

STEM Ambassadors Summative Evaluation Report

Inverness Research

November 2018

INTRODUCTION

The STEM Ambassadors Project

The STEM Ambassadors project, funded by the National Science Foundation's (NSF) Advancing Informal STEM Learning (AISL) program, combines elements of existing programs designed to engage STEM professionals with the public around their scientific research to create a new model for public engagement of science. This new model recruits, provides training for, and assists STEM professionals in drawing on their own interests, hobbies and backgrounds to connect with audiences that may not have access to scientists (such as prisoners, senior citizens who live in senior housing, community groups who live far from museums or science festivals/events, etc.). The aim of the project is to "stretch" scientists in their view of themselves and their skills as effective science communicators, to stretch their view of audiences who can or cannot participate actively and willingly in science outreach activities, to expand the diversity of public participants in science outreach activities, and to expand these participants' view of scientists as people who care about and are invested in their communities, and their sense of themselves as people who can do and understand science research. The project also supported qualitative, case study research conducted by Stanford University on the impacts of the program on the STEM Ambassadors.

Inverness Research Role and Data Collected

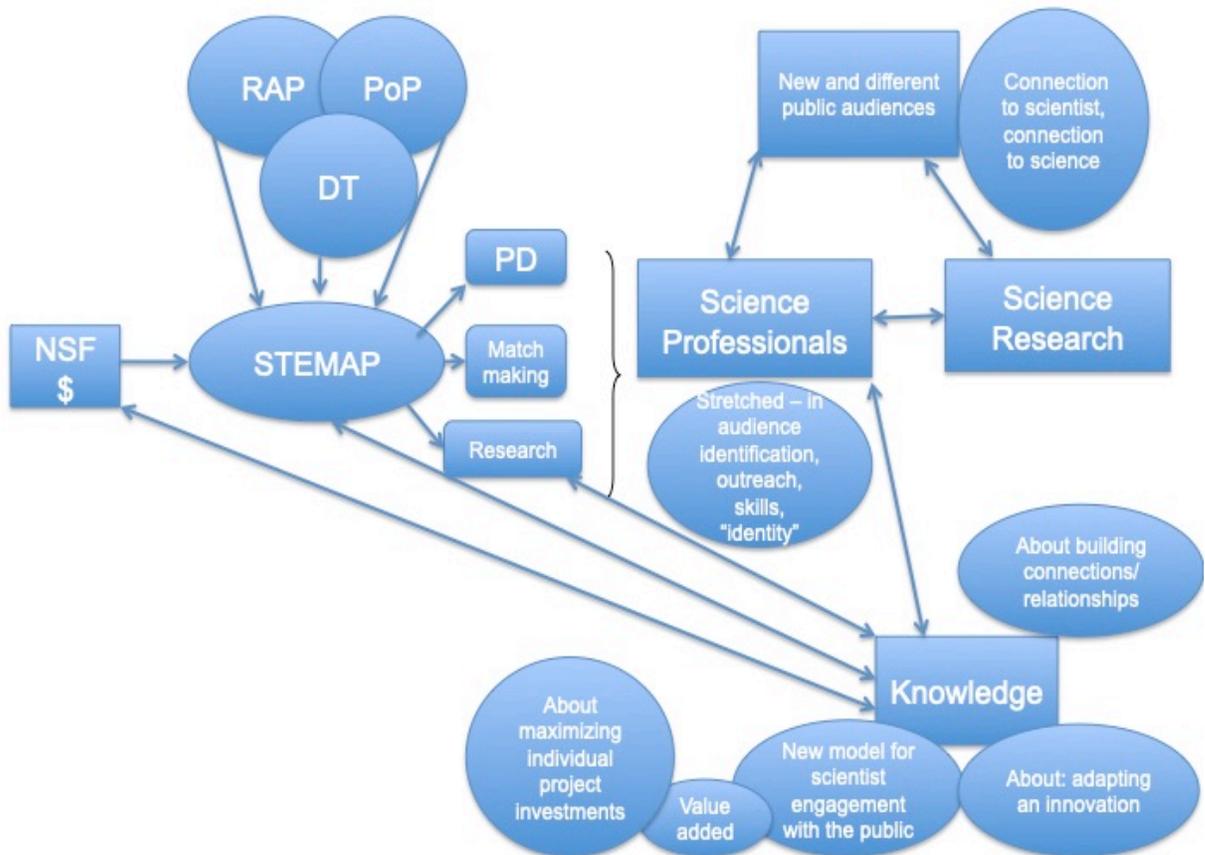
Inverness Research has served as the external evaluator for the project, providing developmental and summative evaluation. Because the Stanford Research was qualitative, Inverness focused on collecting largely quantitative data supplemented with interviews to study the reach and impact of the project on the participating STEM Ambassadors, on the communities and focal groups, and on the dissemination/scaling pilot efforts that were funded through a supplemental award. Over the course of the project, we have collected the following data:

- pre-post surveys of STEM Ambassadors, for the 2016, 2017 and 2018 cohorts, and for the online and University of Washington cohort
- post-workshop surveys administered to the 2016, 2017 and 2018 cohorts, and for the online and University of Washington cohort
- post-workshop survey administered to the participants in the Ecological Society of America (ESA) STEM Ambassador workshop
- telephone interviews with community representatives whose organizations hosted 2016 and 2017 STEM Ambassadors

- telephone interviews at the end of their involvement in the program with a sub-set of 2017 Ambassadors (the rest were interviewed by the research team)
- participant feedback forms collected from focal group members at STEM Ambassador engagement events

Theory of Action

Early on in the project, Inverness Research worked with project leadership and key advisors to develop the theory of action diagram below, which displays the flow of project work and its intended outcomes for key audiences and the broader field.



The National Science Foundation invested funding in the STEM Ambassador program; that funding aimed to create a new model for engaging scientists with the public by combining elements of three existing, successful programs/models: Portal to the Public (PoP), a network of informal science education institutions that provide training and support to scientists to engage with the public in informal STEM education settings through inquiry-based activities; the Research Ambassador Program (RAP), a program at the University of Utah which encourages scientists to

interact with non-traditional public audiences; and Design Thinking, which encourages empathy and deep knowledge of users/communities. Following the theory of action, the STEM Ambassadors program would develop a new model out of these component parts. They would provide professional development, resources and support to multiple cohorts of STEM Ambassadors at the University of Utah (and later, through supplemental funding, to cohorts at the University of Washington and online), in order to facilitate STEM Ambassadors developing meaningful connections with local focal groups and providing high-quality STEM engagement activities. The program would also conduct research on the impacts of this training on the STEM Ambassadors. The primary audiences for this work would include the STEM Ambassadors, the members of the focal groups Ambassadors engaged with, and the broader field. The potential outcomes of the project were for STEM Ambassadors to stretch their perceptions of themselves as effective science communicators, stretch their perceptions of the audiences they could effectively interact with around their science research, and stretch their skills in connecting and engaging with the public. The potential outcomes for focal groups members were to strengthen their connections with scientists in their local communities, strengthen their perceptions of themselves as audiences that can understand science research, and encourage their active participation in dialogue and engagement with scientists. The knowledge generated by the project, through project documentation, the qualitative research work, and the evaluation, would add value to the field's understanding of how to leverage existing investments to create a new model for engaging the public, how to adapt innovations, how best to meet the mutual needs of scientists and communities, and how best to improve public engagement efforts.

Key evaluation questions we addressed through our evaluation work included the following:

- What is the nature and quality of STEM Ambassadors experiences in the program?
- What is the nature and quality of focal group participants' experiences in the STEM Ambassador engagement events?
- What are the contributions of the project to STEM Ambassadors, participants in Ambassador engagement events, and community organizations that host these events?
- To what extent is a new model created, and what is the potential of that model for broader dissemination to the field?

This summative report is divided into the following sections:

- an overall summary of key findings
- a discussion of the development of the new model
- contributions to STEM Ambassadors
- contributions to communities and focal groups
- lessons learned from scaling/dissemination pilots

- a final summary

OVERALL SUMMARY OF KEY FINDINGS

Briefly, the STEM Ambassador has been a highly successful project. The project has:

- Incorporated key elements of Design Thinking, Portal to the Public, and the Research Ambassador Program to create an integrated, seamless new whole that is greater than the sum of its parts; the model was continually refined throughout the project based on the experiences of project leaders, staff, STEM Ambassadors and focal audiences.
- Provided high-quality professional development to over 50 STEM Ambassadors. The professional development was valued by the Ambassadors and has enhanced their skills in engaging the public with their science research.
- Generated 113 STEM Ambassador engagement activities, noteworthy in their variety and the diversity in audiences reached -- from engaging cooking class participants at a local grocery store about the science of fermentation, to sharing geology and mathematics with youth participating in outdoor activities such as rock climbing and hiking, to sharing resources for water conservation to inmates as part of a jail horticulturalist program. The project has succeeded in helping scientists connect to new communities, and helped new communities connect to scientists and science.
- Been valuable to scientists, community partners, and participants. STEM Ambassadors participating in the program greatly valued their experiences in the program, gained important skills in communicating science to the public, and successfully engaged with new audiences in new venues. Focal groups enjoyed the STEM Ambassador engagements, learned from them, are interested in the Ambassadors and wanted to know more about them, and felt like Ambassadors value their interests, ideas and questions. And Community partners valued the program and the Ambassadors -- their presentations, their personal stories, the connection with and work of the project staff -- and felt their participants and staff benefit from the programs in lasting ways

- Discovered that the STEMAP staff play a key role – their organization, support, communication, and outreach facilitation are important for and highly valued by both the STEM Ambassadors and community partners.
- Involved in the outreach efforts both a mix of individual Ambassador-community initiated relationships and STEMAP project-community initiated relationships, and found that there is value in both.
- Tested dissemination and scaling of the model through small-scale pilots at the University of Washington with a local point-person, and online through NPR's Friend of Joe's Big Idea group that engaged another seven Ambassadors, as well as through a two-hour workshop at the Ecological Society of America meeting with 23 additional STEM professionals.
- Tested a variety of strategies for collecting participant feedback about outreach activities. This has been challenging; collecting consistent data across venues/audiences is difficult, some of the non-traditional audiences (prisoners, juveniles in custody, refugees) include time-consuming IRB protocols, and some venues (rock climbing) are not conducive to traditional pre-post/paper-pencil modes of gathering feedback.

DEVELOPING A NEW MODEL

The project combined elements of three existing projects -- Portal to the Public, Design Thinking and the Research Ambassador program to create a new model. This new model combined these elements from the three projects: from Design Thinking, the importance of empathy and deeply understanding the audience; from Portal to the Public, the importance of engaging with an audience using informal STEM engagement techniques, inquiry, questioning strategies, and moving beyond power-points and lectures; and from the Research Ambassador program, the view of STEM professionals as ambassadors that go out into the community to interact with audiences, and the value of engaging with non-traditional audiences that may have limited access to scientists.

CONTRIBUTIONS TO STEM AMBASSADORS

Over the course of the project, 46 STEM Ambassadors conducted 96 engagement activities. More importantly the variety of programs and diversity in audiences reached is noteworthy -- from engaging cooking class participants at a local grocery store about the science of fermentation, to sharing geology and mathematics with youth participating in outdoor activities such as rock climbing and hiking, to sharing

resources for water conservation to inmates as part of a jail horticulturalist program. To prepare for these engagements, the STEM Ambassadors received training in brainstorming potential focal groups and engagement ideas, how to do an immersion experience with that focal group in order to learn about the community and look for areas of potential mutual interest around which to create a science engagement activity, and questioning and facilitation strategies for how to move beyond lectures and talks to more two-way engagement, dialogue, inquiry and authentic relationship-building with their focal group. For a much more in-depth analysis on the types of engagement activities STEM Ambassadors did, and the outcomes and contributions of the program to Ambassadors, we encourage readers to review Stanford University's case studies and cross-case analysis, which at the time of this report is still in progress.

STEM Ambassadors participating in the program greatly valued their experiences in the program, gained important skills in communicating science to the public, and successfully engaged with new audiences in new venues. STEM Ambassadors were moved out of their comfort zones in terms of the types of audiences they engage with and the venues they engage with them in; some Ambassadors inched out of their comfort zones, while others made broader leaps.

Data from the pre-post survey highlight that the majority of STEM Ambassadors rated their overall experience in the STEM Ambassadors program highly -- 97% of the 2016, 2017, and 2018 STEM Ambassadors (n=37) rated their experience as valuable or highly valuable, while 86% of the UW/Online cohort of STEM Ambassadors (n=7) rated their experience in the program as valuable or highly valuable.

Perhaps most importantly, 97% of the 2016, 2017 and 2018 STEM Ambassadors agreed or strongly agreed with the statement, "The STEM Ambassador program increased my interest in offering science outreach activities to new audiences." And 89% of the 2016, 2017, and 2018 STEM Ambassadors agreed or strongly agreed with the statement, "I want to reach out to new audiences as a result of participating in the STEM Ambassador program."

In addition, data from our pre-post surveys indicate that the program has broadened STEM Ambassadors' perceptions of types of audiences that they were comfortable with, and that could become more engaged with science if given the opportunity. For example, most STEM Ambassadors chose audiences in the pre-survey that they were comfortable working with -- K-12 school children, and the public in informal science education settings. The audiences that showed the greatest increase from pre to post in terms of STEM Ambassadors' comfort level in working with them and STEM Ambassadors' perceptions of their abilities to become more science engaged included prisoners, refugees, church groups, and seniors. We also saw slight differences among the three University of Utah cohorts with regard to this -- unlike the 2016 and 2017 cohorts which showed more of a range, 100% of the 2018 cohort agreed or strongly agreed in the post-survey that they would be

comfortable working with ALL of the audiences types listed, and 100% agreed or strongly agreed with the likelihood that ALL of those audiences could become more science engaged if given the opportunity. This may be due to the smaller number of Ambassadors in this cohort, the involvement of mentors, refinements to the STEM Ambassador program over time, or a combination of all of these things.

STEM Ambassadors also reported gaining new skills through the program that have improved their preparation and confidence in doing outreach with the public. For example, 94% of the 2016, 2017 and 2018 STEM Ambassadors agreed or strongly agreed with the statement, “I have gained new skills for offering successful science outreach activities because of my participation in the STEM Ambassador program.” In addition, data collected from the 2016 cohort by the research team showed that 80% of these 20 Ambassadors noted improved communication skills as a benefit of participating in the program.

The pre-post survey data also revealed shifts in STEM Ambassador perceptions of what limitations they have on their ability to engage with the public around their science research. The table below highlights the four areas of limitation where we saw the biggest differences from pre-to-post survey, and these differences for these areas held true across all three of the University of Utah cohorts, as well as the UW/Online cohort.

Percentage of STEM Ambassadors agreeing or strongly agreeing with each statement of what is currently limiting their activities to engage with the public around science research:

	University of Utah Cohorts		UW/Online Cohorts	
	Pre (n=40)	Post(n=37)	Pre (n=7)	Post (n=7)
I lack opportunities or a venue to do so	75%	25%	83%	17%
I lack the skills to be effective	19%	2%	17%	0%
I have difficulty conveying my research to the general public	15%	3%	17%	0%
I have serious time constraints	68%	80%	50%	67%

We think several things are important to highlight from this data table. The first is the significant change in the percentage of STEM Ambassadors, from a majority of Ambassadors to a few, in both the University of Utah and UW/Online cohorts who believed prior to their participation in the program that a major limiting factor was a lack of opportunity or venue for sharing their science research with the public. Since this is a major emphasis of the project, this is key data in showing the effectiveness of the STEM Ambassadors program. We think the data about time constraints as a limiting factor is also significant. This is viewed by STEM Ambassadors as a major limiting factor going into the program, and seen as a limiting factor by an even higher percentage of STEM Ambassadors after the

program. The program requires an investment of time by Ambassadors in reaching out and engaging with new audiences, and designing their outreach programs in new ways. It is also important in reviewing the data in this table to note the small number of Ambassadors, in both the University of Utah cohorts and the UW/Online cohort who believed from the beginning that they lacked the skills to be effective in communicating their science research with the public, or believed they had difficulty conveying their research to the public.

There were several key project resources and supports that contributed to the strong outcomes for STEM Ambassadors. Brainstorming engagement ideas was identified frequently by STEM Ambassadors in post-workshop and post-program surveys as the most useful activity, and the percentage of STEM Ambassadors identifying this as the most useful activity grew over time (71% of 2017 STEM Ambassadors chose this, 83% of 2018 STEM Ambassadors chose this, and 86% of the UW/Online STEM Ambassadors chose this). We think this growth reflects continued refinements to the program materials and training that took place over the course of the program.

Support from project staff was also one of the most important elements of the project for STEM Ambassadors, particularly in the brainstorming of ideas, identifying of audiences/venues, and connecting with community representatives.

It was an excellent program and I thoroughly enjoyed working with the staff. They were helpful both in thinking outside the box to find a group to engage with, and were very critical in the revising of my presentation to make it appropriate for the different audiences.

The program was great, and I wished I had more time available to have created even more engagement events. The STEM Ambassador staff was invaluable every step of the way.

The individual assistance and encouragement from STEMAP staff is extremely motivating to follow through with potentially difficult immersions.

My interactions with Meg and Caitlin and their help with contacting community partners has been the most valuable part of the program.

Meg and Caitlin have been so helpful in terms of reaching out to the community and fine-tuning my engagement ideas.

The immersion experience in which the STEM Ambassadors gained knowledge of their focal group and communities were also viewed as important and valuable to the STEM Ambassadors. Questioning strategies highlighted during workshops were also viewed by STEM Ambassadors as important for fostering dialogue and mutual engagement with community members. For example, STEM Ambassador comments in both post-workshop and post-program surveys highlight the extent to which they

were attentive to the importance of the immersion and questioning activities, and how much it informed their thinking and engagement work:

From the immersion experience, the most important things I learned was about the culture of the group, and a better understanding of their community.

I learned from the immersion what is generally important to this group, and how gaining trust is going to take some time.

From the immersion, I learned the dynamics of the community I plan to work with, which influences potential engagement formats.

I found out how important the personal connections are, being able to make those connections based on their personal interests and my personal interests, and how much that helps.

Don't take for granted how important the immersion experience can be to make a successful event.

These impacts were also true for the UW/Online cohort of STEM Ambassadors. In the post-workshop survey, we asked them to list the three most important benefits to them from participating in the training; the following is a sample of their comments:

It forced me to shift my perspective from purveyor of information to 2-way exchange.

Establishing that I should be observing and then drawing insights from those observations.

Emphasizing that we are ambassadors and are here to learn just as much as the focal group.

For the 2018 STEM Ambassadors, there was added value of having 2016 and 2017 STEM Ambassadors serve as mentors. In post-workshop surveys at the mid-point of the 2018 cohort's participation in the program, 83% of the 2018 STEM Ambassadors rated engaging with former STEM Ambassadors as very high value. In addition, the UW/Online cohort of STEM Ambassadors mentioned in open-ended comments that they thought being able to interact with past STEM Ambassadors would be helpful to them. And several of the 2018 STEM Ambassadors commented in response to open-ended questions about the most valuable elements of the program about the importance of the mentors' participation:

Having the previous ambassadors attend our trainings was really helpful!

The mentors are amazing!

I think talking with the mentors was very helpful in discussing our current ideas and what they thought since they had done this.

Hearing how other (previous STEM Ambassadors) approached their community groups.

Hearing the mentors' successes and failures.

Using the examples from past STEM Ambassadors for emails and calls was really helpful.

Perhaps most importantly, STEM Ambassadors are continuing to offer public engagement activities in the community. Several of the 2016 and 2017 Ambassadors continued to offer engagement activities long after their official commitment to the program ended.

CONTRIBUTIONS TO FOCAL GROUPS AND COMMUNITIES

In this section of the report, we share data collected from focal groups that participated in STEM Ambassador programs and community organizations that hosted STEM Ambassador activities.

- **Focal groups enjoy the STEM Ambassador engagements, learn from them, are interested in the Ambassadors and want to know more about them, and feel like Ambassadors value their interests, ideas and questions**

Post-event feedback forms were collected from members of the focal groups participating in STEM Ambassador events whenever possible; a total of 778 surveys from 28 STEM Ambassador events were collected. In addition, 180 post event forms were collected from nine STEM Ambassador events at jail and prison lectures using a survey form from the University of Utah's Initiative to bring Science Programs to the Incarcerated (INSPIRE) project (we did not have permission through our IRB to collect data from vulnerable audiences). We share the following caveats about the data collected from participants:

- The completion of feedback forms was voluntary

- Because of the wide variety of venues and audiences, it was not possible to collect pre-post data, or to collect survey data from every engagement event
- We developed multiple versions of the participant feedback form in an effort to both best meet the needs of audiences and venues (e.g., developing short feedback forms for use at table or shorter-length interactions; developing large print forms for senior citizens), to hone in on a set of questions that we could ask across as many venues as possible and to capture the desired outcomes of the project
- Data collected from focal groups inquired both about their overall interest in science and access to scientists/scientific information, as well as the impacts of the program

Focal group feedback form data showed that participants in STEM Ambassador events are generally interested in science. For example, 98% of the 93 focal group members who were asked the extent to which they agreed or disagreed with the statement, "I think science is interesting" agreed or strongly agreed. However, not all have access to scientists -- just over half (57%) of the 69 people who were asked the question, "I have lots of opportunities to interact with scientists" agreed or strongly agreed, while just under half (48%) of the 46 focal group members who attended 2018 Ambassador events said they have the opportunity to interact with scientists frequently.

In terms of the contributions of attending STEM Ambassador events for focal group members, participants enjoyed the programs and learned from them. Perhaps most importantly, they felt like active participants in the events, and felt the scientists had good rapport with them.

For example, 84% of 55 focal group members rated themselves as enjoying the programs or enjoying the programs very much, while 90% of 248 focal group members agreed or strongly agreed with the statement, "I learned something new today." Nearly all (96%) of 207 focal group members agreed or strongly agreed with the statement, "The scientist did a good job of communicating information." And 85% of 210 focal group members agreed or strongly agreed with the statement, "The scientist was open to having audience members ask questions or share ideas/the scientist encouraged us to ask questions and share ideas." And 70% of jail focal group members strongly agreed with the statement, "The speaker presented this information in a way that was interesting."

Focal group members also reported that participating in the STEM Ambassador events increased their interest in science and seeking out scientific information, increased their interest in the scientists and their work, and impacted their view of themselves as being able to understand and do science. For example, 71% of 100 focal group members said, "After attending this presentation, I am more interested in seeking out scientific information or participating in science events." In addition, 52% of jail focal group members strongly agreed the statement, "I would like more

information on this topic.” And 82% of 100 focal group members said, “After attending this presentation, I more strongly consider myself as someone who can understand and do science.” 88% of 101 focal group members agreed or strongly agreed with the statement, “I want to know more about this scientists’ work,” while 87% of 40 focal group members attending 2018 cohort events said that after attending the event, they wanted to hear more from the scientist. 55% of the 2018 cohort focal members surveyed said that scientist demonstrated he or she has something in common with them (a hobby, an experience), while 81% said they thought the scientist demonstrated that he or she cares about the focal group member’s community.

This participant data is also supported by interviews with community organization representatives.

- **Community partners value the program and the Ambassadors -- their presentations, their personal stories, the connection with and work of the project staff -- and feel their participants and staff benefit from the programs in lasting ways**

Inverness Research conducted interviews with nine community partners representing six different organizations, including juvenile justice, senior centers, horticulture programming at the jail, a café, SPLORE, and a community council.

According to community partners we interviewed, the STEM Ambassadors’ programs were well-received by participants and by staff at these organizations; community partners appreciated that the STEM Ambassadors brought new topics and new types of programs to their organizations. As one representative from the senior centers noted:

Our seniors really loved it because it is something different. They really enjoy stuff like that because it is not the norm and we don’t have presentations like that all of the time. Mostly what they get is, “are you walking okay, how is your Medicare, get your blood pressure done...” and that becomes routine. So this stimulates their minds and gets them thinking about other things besides what is going on with their health or insurance, things like that. It was a great treat.

Community partners were impressed by the STEM Ambassadors, particularly their preparation, and their knowledge of the participants. As a community partner from the juvenile justice department noted,

I was so impressed with the grad students. They were asking the right questions, and they had the right kind of attitude about working with our kids. They had a high level of awareness of what sort of situation they are coming into and what some of the needs were.

And as a representative of the jail horticulture program said,

She (the STEM Ambassador) was open to questions and responsive to them, and very affirming to the questions. If you haven't ever taught in a jail, it can be really intimidating. Our guys aren't rude, but guests don't know that, so it can be easy to feel uneasy, and she did quite well. Many people who we've had who are seasoned professors who have not talked to inmates didn't do nearly as well on their first go-round.

The representative from juvenile justice shared an example of a STEM Ambassador whose activity helped to highlight skills of youth that have come out of negative experiences and show them how to use them in a positive way:

We had this wildlife biologist and he does animal recognition things and teaches the kids how to recognize things and do hands-on things. He was showing them outdoor scenes, which first of all, is a good break for the kids to experience the outside world. But then, our kids, kids that are abused, neglected -- they are hyper-vigilant and very perceptive of their surroundings and the activity was a perfect thing to use their ability to recognize even blurry pictures... when we can match what is perceived as a disadvantage and flip that into an advantage...

For most of the organizations, connecting with the overall STEM Ambassador program (beyond the individual scientists) was valuable. Community partners we interviewed told us the connection between the STEM Ambassadors and organizations was usually facilitated by the STEM Ambassador program, not by individual STEM Ambassadors, and the community partners from the participating organizations like this arrangement very much. They appreciate having a single point of contact, and they appreciated, in particular, Caitlin's skill and support. Community partners told us they like that the STEM Ambassador program makes things easy for them -- they are busy people and organizations, and while they like having new/different/scientists and programs to add in to what they do, they really like that it doesn't add to their overall work and burden. Connecting through the central STEM Ambassadors organization works well for the community partners. In addition, community partners greatly appreciate when STEM Ambassador program staff attended the events. Community partners liked being invited to and attending the coffee hours as well.

We asked the community partners about the number of offerings that was optimal for them. For most of these community partners, the number of offerings is less important than the overall "fit" of the topic and presenter to the organization, which they saw as being the most important. And with good fit being the key, making this a priority on all sides, with plenty of time to proactively plan in advance, is not trivial. The Community Council, for example, has agendas that are set well in advance with a lot of input from the community, so including a presentation by a STEM Ambassador takes some advance planning (which is why for this particular connection, having the connection facilitated by one point of contact at the

University is important). On the other hand, the Senior Center involved in the project would love to have STEM Ambassadors present more regularly, and they have a lot of flexibility as to the topics that can be presented. The horticulture program has limitations to the number of programs it can handle because of the timing -- presentations during busy times, when there is a great deal of outdoor work that has to get done in a short window of time, are difficult to schedule; they would prefer to have Ambassadors come when they don't need their workers to be out in the field. For many of these organizations (horticulture, SPLORE, Community Council), there has to be a strong connection between the organization and the topic for this to work at its best. Both SPLORE and the Senior Center are very open to do more work with the STEM Ambassador program. As one representative from SPLORE said,

Finding the best fits works great. We have the capacity to do more with STEM Ambassadors, and we know scheduling is hard for them. It is a really positive thing... having more would be something we would all be open to.

Community partners we interviewed noted that the personal stories shared by STEM Ambassadors resonated well with participants. As a community partner from the juvenile justice system said,

The STEM Ambassador program is a great opportunity for the research people to come in and put their information out in a way that makes sense for non-technical people, but even of more or equal benefit is hearing their personal stories of how they got to where they are. I've heard a couple of things that I thought were really impressive. One marine biologist said they didn't like science and didn't do well in science but fell into this. She came from a family that didn't really encourage college and here she is a graduate person -- that story is so helpful... We have a girls unit here, and having women come in and share their stories -- anything that shows these girls other possibilities is so important... And then I heard a story where this kid said he was in a detention center in this area; he came from a title one school. He was sharing what you have to do if you didn't do so well in school and how he got into college. He talked about how he had to take classes over. In an indirect way, that inspires kids to what they can do... that is really powerful stuff...

We heard multiple examples from the six community organizations about mutual benefits of the STEM Ambassador programming -- to participants, to scientists, to the University, to the organizations, and to the staff of these organizations.

Perhaps most importantly, the community partners we interviewed noted that seeing how their participants responded to the STEM Ambassadors' programs helped them to see their participants differently, and more positively. For example, community partners from the juvenile justice system and the senior centers said that observing the types of questions their participants asked, and the way they

responded to the programs, made them think more deeply about more rigorous and different kinds of program offerings they could offer to their participants.

Community partners also reported other kinds of mutual benefits. The staff engagement was important for the community organizations -- not only did these programs benefit the participants, but they benefitted the staff working with those participants as well. Staff at their organizations were also engaged by the STEM Ambassador programs, and in some cases, were able to incorporate more science learned from the Ambassadors into their regular, ongoing program offerings. As two representatives from the SPLORE program said,

So we had an ornithologist who came and gave us stuff that our guides can incorporate into our trips, so now our guides have a bit more in their pockets.... Not anything too in-depth, but enough to enhance what we are doing and give that little extra flavor to our trips..

For our guides, being able to listen to someone talk about the body mechanics and muscle movement that allow you to climb better -- -- that guide can then take that and add that to their repertoire. It just allows them to broaden their base of things to talk about on the trip. Every Ambassador has provided us with some kind of tool so we can teach it if they aren't there.

As the representative from the juvenile justice system noted:

When they come in, we have science teachers who work here, who all have good credentials, but they are dealing with 7-8 kids at a time in a class and cover all these grade levels in one class. So that makes them get more focused and practical in their work. I've seen when the STEM Ambassadors come in, some of these science teachers on staff light up because it gives them a chance to talk about their deeper knowledge too. Here they are communicating on a professional level with research scientists in front of the kids. So this is enlivening the professional environment for these staff as well as the academic environment for the kids.

And finally, the representative from the community council spoke about how having the STEM Ambassadors come to present at these meetings helps the image of the University within that community:

It also helps us I think tying the University in, in a more personal manner because we have this University here and there are people in the community that aren't associated with it. And I know they complain about traffic on football game days or things like that. But this helps show them that there are benefits to having the University here.

This representative also thought that it benefits the University when they better understand what people in the community have to say about particular science topics:

I think in some ways it is also good for them (the University) to know that there are people in the community that want to hear about science and what scientists have to say, even if they are not part of the discipline and that they are not fluent in the science...

SCALING/DISSEMINATION PILOTS

In the spring of 2018, the project received supplemental funding to do two small-scale pilots of dissemination. The project as enacted at the University of Utah required a great deal of project staff time, and project leaders were interested in testing out some modes of interaction with scientists outside of the University of Utah, and exploring modes that might require less staff time. The project engaged a small cohort of STEM Ambassadors (four total) at the University of Washington, provided in-person training to these scientists, and supported a point person, the Associate Director of Science Communication and Special Projects within the Marketing and Communications department, who then shepherded the local STEM Ambassadors through the program over the summer and early fall of 2018. Simultaneously, the project tested a wholly online format, recruiting six scientists through National Public Radio's Friends of Joe's Big Idea, a community of young scientists interested in improving their science communication skills. The project offered online webinars to both the UW and Online cohorts. Inverness Research administered a post-workshop survey after the workshops and webinars were complete, as well as a pre-post survey to these two small cohorts of participants. We also conducted a telephone interview with the UW point person.

We received pre-post survey data from seven of the ten UW/Online cohort (three from UW and four from the online cohort). In terms of their interest in communicating their science research to the public, we saw no change from pre-to-post survey, with 14% stating they were somewhat interested, and 86% stating they were very interested. The differences between the UW and Online cohorts were that one person from the UW cohort was somewhat interested, while all the rest were very interested. Just slightly more than half (57%) of the UW/Online cohort rated their experience with the STEM Ambassador program as valuable or very valuable, while 43% rated it as mixed, and the ratings were similar for both the UW and Online cohorts.

We also saw more mixed results from the two cohorts with regard to the programmatic impacts in comparison with the data from the University of Utah cohorts, as the table below highlights:

Percentage of STEM Ambassadors agreeing or strongly agreeing with each of the following statements:	UW/Online (n=7)	University of Utah (n=37)
The STEM Ambassador program increased my interest in offering science outreach activities to new audiences	43%	97%
I have gained new skills for offering successful science outreach activities because of my participation in the STEM Ambassador program	57%	94%
I want to do more science outreach activities as a result of participating in the STEM Ambassadors program	29%	96%
I want to reach out to new audiences as a result of participating in the STEM Ambassadors program	57%	89%

It is important to note the differences in the number of respondents here. It is also important to note that there were no significant differences between the UW and Online cohort data here. Post-survey and interview comments shed some light on why there may have been less significant impacts on this cohort, beyond the differences in program implementation -- most of the UW and online cohort STEM Ambassadors had more experience engaging with the public around their science than the University of Utah cohorts did, and they felt that because of that, this program was not ideal for them:

The structure (e.g., deadlines) was super helpful, and the staff were always eager to support (which I found I didn't need all that much). But know that if you already have teaching/engagement experience, much of this may be repeat material.

If you are already set up for outreach this program is not for you. This is designed for people who need help getting started, coming up with ideas, and planning. If you are new to outreach, this is probably very helpful.

Particularly useful for people who have no experience or ideas about how to do this kind of thing. I already had a solid idea of what I wanted to do and strong commitment to making it succeed so that value to me was perhaps not as great as it might be to others.

In a follow-up telephone interview, the UW point person also noted that there wasn't a "cohort" experience here like there was with the University of Utah STEM Ambassadors, where they came together and shared ideas and processes with one another through coffee hours and regular meetings; he felt that should be a part of the model being implemented elsewhere:

I think the Ambassadors themselves would have benefitted from getting to know one another... there just wasn't a feeling of cohesiveness and I think they would have benefitted from bouncing ideas off of each other.

The UW point person also offered additional feedback on the pilot. On the positive side, he noted that the STEM Ambassador program was different from, and highly complimentary to, the science engagement training they offer through their program at UW which tends to be either at the “30,000 foot, big picture” level or training in how to respond to a very specific request (such as testifying before Congress). He felt the STEM Ambassador program offered a nice middle ground for scientists interested in public engagement work. He also felt the materials provided for him as the point person, and those provided for the STEM Ambassadors were thorough and high quality, and he appreciated the responsiveness of the program staff whenever questions arose. He felt the most valuable aspect of the program for both him and the STEM Ambassadors he was working with was the brainstorming about potential matches (and post-survey comments from the UW STEM Ambassadors support this); he said:

I thought that the exercise of figuring out matches -- what you might want to talk about and who you might connect with -- was really interesting and perhaps the most valuable part. In each instance, when I sat down with the Ambassadors, something was uncovered that was totally out of the box and we wouldn't have thought of it without that process. So it was really illuminating for everyone and that process was really eye-opening and great.

In terms of additional feedback for improving the model, he felt the timing of the pilot was problematic as it happened in the summer and early fall, when most scientists were out engaged in field work and not available for consultations or planning and pulling off an engagement event. He also thought that point people might need more help when it comes to pushing Ambassadors to act on innovative engagement ideas. He said,

...Helping them (the STEM Ambassadors) work through those more interesting connections and feeling empowered as a facilitator to help them brainstorm -- I could have used a little more help there thinking about how to empower and work with each of the Ambassadors so when that really crazy connection is unearthed that I can help them piece it together a bit more and land on a workable idea.

Not everyone took the most interesting idea, so thinking about how to empower and work with each of the Ambassadors so when that really cool, crazy connection is unearthed that I can help them piece it together a bit more...

Only two of the STEM Ambassadors in the UW/Online cohort completed engagement activities, which may have been due to the constrained timeline for the pilot.

In addition, the project offered a two-hour STEM Ambassador workshop at the Ecological Society of America annual meeting; Inverness sent out an online survey to 21 of the 23 workshop participants, and we received eight back, a return rate of 38 percent.

74% of the respondents rated the workshop high or very high quality. Of the respondents to the survey, 75% had attended public engagement workshops in the past, and 100% of those thought that the STEM Ambassador workshop was different than others they had attended in the past. The table below identifies findings from the post-workshop survey related to workshop outcomes:

	Percentage of respondents agreeing or strongly agreeing with the statement
This workshop increased my interest in offering science engagement activities to new audiences	62%
I have gained new skills for offering successful science engagement activities because of my participation in this workshop	74%
I want to do more science engagement activities as a result of participating in this workshop	37%
This workshop increased my interest in offering science engagement activities in new/different community venues	87%

Respondents selected identifying focal groups as the tactic discussed in the workshop most applicable to their work -- 87% of respondents chose this tactic, while the other tactics (immersion, how to build community contacts, how to transform immersion notes into an engagement activity, and general science communication skills) were only chosen by 25% of the respondents.

About three-quarters of the respondents (74%) said it was somewhat to highly likely that they would apply the tactics they had learned in the workshop to engage with the public, and 50% said it was somewhat or highly likely that they would reach out to a focal group. 75% of the respondents said they would attend a full-day STEM Ambassador workshop ahead of ESA, while 71% said they would participate in online training. And while 62% of respondents indicated they would like to see this at their college or university, only 12% thought there would be funding to support it.

While there was attrition in both cohorts, and we did not see the same strength of impacts that we saw with the University of Utah cohorts, we think there is potential for further testing of alternate implementation strategies and scenarios to see if the

STEM Ambassadors model can be implemented in other places, and in ways that don't require as much project staff time.

SUMMARY

The STEM Ambassadors project created a new model for training STEM professionals to engage with the public, one that focuses on developing relationships between scientists and audiences that do not typically have the opportunity to interact with scientists. It is also a model that focuses more on developing shared values and common identities among scientists and public audiences as much as or more so than the transmission of scientific facts or knowledge.

The STEM Ambassadors project has engaged over 50 STEM professionals who have gained empathy, questioning and facilitation skills, and engaged diverse audiences in an array of new venues over the course of the project. STEM Ambassadors changed their perceptions about audiences they might connect to, and how they might communicate their science research with them, based on mutual interests and understanding. Ambassadors also changed their perceptions of these audiences, finding they had as much to learn from prisoners and senior citizens as these audiences had to learn from them. Audiences engaging with Ambassadors were interested in the scientists and their work, wanted to know more about the scientists and their work, and felt the scientists were interested in their ideas and questions and valued their communities.

The project refined its training materials and support processes creating an infrastructure that was highly valued both by local cohorts and those not at the University of Utah. The project also did small-scale pilots of scaling methods that highlight the potential of this model to reach many more scientists, and the continued refinements of materials, training and support that can best make that happen.