school STEM programs and resources available to them? If so, how has this changed them and the STEM-related choices they make?
- 3) On a systemic level, how have communities changed in terms of their collective ability to identify and deploy STEM resources to meet the needs of many more students and their families? Has youth participation in STEM-related out-of-school activities at least doubled over a 3-year period?

To begin to address these questions, the evaluation team employed a mixed method approach to data collection, including compiling data from student surveys and partner interviews in the various communities, with STEM Guide and MMSA staff interviews. The survey data collected over the course of this project informs our evaluation of the extent to which students across the hubs are involved in out-of-school STEM activities and the degree to which they were aware of STEM Guides' services toward the beginning of the program in their communities. Partner interviews help address the third research question regarding communities' collective abilities to provide resources for students interested in STEM-related out-of-school

activities, and STEM Guide and MMSA staff interviews provide insight into all three evaluation questions.

### Changes in the STEM Guide model

Over the past five years, the model for the STEM Guide program has changed so that instead of the one-size-fits-all program that had originally been proposed, the current model allows each hub's STEM Guides to work within a more tailored, community-specific model that takes into account the dynamics of each community and its existing resources. As a result, the focus of the evaluation has also shifted such that it has not been realistic to apply the same evaluation questions within each hub, and quantify the impact of the STEM Guides on students' out-of-school STEM engagement. This final report will outline data collection over the course of the project and provide summative reflections on what the data reveal about the trajectory and outcomes of the program.

## Data

### Student Surveys

Student surveys were originally intended to be administered each year in the operating hubs, but difficulties in coordinating with the schools and ensuring effective administration necessitated a change in this plan. Baseline and follow-up surveys were administered in the first two hubs (DDG and CLC); however, changes were made to the surveys between the two administrations that made some comparisons difficult. Surveys in DE and OH could only be administered once. Descriptive findings from those surveys are discussed here.

In the DDG hub, there was no difference in results between the two survey administrations in motivation for STEM areas, as illustrated in Table 1. Motivation measures

consisted of four questions: 1) I like [STEM area]; 2) I am good at [STEM area]; 3) [STEM area] is useful for solving everyday problems; and 4) [STEM area] is boring (reverse-coded). For each content area, we combined the four questions about the subject and calculated the mean motivation score, provided at least three of the four questions were answered.

**Table 1. Dexter Dover Guilford motivation for STEM scales**

	Time 1 Mean (SD)	Time 2 Mean (SD)
Motivation for Science	2.42 (0.54)	2.40 (0.53)
Motivation for Technology	2.57 (0.48)	2.56 (0.47)
Motivation for Engineering	2.20 (0.54)	2.21 (0.51)
Motivation for Mathematics	2.40 (0.60)	2.31 (0.61)

*Note. 1 = Disagree, 2 = Not sure, 3 = Agree*

Between the two survey administrations in DDG, there was a slight increase in percentage of students who had heard of a STEM Guide (18.2% to 24.3%). The top two future career aspirations for DDG students remained the same across survey administrations: medical treatment fields (doctor, nurse, physical therapist, vet); and military, police, or security officer.

In the CLC hub, there were similar findings across the two surveys. Motivation for STEM content areas remained the same (see Table 2), and an increase in students' familiarity with a STEM Guide was apparent (7.7% to 18.0%). The top two career aspirations for CLC students at Time 1 were artist (writer, dancer, painter, singer, actor) and medical treatment fields (doctor, nurse, physical therapist, vet). At Time 2, the top answer was "I don't know," followed by artist and medical treatment fields.

**Table 2. Central Lincoln County motivation for STEM scales.**

	Time 1 Mean (SD)	Time 2 Mean (SD)
Motivation for Science	2.45 (0.56)	2.47 (0.50)

Motivation for Technology	2.61 (0.45)	2.61 (0.43)
Motivation for Engineering	2.21 (0.54)	2.25 (0.51)
Motivation for Mathematics	2.40 (0.60)	2.33 (0.58)

*Note. 1 = Disagree, 2 = Not sure, 3 = Agree*

As mentioned earlier, the difficulty of administering the surveys to students in the hubs prevented us from continuing with annual surveys to the students. As such, the DE and OH hubs only had one survey administration, which occurred in representative schools and grades, rather than across all schools in the hub serving grades five through 12. Therefore, because of this change, and the alterations made to the survey between Year 1 and Year 2 for DDG and CLC, no summative conclusions about the impact of the STEM Guides program can be made using the surveys, and they should only be read for descriptive information.

In the DE and OH hubs, motivation scores were similar to the other two hubs (see Table 3). In OH, 18.8% of students surveyed reported hearing of someone called a STEM Guide, whereas in DE, 15.5% of students had heard of a STEM Guide. The most popular career aspirations for OH students were in the medical treatment fields, and artist; in the DE hub, the top career aspirations reported by students were in the medical treatment fields, and as a farmer, rancher, logger, or fisherman.

**Table 3. Downeast (DE) and Oxford Hills (OH) motivation for STEM scales.**

	DE Mean (SD), <i>N</i> = 129	OH Mean (SD), <i>N</i> = 610
Motivation for Science	2.42 (0.50)	2.47 (0.47)
Motivation for Technology	2.61 (0.48)	2.61 (0.43)
Motivation for Engineering	2.13 (0.49)	2.44 (0.47)
Motivation for Mathematics	2.19 (0.64)	2.32 (0.59)

*Note. 1 = Disagree, 2 = Not sure, 3 = Agree*

## Partner Interviews

*Oxford Hills.* Four representatives from partner organizations in the OH hub were interviewed by Maine Math and Science Alliance (MMSA) staff between December 2016-March 2017. OH partners were interviewed again in July-August 2018 by EDC staff; however, only one of the originally interviewed partners participated in the second round of interviews.

The partners interviewed by EDC varied in the level of involvement they reported having with the STEM Guides program. One interviewee provided direct programming to students, one served on the board of a location where STEM events took place, and two individuals supervised STEM Guides. All partners described Oxford County as being a very rural area, but having a relatively diverse set of businesses that could contribute to STEM education resources. For example, partners mentioned machine shops, manufactured home building, 4-H Camp and Learning Center at Bryant Pond, Roberts Farm afterschool and summer programming, and the University of Maine as resources for students interested in learning more about STEM areas. Nevertheless, the vast geographic area covered by the OH hub, which include eight contiguous towns within Oxford County who send their students to the Oxford Hills regional middle and high schools, means that transportation to and from specific events and activities is an issue. Even if students are interested in attending a particular event, attendance still may not happen. In a regional school district that covers eight towns, a family may live 40 minutes away from an activity, and there are no buses that run across the entire district. As one partner explained, “The program has appealed to a number of kids, and a variety of kids. Not just the kids interested in STEM, but it’s actually opened the door to some kids who didn’t think STEM was exciting. The greatest limitation is getting them there and getting them home.” This limitation means that there

is not necessarily one place that many students go to for STEM activities, but a handful of places where select kids will attend programming, if it happens to be closer to their house or school.

Interviewed partners spoke about the successes of the program with activities such as the Junior Solar Sprint program that was enabled through STEM Guides funding; an astronomy club that utilizes a new observatory slated to be relocated to Roberts Farm; a drone program run through the University of Maine at Augusta; 4-H camps; the ELLMS (Environmental Living and Learning for Maine Students) project that provides summer camp and nature-based experiences for students; Teen Science Cafes; and the relationship between the local land trust and the school district.

Overall, partners had a positive experience with the STEM Guides program, and hoped that even with the funding coming to an end, programming could continue in the area. All partners saw the STEM Guides as a valuable resource in their community, and felt that MMSA “had their hearts in the right place” and helped the community see that this program can be a benefit for students. One partner described a feeling of being micromanaged and having the level of communication requested by MMSA to be “a little cumbersome;” however, even where there were struggles with communication, one partner still felt that overall the STEM Guides program was “a net gain” because of the number of individual students their organization was able to reach, and the programming that was developed as a result of the partnership.

*Downeast.* Seven partners from the Downeast hub were interviewed by EDC; however, the notes file from one of the interviews became corrupted and was lost. Therefore, data from six of the interviews will be reported here. All six partners are members of the Hub's Partners Council, which was called the Downeast STEM Hub Advisory Committee and in 2017 became a source of members for the STEM Guides Downeast STEM Learning Ecosystem. This collaboration among schools, afterschool programs, businesses, universities and STEM-related organizations works with the STEM Guides to identify and support STEM opportunities for students in the Washington County area. All partners had a solid understanding of what the STEM Guides program entailed, but they varied in their level of involvement. One partner was a supervisor to a STEM Guide; five partners saw themselves more as "intermediaries" and in administrative roles for coordinating STEM Ambassadors, a related, statewide program between 4-H and the University of Maine system, which the STEM Guides project supported in Washington County, or their own staff. One partner reported playing "a pretty minor role" in just being the voice of for-profit businesses and their role in the program; they did not provide any programming.

Partners generally reported having a positive relationship with STEM Guides, although one partner said they only worked with the 4-H STEM Ambassadors program, not with the STEM Guides. Two of the partners reported being "familiar" with them, but not necessarily working closely. One, as mentioned previously, supervised one of the STEM Guides and therefore interacted on a daily basis, and another reported only interacting with STEM Guides through the advisory meetings.



Most partners agree that the Downeast community has some STEM education resources, mostly surrounding the natural resources present in the area. Such industries as the fishing industry, forestry, conservation land, aquaculture areas, and 4H provide a solid exposure to STEM experiences; however, this is just one particular area of science that is present. As one partner noted, “we have a shortage in medical areas and jobs that aren’t being filled.” The Maine Cooperative Extension 4-H program is viewed as one of “go-to” spots for resources, but communicating what opportunities are available can be difficult. One partner reported, “My daughter doesn’t always get a handout from school about stuff that’s going on, so hearing about some of the activities as a parent didn’t always happen. Some of the things I found out about after the fact.” Also, competition with other activities afterschool (e.g., athletics) is an obstacle to getting more students involved with out-of-school STEM activities.

Despite the obstacles and limitations of being in a rural area, four of the partners believe the number of STEM activities available in the DE hub have increased since the STEM Guides started working in their community. One partner referred to the STEM Guides as “the catalyst” to bringing more activities such as game nights, weekend events, and coding events, as well as more community partnerships, such as expanding the Downeast Institute’s STEM work, and working with the STEM Ecosystem and Axiom Education & Training Center. They were not able to say whether these developments came as a result of the STEM Guides program, but the increase in STEM awareness and activity in the community happened over the same time period as the STEM Guides’ work in the hub.

Consistent with other hubs, the nature of being in a wide-reaching, rural area such as Washington County means that transportation to activities is a real issue and obstacle to many

students' involvement in out-of-school STEM events. One partner pointed out, "It's 200 miles across the county in very simple rural areas, no public transportation. Many low income families don't have transportation, so that's one of the big barriers for the kids." A high level of poverty also means that fee-based activities will exclude some interested students. The Downeast Institute offers scholarships for their summer camps, and EdGE afterschool programs are free for students – busing is also provided – so those programs are well attended and growing in popularity. Another partner raised the issue of increasing the relevance of STEM for families, "I think part of the issue is that they're not sure how STEM activities fit in the real world. Our lobster industry is huge, so we need to be able to connect to the woods, the ocean here. We've connected to the conservation trust, could do more with the blueberry and lobster industries. It needs to be more education around aquatics."

This idea of connecting STEM more to local industries and increasing the relevance to families who may have previously been disenchanted with education and school resonated with another partner. They praised the involvement of Axiom in the STEM Guides program, and helped increase the perceived importance of adult education. Even though the STEM Guides program was geared toward 10- to 18-year old students, raising awareness of the importance of education and STEM work has necessitated buy-in from the community and families, not just students. "The fact that Axiom has done what people need with the goal of getting a lot of people who never finished school...and getting them to a place where they can fill the gaps of the trades... They take people where they meet them, and they move them along the continuum of education and the workforce. They also teach some of those soft skills (be on time, show up, work even if you don't like your supervisor)."

When asked what else they would like to share about their experience with the STEM Guides project, four of the partners mentioned their concerns about the sustainability of the initiative. One partner stated, “I think we would definitely continue it if we had the resources for it. We definitely believe in the importance of this type of education in the world today, so that’s something.” They continued, saying, “The partnerships have been great. We’ve all learned from each entity, but it’s been a great partnership. I’m just sorry it’s ending. If you’re forward thinking, you know these are the fields that are really growing and are really important... but in this area, the resources are lacking, even compared to southern Maine. It’s all about the money, unfortunately.” Another partner lamented, “With everything, I’m concerned about the funding. How are we going to keep the STEM Guides? Where the funding going to come from? I hope we’ll be able to continue.” Another partner expressed disappointment in not being able to continue: “I think the one piece that was missing for us was conversation around the sustainability, how we keep this work going. We knew it was a 3-year project, but we kept thinking and hoping someone would step forward and help us continue and come up with a plan... That was a little disappointing or frustrating. We were thinking there would be a time we would all sit down and brainstorm. But it’s just coming to an end.”

#### STEM Guide Interviews (Recruitment, training, perceptions of sustainability)

Due to the relatively small number of STEM Guides in each hub that were interviewed, interview data for DDG and CLC STEM Guides will be discussed together, and DE and OH STEM Guides’ responses will also be aggregated, in order to preserve the privacy and confidentiality of each respondent.

*Dexter Dover Guilford and Central Lincoln County.* Three STEM Guides from the DDG and CLC hubs were interviewed between April-May 2018. STEM Guides for these two hubs worked for MMSA and were already working for the organization before the STEM Guides project began, or were brought on by current STEM Guides to help establish clubs and other activities in the hubs. All three had classroom experience teaching science and/or math, but only one had experience in youth development before their tenure as a STEM Guide. Two of the STEM Guides had relationships with community partners before becoming a STEM Guide, but only peripherally since they had been living in the area already. Formal working relationships were not established until after becoming a STEM Guide.

All three of the STEM Guides described their community's STEM education resources as in a better state than it was before the program began. The CLC hub was described as "highly nature-based" that allows for outdoor experiences for students, but not as many technology industries or physical science and engineering firms. The DDG hub has some camps and internships available for students, and other activities outside the area. "There was a lot that we discovered that was hidden. People are more aware of it, more stuff in Orono, Waterville, and maybe further afield that parents weren't paying attention to until they realized their kids were interested in it."

The STEM Guides felt they were successful in connecting students to STEM education resources, but all three wish they could have done more. One STEM Guide said, "I can see there's more out there than there was before. Did we help start something? Maybe there are new players now that are helping get things going, maybe we planted a seed and it just took a while for it to come together." Another STEM Guide reflected, "We have gotten students to get out of

their town and interact with the larger world in a STEM way...however, there's always more to do. It's less an issue of culture now than it used to be. It's more economic-based, if you will."

Finally, a third STEM Guide spoke about how there were small successes, but successes nonetheless. "I know some kids were connected to opportunities that they wouldn't have been connected to otherwise. Some were able to explore pathways that they didn't know existed before." This was also reflected in how the STEM Guides perceived changes in the community's awareness of STEM resources in the hubs. One STEM Guide commented that it did not seem to be just in the hub that was more aware of STEM, but across Maine, and even the nation.

"Everyone is more aware of STEM and what it is. I think people know the acronym better now and see the importance of it." Another agreed, saying "I think a lot more people are aware of [STEM] and may ask about it. I feel like now if you just say the word 'STEM' they know what it means." STEM Guides were not sure whether this increased awareness is due to their efforts or not, but either way, they applauded the change.

When asked about the challenges of connecting students to STEM experiences, four main themes were raised by STEM Guides. First, STEM Guides discussed how a general awareness of what STEM entails and what opportunities are available impacts students' connections to resources. "The whole point of the project was helping them find a path. That's a lot of it, showing them, 'What are the possibilities?' We don't have science museums, universities nearby. We have associations." Second, with the small school populations, there is a lot of competition for attention, between scouts, sports, music, etc. "There'd be room for everyone to do different things, but here, it takes a while to get something on their radar and get them to take a chance on something that isn't well known." Third, as alluded to before, there are some local

industries, but the technology and physical science industries are located outside of the hub, making it difficult to generate interest in attending opportunities at those organizations; transportation becomes an issue. Finally, the lack of exposure to various STEM careers results in a lack of understanding of the relevance of STEM to students and families. “If you don’t know something exists, how do you know you want to do it? We made a strong effort to do things like Teen Science Cafés and bring people into the community to increase that exposure.”

Moving forward, STEM Guides feel strongly that in order to keep the initiative successfully moving forward, partnerships with schools are imperative, since that is where the largest target audience is; especially in rural areas, it is difficult to gather students anywhere unless it is at a sporting event. As one STEM Guide cautioned, “Building a positive relationship with the administration and teachers is pretty important. It can quickly turn into a competitive thing if schools get defensive that they’re not doing a good enough job teaching students.”

In addition to establishing strong relationships with schools, one STEM Guide recommended maintaining the strong networks that have been established, both inside and outside the hub. “[Making connections between students and STEM resources] is becoming more of a habit as opposed to an effort. It’s become second nature to try to connect people. I think we’ve gotten the reputation of being that agency that can push out good stuff.” Having said that, there is also the realization that a cookie-cutter approach to establishing a hub does not work. Some hubs may have wonderful local STEM resources that can help with the effort, but if there is a dearth of resources, things may have to be developed separately. Finally, when establishing hubs, one STEM Guide reflected that the turnaround time for seeing progress is

closer to five years, instead of the originally slated three-year program. Patience and persistence are key in the development of a functioning hub.

Respondents were asked to rate their overall experience as a STEM Guide. All three rated it highly, saying that “it has been wonderful,” “really fun,” and it was “an excellent opportunity to know my community better.” One STEM Guide reflected that having it be your own community was necessary, but also frustrating, and that one should remember to not take things personally when things do not work out. This STEM Guide particularly enjoyed the feeling of seeing kids get excited about topics and want to pursue more opportunities. Another STEM Guide felt that the number of hours allocated to the STEM Guides were not enough to do things in a timely way. The time it took to engage in networking, which was a major focus of the STEM Guides project, took up a lot of the hours each week and should be taken into account if and when this program is continued. Having a funded position for a STEM Guide, and not relying on volunteers, is also seen as a necessity. “When this goes away, there isn’t one person that is left to lead the charge. You need a local champion and honestly, they tend to not be retired people who want to do this. They are people in the prime of their profession and taking any quantity of time away from that costs them. If there was any kind of funding available for hours, that might actually work better.” Finally, a STEM Guide suggested that offering actual programming and hosting events they pulled together themselves saw more sustainable success than just pointing out resources that others were providing. “The model itself was really interesting, what it is attempting to do. It has tried out so many different things, so we’ve learned a lot about what doesn’t work, as well as what works...The one-offs weren’t as successful. The repeat contact events were most effective.”

*Oxford Hills and Downeast.* Five STEM Guides from the DE and OH hubs were interviewed between April-June 2018. Unlike the DDG and CLC Hubs, STEM Guides in the DE and OH hubs did not work for MMSA, but were hired by 4-H or Axiom Education and Training Center. Two respondents were high school science teachers before their work as STEM Guides, one is a scientist with a background in fisheries conservation, and two had experience working with students in formal and informal education settings in Maine. All five had experience working with youth, including one working at Roberts Farms with at-risk, middle-school-aged youth; one as a county program coordinator for 4-H; one incorporating environmental education in their work with summer campers; one having multiple masters degrees in family therapy and counseling, and education administration; and one working with youth through Americorp, CityYear, and the Young Heroes program. Three of the STEM Guides had connections to local partner organizations when they first started their work. The other two were relatively new to the area and did not have many connections beforehand. The partners established relationships with the Bryant Pond 4-H camp and other 4-H offices, Axiom, Maine Machine, and Roberts Farm.

Responses were somewhat mixed when asked about the STEM resources available in the DE and OH hubs. Three STEM Guides used the words “limited,” “lacking,” and “disconnected” when describing the resources. They continued to explain that it seems that “the resources are there, but it’s a matter of making them available to more students.” The other two STEM Guides interviewed from these hubs spoke about how awareness has increased in the communities, resulting in more support and opportunities available. “I think the resources have always been there, but awareness has increased. Oxford Hills is lucky in the variety of opportunities available for youth. They have an invested community, but having industry in the area has helped with the



STEM side of things.” Working with partners who can help students build a racecar, build and program drones, give astronomy lessons and set up telescopes in an observatory at Roberts Farm, study various ecosystems at a nature preserve, teach kids about being first responders, and other STEM opportunities have enabled STEM Guides to connect students with content in which they are interested in their own communities.

Nevertheless, while these opportunities are available in their communities, the communities themselves are extremely large geographically, and once again, as in the other hubs, transportation is an issue. One STEM Guide lamented, “We have a great resource on Beals Island and the Downeast Institute. But that’s an hour away from everybody, so getting students there is difficult. We have great resources here in Machias, but there’s always room for improving access. Machias isn’t a central hub, it is so geographically dispersed that it makes it difficult.”

In addition to transportation and awareness of resources, STEM Guides cited things such as poverty, understanding what a STEM career looks like, and unwillingness to try new things as challenges to getting students to become involved in STEM opportunities outside of school. One STEM Guide pointed out that “there isn’t excess money to pay for things like summer camps or thinking of going to college.” Related to this idea is that some students assume they will work in the fish industry like their fathers and grandfathers. As one STEM Guide said, “We’re trying to change hearts and minds so they know that they have other options.” Another STEM Guide further explained that there is “a general lack of understanding (not just students, but with parents, too) of what a STEM career looks like. A lot of parents don’t see those opportunities, they don’t see working for a blueberry company as a STEM career, but there is so much

technology involved that it is a STEM career, and it could be a very lucrative one...Eliminating those types of [misconceptions] is what we tried to do as STEM Guides.” Another factor that a STEM Guide raised was that since parents do not believe that there are STEM careers in their geographic area, if their children become well educated, or pursue a STEM career, this means they will leave the area. This furthers the resistance of parents in letting their children engage in STEM activities. Finally, one STEM Guide suggested that a challenge in getting students to engage in STEM activities outside of school is the lack of interest to try new things, especially before high school. Once they reach high school, there are more opportunities for students because of the tech school (e.g., building race cars, automotive, culinary school), Roberts Farm, and Bryant Pond, “but from 8<sup>th</sup> grade and down, the opportunities aren’t there... The willingness to try new things is tough.”

The STEM Guides were asked what they thought the most important things MMSA should bear in mind to successfully move the project forward. One suggested using STEM kits – similar to those available through the 4-H program – for distribution to students, teachers, and families, as well as continue the Teen Science Cafés but allow them to be more youth-driven and organic, as opposed to limiting it to just content about one STEM-related career (e.g., Oxford Hills held Teen Science Cafés highlighting first responders). Another STEM Guide felt MMSA had done a relatively good job of getting as much information as they did, out to such a geographically spread out area, but that moving forward, students need to be connected to existing opportunities in the area. “There aren’t a lot of opportunities out there – we were creating them. We couldn’t just talk to a group of students and get them involved in something. We had to work to put something on for them.” Without funding for a particular STEM Guide

position, it will be difficult, as other STEM Guides acknowledged. One STEM Guide suggested getting the program to be part of the school curriculum or culture. “We sign out for a space in the building, but we don’t talk to the administration about what is happening. It would be really good to share that, the feedback from the kids, even pictures from events.” The evaluator notes that having the STEM Guides program linked with the school curriculum could negate the project’s focus on out-of-school STEM activities, but recognizes the importance of having school buy-in to help recruit and retain interested students.

All five STEM Guides rated their experiences highly. One said they would “rate it as high as I could. I never had the opportunity to do something quite like this. I’ve gotten to make connections with a lot more kids than I had in the past.” Two other STEM Guides agreed with enjoying the connections they were able to make with kids and helping them find STEM activities they enjoyed. The other two STEM Guides reflected on how they enjoyed working with people in the community, and having the opportunity to connect students with professionals in STEM fields in their areas.

When asked about any aspects of the program they might change, two Guides suggested loosening the requirement of only having it encompass out-of-school time. One STEM Guide said, “It would have been nice if we could have worked directly with teachers. There is not a lot of time/resources for authentic STEM learning in the schools.” Another suggested being able to hold Teen Science Cafés during study hall or other opportunities during school would increase turnout. With the grant ending, perhaps this restriction could be loosened, if the schools agree.

As mentioned earlier, it was reported that programming went well when STEM Guides developed opportunities for students, as opposed to trying to find existing activities in the

community. This was repeated when asked what STEM Guides would change about the program. At least two STEM Guides felt that they wanted the flexibility to develop programs tailored to the community and student interest. Not only would this allow for more student-centered programming, but it would also allow STEM Guides to provide input on what kinds of opportunities would be appropriate for their particular area. For example, regarding MMSA's research on the first responder program implemented in one hub, a STEM Guide noted, "[MMSA] wants to come in and watch a student for three hours to see what they do. That's fantastic, but you're going to need to put on a bullet proof vest and go out in a cruiser to observe them... There aren't that many stations that want observers. Things like that they don't necessarily know or realize."

While some STEM Guides complimented MMSA on the flexibility they were afforded to develop programs and tailor experiences to meet the needs of the community, at least two respondents complained about the level of communication and guidance they received from MMSA. Interestingly, one STEM Guide felt that they were micromanaged during the process and had to field phone calls each week from several people involved in the grant, when ideally they would have just worked with one point person. This STEM Guide was quick to say that they thoroughly enjoyed the people with whom they worked, but felt the number of contacts they had to maintain was inefficient. On the other hand, another STEM Guide felt that they sometimes did not know what they were expected to do. "I'll make anything happen if I know about it, but sometimes things wouldn't be communicated well enough for me to do my job. So there were times that weren't a lot of fun."

Related to the theme of communication, one STEM Guide recommended having more face-to-face or Zoom meetings with other STEM Guides – either active Guides or those from the past. “We had only one face-to-face and it was really powerful. It made me see how things should or could go, to be able to sit down and brainstorm.” Sharing resources or ideas would be a useful tool between STEM Guides, and if those from the past are included, lessons learned could be shared as well of activities that worked well and those that did not necessarily work.

*MMSA.* Two MMSA staff were interviewed in May 2018 and provided their perspective on the STEM Guides program, the changes it has gone through over the years, challenges and successes, and their vision for the future of the project. They both acknowledged the growing pains that the project has gone through over the years, but feel that overall the STEM Guides program has been a success. Some of the bigger changes that occurred over the life of the program were the approach to who STEM Guides would be and from where they would come, and from where the STEM opportunities in each community would come.

At the beginning of the project, it was believed that the STEM Guides would be retired professionals living in the communities that had STEM connections and would volunteer their time to be the liaison between students and the STEM resources in the hub. It was discovered that the kind of work required of an effective STEM Guide was not something that a retired person would or could do, but a role for which an active professional would be well suited. As one person said, “Paying someone means that you respect them and there are expectations that need to be met on both sides. Making that into a legitimate paid job was important.”

Once STEM Guides became paid positions, the question of who would employ them came up. In the first few hubs, STEM Guides were employed by MMSA, which meant that there

was closer control over what was happening and how things got done. However, this also came at a cost of what happened once MMSA left a hub. Sustaining STEM Guide activity in those hubs became difficult, and highlighted the need to work with what one respondent called “institutional champions” and have STEM Guides employed by people “on the ground” in the hubs. In the last two hubs, STEM Guides were employees of partner organizations. This made it more difficult to monitor the status of the STEM Guides’ work in the hubs. As mentioned earlier in the partner interviews, the balance of micromanaging the process when it was out of MMSA’s hands and allowing the STEM Guides to have the flexibility and authority to run and organize programs may have sometimes been difficult to achieve. In addition to not directly managing STEM Guides’ time and efforts, one respondent pointed out that “if a partner hired the STEM Guide, it was harder for MMSA to say something wasn’t working out” when expectations were not being met. It is too early to say whether the transition in these communities will be smoother than in the earlier hubs once MMSA leaves these latter communities.

Another major change that occurred to the STEM Guides model over the course of the project, was how the role of the STEM Guides themselves changed from being a STEM resource or educator to more of a youth development professional and manager of partners within the communities they serve. STEM Guides originally were meant to connect students to existing resources and opportunities in their communities, but often these opportunities were more informal in nature, and needed to be developed more. One respondent reported that the STEM Guides were now viewed more as STEM “brokers” such that their role has expanded to not just working with students, but also with institutions and community members to get them engaged in out of school STEM learning. In some situations, they are providing and doing the activities

themselves, or they may be helping others do them, or providing extra resources. “We learned the importance of listening to [the community’s] needs and capacity, rather than going in with an eye toward ‘fixing’ them. You can’t broker in a vacuum of completely informal opportunities... There was a continuum of opportunities that we provided, to help bridge formal and informal activities.”

MMSA staff were asked about the successes of the STEM Guides program with which they are particularly pleased, and how their definition of “success” may have changed over time. While one respondent said that they had hoped at the beginning of the project that 50% of the students would have one STEM encounter, most of the students have had two or more encounters. Nevertheless, both respondents talked about moving beyond just numerical goals and metrics to gauge success, and identifying evidence of meaningful relationships and connections with the community. “An indicator of success is still numerical,” one respondent explained. “You know a STEM Guide isn’t doing a good job if they’re not reaching that many kids. But it’s not the only metric. You know a guide is being successful if you hear that they’re talking to people in the grocery store. Or they don’t think to tell you about when the principal offers to move basketball practice for STEM club. When they take their own skills and impact for granted [that is a measure of success for us].”

Another identified success of the project was the partnership that was established with 4-H. One respondent mentioned that the business partner model in the DE hub was one of the most effective of the whole project, and the last two hubs were largely chosen because of the presence of 4-H. Axiom was also present in the community and knows a lot of people, but their focus is more on adult education, not on K-12. However, although “4-H is a good institutional partner in

both the Machias and Oxford Hills hubs, the STEM Guide model wasn't nuanced enough because 4-H is present in some communities but not in others." Therefore, once again, a cookie cutter model for the STEM Guides project would not work designed around a 4-H partnership because they are not necessarily in all communities.

Finally, one of the respondents discussed ongoing successes with the project, namely in one of the first hubs: DDG. As discussed earlier in the STEM Guides' interviews, some of the early efforts to increase student engagement in STEM activities, and establish programs in the community took a lot longer to establish than anticipated. It is only now, five years after the hub was operating, that some of these efforts are coming to fruition. "In the DDG hub now, we helped to get something going and it's exciting to see how, even though we haven't been there for two years, the momentum continues to build. The successes we've heard about libraries starting programming, schools being more open to certain opportunities, I think a lot of those have to do with the STEM Guides project having made those investments."

The MMSA staff were asked about challenges they encountered in the STEM Guides implementation. In addition to the already-discussed challenges around transportation and lack of awareness of opportunities, MMSA staff talked about challenges with the partnership model, and with the different communities in which they operated. It appeared that in many cases, the strength of the partnership in the hub determined the success of the hub overall. As one respondent noted, "Not all institutional partners are created equal." In the CLC hub, it was a struggle to get partners to "get out of their own boxes" and work with other institutions to provide opportunities for STEM learning. In other hubs where key institutions already had good



working relationships with youth development organizations, providing opportunities was much easier.

In the OH hub, a “Partners Council” was attempted, but ultimately did not work because the partners were only accustomed to coming together to address specific topics or projects. Trying to facilitate broader conversations about STEM interests and youth development was not effective at all and the council was eventually dropped. However, the camp and school system in OH have been able to do some work together to establish a drone and coding program. The Partners Council was more effective in the DE hub because the key partners there worked well together.

Another challenge MMSA faced was within the communities themselves. It has already been discussed how the varying needs and nuances of each community necessitated a shift in the STEM Guides model, such that a cookie cutter approach was not going to work. The respondents talked about the need to get to know the community and its needs, in order to provide the best kind of programming that would appeal and resonate with students and families. Relevance was a key theme in discussions about what kind of STEM opportunities should be pursued in each hub. Even the shift to hiring STEM Guides through the local partner organizations and not through MMSA in Augusta reflected this effort. However, even these changes sometimes fell short, as explained by one respondent. “We were told a lot about how important it was to fit in, go there, but they think of Augusta as the place where all the people wear suits. We went there, and tried to really listen, but it’s hard to not be outsiders. And we’re double-outsiders; most of the people on this team are from ‘away.’ So not only do we not live in Machias, but we’re not

‘from’ Maine. We have rapport with them, but it’s not the same. It would take a lifetime to really fit in if we lived there. Do you need to live there to be effective at an intervention?”

When asked about how they envision the STEM Guides program moving forward after the conclusion of the funded project, the MMSA staff were reflective and had clearly had internal conversations about how this initiative could be scaled up and/or transferred to different settings. One respondent wondered how this kind of model would work in other rural areas, such as Pennsylvania’s “fracking country” or in rural New Mexico. Alternatively, would this model translate to urban settings where there are high populations of underserved students and families, but perhaps untapped resources and opportunities in STEM fields in the community?

Related to the idea of identifying other communities in which a STEM hub could be successfully established, MMSA staff wondered about the process of how future hubs would be identified and selected. It has already been discussed how efforts to increase awareness of and opportunities to engage in STEM activities took nearly five years to establish in early hubs. One respondent wondered whether it would have been more effective and easier if the community had been farther along in establishing STEM opportunities for students as a priority. “Could a more competitive process for hubs have worked better? Are there indicators we could identify that would help predict the more successful hubs?” Identifying which hubs want and seek out a program like STEM Guides would obviously mean a self-selecting population that would probably be more likely to be successful. However, the evaluator notes that the communities in most need of such programs are not always the ones who seek out such opportunities, so the ultimate goal of the program should be evaluated when weighing these questions.

## Evaluator Reflections

The evolution of this project over the past several years has been interesting to observe, although it made our job as evaluators more difficult in the sense that the original evaluation questions that were proposed at the beginning of the project became increasingly irrelevant and impractical to measure. The shift away from an emphasis on numerical metrics of success has already been addressed in this report; however, this was also made abundantly clear during the last two years of the project when the data that were supposed to be the focus of the summative report – student surveys demonstrating the types of out-of-school STEM activities in which students were interested – were no longer collected longitudinally. Student attendance at STEM activities was another data point that was never provided, as was originally proposed. The focus shifted away from questions about whether “youth participation in STEM-related out-of-school activities at least doubled over a 3-year period,” (Evaluation Question #3) toward the role of partnerships, as well as the qualitative reports from STEM Guides themselves about how they felt the program was working in their hubs. Even questions about community and family awareness of STEM Guide offerings became secondary when families’ contact information could not be obtained for a family survey EDC developed in 2015. Families were difficult to reach, even for MMSA staff.

Three main themes emerged from the data collected from partners, STEM Guides, and MMSA staff. The first – issues with transportation to and from STEM activities – was mentioned by all of the respondents. It was not surprising to any that this was a major factor in whether students participated in the STEM Guides programs, and was rather noteworthy when transportation was a non-issue in one district because the superintendent of a district arranged

afterschool buses from the middle and high schools. Nevertheless, any activities that occurred away from the school and in other areas necessitated taking transportation into consideration. Especially in rural areas such as those encompassed by these hubs, when it can take four hours to drive across the county, public transportation does not cover the entire area, and poverty limits many families' access to cars, how students are expected to travel to and from out-of-school activities is a factor that cannot be ignored.

The second main theme in the data involves the role and impact of the STEM Guides in each hub. At the beginning of the project, STEM Guides were employed by MMSA and worked with community partners in the respective hubs. This allowed for a certain amount of oversight by MMSA on the STEM Guides' work, but made the transition out of the hubs difficult. In the last two hubs, STEM Guides were hired by community partners, which meant less oversight by MMSA and a perceived restructuring of the partner relationship. One interesting note that was raised by one of the MMSA respondents was the idea that in the DE hub, it became clear that Axiom viewed MMSA as more of a funding source than a partner, and became upset that they did not receive more funding from MMSA. Even a proposal that was drafted by MMSA for Axiom was never submitted because "it wasn't a priority for [Axiom]. There was no co-ownership as hoped for." This raises yet another challenge with having the STEM Guides employed by the partner organizations; the role of MMSA may become less clear, and possibly even less important in the eyes of the partners, unless roles and expectations are clearly defined at the outset of the partnership. However, this yields an interesting quandary in that the earlier hubs found themselves floundering when MMSA left. Here we have an example of a hub that is perhaps ready to continue programming without MMSA – pending funding – and yet there

seems to be a sense of disappointment on MMSA's behalf in not being included in future plans and priorities.

As discussed earlier, the evolution of STEM Guides into STEM brokers seems to place a high level of expectation on them. Both MMSA respondents suggested that what makes a good STEM Guide was that Guides would be so embedded in their communities and invested in the project that they would always be "on duty," even when they were running errands and presumably not "at work." One respondent compared this kind of exemplar STEM Guide with another Guide who is "good at what he does, but he's not nearly as invested in it as [another guide]. He loves the kids he works with, but he just goes home at the end of the day." The implication here is that MMSA views the role of a STEM Guide as an identity and as a community presence; more than just a job with set hours but perhaps more like a lifestyle or calling. As one MMSA respondent stated, "The real power of a STEM Guide is they're not beholden to an organization, their job is to connect across organizations. That's a valuable contribution to the field we're making."

The third theme that emerged from the data was regarding the connections STEM Guides made to schools and other institutions in the community. Over the course of the project, it became clear that even though the focus of the program was on out-of-school STEM opportunities, buy-in from the school was imperative. As one respondent noted, "It was harder when a school isn't on board. Not just to host things and help recruit for programs, but legitimizing it." If programs are held after school in the building, it is much easier for students to attend. In Oxford Hills, Teen Science Cafés were held during study hall. Although it was not out-of-school time, it was free choice; the STEM Guides in the OH hub compromised when it

became clear that tying into the school day was going to be one of the only ways they were going to get student involvement. One respondent suggested that the private school model where kids go to school, have sports in the middle of the day, and stay at school until 4:30, could allow for a STEM Guides model to be established and warrants exploration in the future.

Several individuals involved with the STEM Guides project spoke about how in rural areas, with families spread out over a wide geographic area, the schools tend to be the main gathering place and a true center of the community. School events and sports bring the community together in a way that is not matched in urban or suburban areas. This provides yet another reason why having schools on board with the STEM Guides program and model is so vitally important. If school leadership can embrace and see the value in out-of-school STEM activities, and not see it as “competition” or an indication that they are somehow falling short, the connections they can make and the opportunities that can be provided to the students through the community partnerships can be hugely beneficial.

STEM Guides can find success when connecting with area schools, but it is also just as important to connect to the students themselves and their families. This is partly what makes the role of the STEM Guide so large. This is very much a community-based job. Online research can be done to find some STEM opportunities, but as one MMSA staff person said, “it needs to be more than that. You need to meet with people face-to-face, one-on-one, getting to know people. You need to be good at building relationships with community members, institutions, families, kids.” STEM Guides suggest that is not enough to be a STEM educator, but experience in or an aptitude for work in youth development may be even more important for a STEM Guide. Having roots in a community lends credibility as well. One MMSA staff person said, “A lot of the jobs

in rural areas that involve STEM are very community based. There are very few big companies. Knowing about STEM jobs in your community, you don't have to go to school forever to get these jobs – that's where the sweet spot is. We were able to get more boys involved when we did more with technology.”

The STEM Guides program was an ambitious project with many dynamic and evolving pieces. While the program model – and accordingly, the metrics used to define success – changed during the life of the grant, there is consensus that the project has been successful in brokering connections between students ages 10-18 with STEM resources and opportunities in their rural Maine communities. The changing scope of the project was indicative of the responsiveness of MMSA to lessons learned in each of the communities, and the application of these experiences to further develop and hone the model in the next hubs. These adjustments included changing who employed the STEM Guides, the role of STEM Guides in connecting to schools and families, relying more on partner organizations to provide and sponsor programming for students, and focusing less on the impact of the program on individual students' participation in activities. The STEM Guides program contributed to the increase in STEM awareness within each community, and how the unique landscape of each hub could provide interesting and relevant STEM experiences for its youth.

## Appendix A: Partner Interview Protocol

1. Can you tell me a little bit about your organization and your community?
  - a. If necessary, probe with where is it located; what ages are the kids who are served; what kind of STEM do they offer, if any, etc.
  - b. If necessary, probe with a question about what type of organization:
    - i. A youth organization?
    - ii. A STEM organization?
    - iii. An education organization?
    - iv. An afterschool/out-of-school learning organization?
    - v. None of the above. I like to call it a \_\_\_\_\_ organization.
2. And can you tell me what you know about the STEM Guides project?
3. How have you and/or your organization been involved with the STEM Guides project?
  - a. If necessary, probe with what has been your organization's role in the project?
4. And what about you – what role have you played?
5. And what kind of relationship have you had with the local STEM Guides (*prompt: the Maine Math Science Alliance and their STEM Guides*)?
  - a. Possible probes: For example, how often do you talk? What kind of information do you share? How satisfied are you with this arrangement? The relationship?
6. How would you describe your community's STEM education resources? (*prompt: I'm thinking here of programs, exhibits, resources, out-of-school camps and activities, in-school activities, etc.*)?
  - a. Did you learn of new resources or programs because of your work with the STEM Guides? If so, what kind and which ones?
  - b. Have you referred community members (youth and/or families) to a STEM Guide (*prompt: the Maine Math Science Alliance and their STEM Guides*)? For what kind of information or referrals?
  - c. Have you seen any changes in the number of type of STEM activities since STEM Guides started working in your community?



7. Where do you think youth/families in your community have been going if they want to find *something interesting* to do in STEM?
8. So, there seem to be some good STEM education resources in your community. Do you think the youth/families in your region make good use of these resources?
9. And do you think the STEM Guides have helped families better connect to those resources?
10. What about you, have you learned about new resources or programs, or even new information, from your interactions with the STEM Guides?
11. Is there anything else you think I should know about your experience with the STEM Guides project or the STEM Guide in your community?
  - a. If necessary, probe with questions about satisfaction, what, if anything they might suggest get changed, etc.

## Appendix B: STEM Guide interview protocol

### About you:

1. How did you become involved with the STEM Guides program?
2. What kind of STEM background or experience did you have before becoming a STEM Guide?
3. What kind of experience did you have in youth development before becoming a STEM Guide?
4. How have you been able to use these experiences and your background to help you in your role as a STEM Guide?
5. Did you have a relationship with partner organizations before you came into this role? If not, how did you go about establishing relationships with partner organizations?

### Your Community:

6. How would you describe your community's STEM education resources? Has there been a change over the course of your tenure as a STEM Guide?
7. What do you think gets in the way of more youth in your community having great STEM experiences and considering a STEM career? (+ *Probe: any others? Consider physical, virtual, and people resources*)
8. Do you feel you've been successful in connecting students interested in STEM activities to opportunities in your community? If not, what kinds of obstacles have you faced in making these connections?
9. Have you noticed a change in community awareness of STEM resources over the course of your tenure as a STEM Guide? (+ *Probe: If increase, is that a function of more opportunities, or increased awareness of opportunities?*)

### Your perspective/advice"

10. What do you see as the most important things MMSA should bear in mind to make this project successful moving forward, especially after the grant has concluded?
11. Overall, how would you rate your experience as a STEM Guide? Are there any aspects of the program you would change, and why? What have you particularly enjoyed about being a STEM Guide?

## Appendix C: MMSA interview protocol

1. How has the model for this project evolved since it was first proposed? What has remained constant?
2. How have you identified and recruited the STEM Guides that are working with the hubs? What kind of professional development, if any, do you offer for the STEM Guides?
3. With what successes of the STEM Guides program are you particularly pleased?
4. How has your vision for what counts as “success” for the STEM Guides project changed over time? Is it different for different locations?
5. In your opinion, what have been some of the biggest challenges to implementing the STEM Guides project? Were these challenges expected or unexpected? What are some of the strategies you’ve used to address these challenges?
6. Based on your experience, what features in the hubs have you observed to be most important in impacting the success of the STEM Guides program? Put another way, if you had to make sure one or two critical things were included in the next implementation, what would they be?
7. Have there been any lessons you’ve learned from the earlier-implementing hubs that you’ve been able to incorporate into the models of later hubs?
8. What role has the STEM Resource Bank played in the project, and is this different from how it was initially envisioned? How have resources been identified and vetted for inclusion in the Resource Bank?
9. If you were awarded additional funding for this project, how would you use those extra resources and why?
10. How do you envision this program moving forward after the conclusion of the funded project?
11. Do you have anything else you would like to add about the STEM Guides project?