WHAT WORKS

IN TEAM SCIENCE AND OUTREACH

John Cabra, Julia Figliotti, and Andy Burnett

Knowinnovation Inc.

1207 Delaware Avenue

Buffalo, NY, 14209-1458, US

http://www.knowinnovation.com

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We would like to extend an extremely heartfelt thank you to our colleague, Donnalyn Roxey, for her outstanding effort and keen eye in providing feedback for this book.

Thank you also to the EPSCoR scientists, researchers, and staff who agreed to be interviewed for our collection. Without your stories, this book would not exist.

PREFACE

ABOUT US

Knowinnovation is a consulting firm that focuses on the acceleration of scientific innovation. We help interdisciplinary research teams to work together more creatively, and encourage them to develop those skills in their students.

ABOUT THIS BOOK

This book is based upon a very simple question: If we talked with people involved in EPSCoR projects, and asked them what was working really well in their teams, would we learn things that could be of benefit not only to the whole network, but also to networks outside the realm of team science?

So, why did we do this? The answer is because we are curious. Over the course of a number of different EPSCoR engagements, we have heard conflicting stories about what was easy, or difficult, to accomplish while working under

EPSCoR awards. This usually means that there are pockets of success within these programs which would benefit from being connected. This book is our attempt to do that, within EPSCoR teams and beyond.

BACKGROUND

The information found in this book was drawn from individuals who have worked directly with an EPSCoR award. We applied an Appreciative Inquiry approach as a means to obtain narratives from these individuals. Appreciative Inquiry is an organizational method that looks to bring about change by studying what works well within an organization.[1] This method assumes that organizational members know how to solve problems. Dissecting the best practices and stories for solving past problems allows these practices and stories to be leveraged and applied moving forward.

As referenced in this collection, EPSCoR is an NSF-funded program that supports researchers, students, and institutions. The program strategically supports proposals to build a diverse research and educational infrastructure based on a jurisdiction's level of NSF funding. According to the NSF's website,[2]

1 Cooperrider, D., & Srivastva, S. (1987). Appreciative inquiry in organizational life. In R. Woodman & W. Pasmore (Eds.), *Research in organizational change and development* (Vol. 1, pp. 129–169). Bingley, UK: Emerald Group Publishing Limited.

2 National Science Foundation. (n.d.). *Established Program to Stimulate Competitive*

The mission of EPSCoR is to advance excellence in science and engineering research and education in order to achieve sustainable increases in research, education, and training capacity and competitiveness that will enable EPSCoR jurisdictions to have increased engagement in areas supported by the NSF. EPSCoR goals are:

1. *to provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness;*
2. *to advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation and overall knowledge-based prosperity.*

To that end, EPSCoR seeks to increase its competitiveness in areas supported by the NSF, and the work in this book was conducted as a way to enhance peer-to-peer learning.[2]

EPSCoR is the Established Program to Stimulate Competitive Research.

Research (EPSCoR). Retrieved from https://www.nsf.gov/od/oia/programs/epscor/


SUCCESS

HOW TO USE THIS BOOK

These stories of success were written to be accessible and compelling. Following each story, you will come across many suggestions to improve group dynamics. We believe that many of these suggestions, which stem from the interviews that we conducted with the EPSCoR team members, can easily be transferred to other settings outside of deliberate team science – perhaps in a faculty meeting, or when approaching students in an advisory capacity.

We suggest that you approach this book in four ways:

1. Since the stories are listed alphabetically, use the contents in a complementary fashion to support the work you already do well. We recommend skimming through the stories for the block quotes, and reading the stories whose quotes stand out to you.
2. Go through the short stories and put a Post-it® next to the tips you would like to try out. We would suggest you start with an easy one to apply.
3. After you read through the stories, make a

commitment to apply a suggestion, tip, or technique with a team, colleague, or a stakeholder.
4. As a way to impart your learning (perhaps you modified or enhanced the suggestion or technique) we invite you to share on Twitter using the hashtag #AIinEPSCoR.

One other approach is to apply the Appreciative Inquiry method by taking stock of what you already do well now to advance team science. Begin with experiences that involved you directly. List the attributes of these case studies that led to your success. We would advise you to be as specific as possible, as if you were planning on disseminating these beneficial best practices to others. From a different view, permit the ideas as listed in this book to serve as reminders of what you are already do well, and ask yourself how you might continue to do more. We suggest the following:

- Integrate or adapt ideas into your current work to help advance your team.
- Stay open to ideas that may not seem fitting to your situation by adapting, modifying, or combining them with other approaches until you arrive at an Aha!

Let the ideas from your peers serve as primers for your creative imagination!

INTRODUCTION

Trends suggest that scientific and social challenges have become more vexing and complex. As these challenges have become more difficult, scientists have joined forces to creatively collaborate on addressing such challenges.

In response to this trend, the National Research Council put together a free report in order to advance a clear argument for the need to support scientific teams in their efforts to address challenges.[3] Team science is incredibly relevant in this day and age, and this collection only scrapes the surface of how it might be improved.

But in spite of the vulnerabilities and challenges that a science team might face, the output is frequently well worth the trials and tribulations if contextual factors are taken into consideration.[4] This sentiment was repeated time and again by the interviewees featured in this collection.

3 National Research Council. (2015). *Enhancing the effectiveness of team science*. National Academies Press. Brief Report.

4 Stokols, D., Misra, S., Moser, R. P., Hall, K. L., & Taylor, B. K. (2008). The ecology of team science: Understanding contextual influences on transdisciplinary collaboration.

Let's take an example of a challenge a science team faces that is worthwhile.

In 2015, our organization was asked to work with a group of EPSCoR stakeholders and scientists that had been assembled to tackle a wicked problem: How to maintain the meeting point of our food, energy, and water system – notwithstanding a changing climate and a population expected to reach 9.6 billion – by 2050?

Several teams of scientists, comprising 5-7 members in each team, were assembled to take on this challenge. Some of the members of the team knew one another very well from previous research work they had completed together. Others they knew based on positive reputations in regards to technical and interpersonal skills (e.g., the ability to work with others in a frictionless and egoless manner). This was a relief for us, of course; in our experience, these types of team members are more likely to be able to submit grant proposals that receive funding, and that ultimately advance productive solutions.[5] Moreover, the more novel and breakthrough solutions that tend to come from such teams would not likely be possible if those same team members worked individually, instead of collaboratively.[6]

American Journal of Preventive Medicine, *35*(2), 96-115.

5 National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. (2005). Facilitating interdisciplinary research. Washington, DC: The National Academies Press.

6 Anacona, D., & Caldwell, D. (1992). Demography and design: Predictors of new product team performance. *Organizational Science, 3*, 321–241.

Studies have demonstrated, and a growing body of literature seems to suggest, that the more diversity that exists in a problem-solving group, the better positioned that group is to address complex and vexing scientific problems.[7] Truly novel and innovative solutions require points of view that draw from a broad, diverse repository of experiences and expertise.[7] [8] [9] In addition, trends are emerging that show funding agencies seeking more and more interdisciplinary collaboration.[10] Whereby teams in the past were held accountable based on the impact of their research at the local and regional levels, they are now being measured by their collective influence with other teams and institutions across the nation as they tackle problems under conditions of complexity.[11] These are vexing problems that funding agencies have been unsuccessful in solving, such as encouraging more underrepresented students to pursue STEM programs at universities. In this example alone, there are so many different facets of the challenge that the issue can appear

7 Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of International Business Studies*, *41*(4), 690-709.

8 National Research Council. (2015). *Enhancing the effectiveness of team science*. Washington, DC: National Academies Press.

9 Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. (2011). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management*, *37*(3), 709-743.

10 Rhoten, D. (2004). Interdisciplinary research: Trend or transition. *Items and Issues*, *5*(1-2), 6-11.

11 Hanleybrown, F., Kania, J., Kramer, M. (2012, January 26). *Channeling change: Making collective impact work*. Retrieved from https://ssir.org/articles/entry/channeling_change_making_collective_impact_work

to be almost impenetrable. And yet, every day, across these institutions, scientists, academics, and staff are actively engaging in activities that broaden participation.

The same holds true with challenges related team science (e.g., knowledge integration, ways to work together, goal misalignment, geographic dispersion).[8] Many individuals are working on their own, and have developed approaches that work within their specific communities or units. The limited size and nature of their actions means that their respective approaches are rarely transmitted beyond their immediate context. But through team creation, some of these individuals are engaged in systemic change that alters the way people within and outside of the institution think and act, including approaches to the way things operate within their organizations.

Unfortunately, many people don't even realize that their actions are unusual or impressive, and therefore do not share their stories. That is why we set out to learn more about these teams and their approaches. By listening to the thoughts and memories of those who shared their experiences with us, our goal has been to capture and disseminate their stories and create a space to promote peer-to-peer learning. The resulting collection is organized to help individual faculty members, researchers, and staff answer the question, "What one thing could I do – immediately –

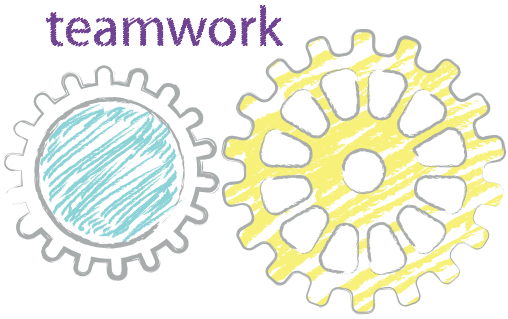
that would help to enhance team science within my EPSCoR project?" Although the information in this book emerged from conversations with individuals who shared their stories of success associated with EPSCoR, these learnings can easily be transferred to teams in general. Individually, these tips and suggestions may only have a smaller-scale impact, but implemented across the nation, they could play a significant role in making scientific teams, and therefore the entire scientific community, even more productive.

This book embraces a holistic approach[12] to apply observations that may enhance the effectiveness of scientific teams. This approach aims to bring together

1. the leadership qualities that have contributed to past successful team science (Leadership);
2. the behaviors that individuals and groups demonstrated that led to success (People);
3. the organizational factors and practices that promoted peer-to-peer learning in a team science context (Environment);
4. the operational and social tactics that contributed to a positive team science experience (Process); and
5. the results that were achieved through implementing the aforementioned tactics (Product).

12 Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan*, *42*(7), 305-310.

To capture the variety of impressive approaches to encouraging productive team science, we integrated Appreciative Inquiry (AI) into our interview strategy. In its simplest form, Appreciative Inquiry aims to support effective change by focusing on the positive qualities of a situation and asking, "What is working?" The answers to that question, compiled in this book, are meant to allow people to draw generalized lessons and conclusions that can then be adapted into other contexts. It is our intention with this book to provide examples of best practices that can be integrated by institutions and teams as part of their overall strategies, and to provide tangible tips through specific stories from real people carrying out this work.



WHAT DO WE MEAN BY TEAM SCIENCE? [8]

According to the National Research Council, team science comprises scientific collaboration in which "research is conducted by more than one individual in an interdependent fashion, including research conducted by small teams and larger groups" (p. 2). Specifically, the Council defines a team as "encompassing two or more individuals with different roles and responsibilities, who interact socially and interdependently within an organizational system to perform tasks and accomplish common goals" (p. 2). Moreover, they refer to teams that make up 10 or less members as *science teams* in keeping with the size of most teams with similar roles and responsibilities, and teams greater than 10 as *larger groups of scientists*.

Because of the inherent diversity involved and the variety of factors to be considered, it is not easy to lead successful science teams. [4] Leaders are faced with stressors such as group composition and size, organizational complexity, and

varying geographic locations of team members. In addition to logistical complications, the goals of a science team project may vary in desired outcome: some team members may pursue a focus on training output, others may seek scientific discovery, and still others may target policy-related targets, as in public health.[13] Consequently, these competing interests, when not tended to properly, can lead to clashes among egos, misunderstandings, ineffective decision making, and the anxiety that comes with learning something outside of one's own discipline.

Of course, teams do vary depending on the levels of disciplinarity involved. More precise descriptions of disciplinarity levels can be found in the following table.[8]

Scientific Orientation	Definition
Unidisciplinarity	Unidisciplinarity is a process in which researchers from a single discipline work together to address a common research problem.
Multidisciplinarity	Multidisciplinarity is a sequential process whereby researchers in different disciplines work independently, each from his or her own discipline-specific perspective, with a goal of eventually combining efforts to address a common research problem.

13 Stokols, D., Hall, K. L., Taylor, B. K., & Moser, R. P. (2008). The science of team science: Overview of the field and introduction to the supplement. *American Journal of Preventive Medicine*, *35*(2), S77-S89.

Scientific Orientation	Definition
Interdisciplinarity	Interdisciplinarity is an interactive process in which researchers work jointly, each drawing from his or her own discipline-specific perspective, to address a common research problem.
Transdisciplinarity	Transdisciplinarity is an integrative process in which researchers work jointly to develop and use a shared conceptual framework that synthesizes and extends discipline-specific theories, concepts, methods, or all three to create new models and language to address a common research problem.

These levels are important to consider. Studies have shown that the most challenging problems facing non-unidisciplinary teams include disciplinary jargon and working norms, which are often not well understood or appreciated universally. And when high levels of interaction are required, problems can be compounded when the communication system at hand lacks a filtering mechanism that accounts for multiple disciplines.[14]

The National Research Council asserted:

14 Qin, J., Lancaster, F. W., & Allen, B. (1997). Types and levels of collaboration in interdisciplinary research in the sciences. *Journal of the American Society for Information Science*, *48*(10), 893-916.

Emerging research shows that team science can lead to results with greater scientific impact, innovation, productivity, and reach than single-investigator approaches. When team science works, it works very well.[8]

Put simply, team science is incredibly relevant in this day and age, and this collection only scrapes the surface of how it might be improved.

In our experience, these successful science teams are made up of individuals from different disciplines who are willing and able to leverage this diversity. According to some scholars, diversity (e.g., cognitive, disciplinary) among team members has a positive association with enhanced creativity, innovation, and problem-solving capabilities.[15] These scholars argue that performance within an interdisciplinary or otherwise diverse team is superior when compared to homogenous groups.

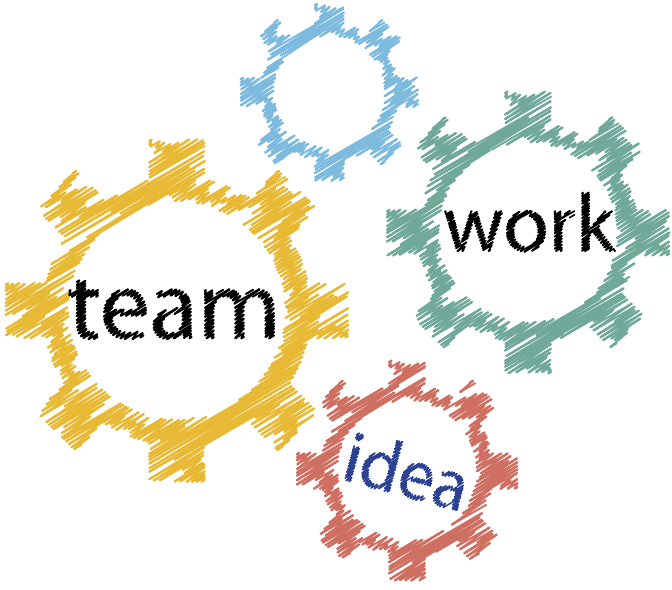
In spite of the vulnerabilities and challenges that a diverse team might face, we believe the output is frequently well worth the trials and tribulations. This sentiment was repeated time and again by the interviewees featured in this collection, from administrative organizers to social scientists to team leaders.

15 Horwitz, S. K., & Horwitz, I. B. (2007). The effects of team diversity on team outcomes: A meta-analytic review of team demography. *Journal of Management*, *33*(6), 987-1015.

TALES FROM THE FRONT LINE

We are grateful to have had the chance to talk with many interesting, enthusiastic science team leaders and participants. From the mouths of our interviewees, we have compiled several lists of habits, tips, tools, and processes that can help scientists and researchers functioning in a team science environment to approach their work in a more productive and engaging way.

Before diving into those lists, we wanted to share with you the stories themselves: who these team leaders and members are, the grants they worked on, the challenges they faced, and the ways they overcame them. Here you will find narrative accounts of each EPSCoR team member's success. We hope that you can read them and find wisdom, humor, and inspiration.


team
work
idea

ROSEMARY BLUM

Rosemary Blum knows that it can be difficult for scientists to participate in outreach. In fact, as an Education, Outreach, and Diversity Director of the EPSCoR office, simplifying outreach has become one of her specialties.

Blum was assigned to the Kansas EPSCoR team a little over two years ago. Before her days with EPSCoR she was a Student Affairs Administrator, and before that, a middle school math teacher. “So science is a new career focus with a large learning curve for me,” she explains. “In school, math and science didn’t come easy for me, but I went into math because I could do it, and I understood what it was like not to understand it. So I wanted to help kids understand.”

Now, over fifteen years later, Blum is working with scientists and researchers to encourage outreach to students like the ones she used to teach. But as most scientists know, it can be very difficult to get excited about outreach. The

scientists on the grant usually have jam-packed schedules, filled with research, deadlines, administrative paperwork, and teaching classes of their own. It can seem nearly impossible for them to make time for extra outreach.

That's where Blum comes in. "I try to make it as easy as possible for researchers to participate," she says. Her goal is to initiate outreach programs that can satisfy everybody involved: researchers can participate with little to no prior preparation, because they will be discussing their passions and current research, and the students benefit from learning about the real-life science happening in their community. "These programs are designed to have as minimal of a time commitment as possible, so it doesn't infringe too much on your current workload," Blum tells the researchers she works with.

Blum attributes her success with outreach in part to intuition and empathetic understanding, which makes it easier to identify with the scientists on her team. "Time is a rare commodity, and to do anything extra beyond the science is really difficult," she acknowledges. "So I try to get to know the person first to understand how they think about their involvement in something additional to their normal workload and the normal science they would be doing for the project."

> "I TRY TO GET TO KNOW THE PERSON FIRST TO UNDERSTAND HOW THEY THINK ABOUT THEIR INVOLVEMENT IN SOMETHING ADDITIONAL TO THEIR NORMAL WORKLOAD AND THE NORMAL SCIENCE THEY WOULD BE DOING FOR THE PROJECT."

From there, Blum takes the lead in setting up outreach opportunities that best fit the preferences of each researcher. For example, she says, when designing a teacher workshop, "instead of putting responsibility on the researcher to break down their research for the teacher, I simply have the researcher talk about their research and set the teachers up to ask the right questions so they can tie the research to their curriculum."

So far, this approach has been incredibly successful. "The researchers who volunteered to participate in the teacher workshop found they really liked working with the teachers," Blum confirms. "Set up a proper framework where it's easy for the scientists to participate, and they'll be more likely to participate."

Another major reason for Blum's success is her design of

the outreach opportunities. “It’s very structured in that everything is taken into account,” she explains. “Workshop objectives, speakers, facility arrangements, and agendas, as well as teachers’ travel arrangements. are taken care of by a planning committee so that all the researcher has to do is show up at the assigned time. I also take care of printing materials, securing demo equipment, and prepping the participants. It’s more or less just taking care of the details so the researchers don’t have to worry about doing any extra work.”

Blum acknowledges that she does not have as much insight into the team’s research as most of the scientists involved. But what she does know is that successful outreach is crucial to the team’s overall accomplishments. “I want to do a good job, I know that,” Blum says. “I want to make sure it all works well, and we all do well as a team.”

What Works – Tips & Techniques

- Notice and acknowledge positive things that researchers are doing. When you recognize the good in your team members, you make a positive connection.

- Start your team planning process early, and keep everyone as informed as possible.
- Share suggestions with all team members.
- Connect over the phone – although email may be quicker, it can be easy to misread things. Take the time to speak and listen, and your communication will improve.
- Connect researcher to passion as a way to sustain participant intrinsic motivation
- Relieve team members from the administration responsibility so that they can focus on research and/or outreach

Resources

Bennett, M. L., Gadlin, H., & Levine-Finley, S. (2010, April). *Collaboration & team science: A field guide (Draft)*. Retrieved from https://www.hopkinsmedicine.org/women_science_medicine/_pdfs/team%20science%20field%20guide.pdf

MARK BRUNSON

For the first two years of Utah's EPSCoR project, Mark Brunson was an outside observer. The project, built around sustainability of water resources in conditions with rapid population growth, concentrated on three main focus areas: ecology and hydrology; the human component around water resources; and using natural systems modeling efforts to make predictions about water challenges.

After two years as an observer, Brunson became Director of Education, Outreach, and Diversity activities for the EPSCoR project – a position he holds to this day. The EPSCoR team, known as iUTAH (innovative Urban Transitions and Aridregion Hydro-sustainability), holds an annual Summer institute to encourage STEM learning in high school and college students. "We bring together high school students, high school teachers, and college students, typically who are not in STEM disciplines," Brunson explains. "They spend a week studying water science and various aspects, doing small research projects, and presenting that research at the

end of the week at a symposium that brings together all the people from iUTAH."

Beyond their Summer Institute, iUTAH works hard to engage as many state institutions as they can – not just research universities, but primarily undergraduate institutions (PUIs) as well. The team created a survey that they could use to gather information from members of the Utah community and sent students from various institutions out to collect data on iPads. "They eventually ended up with faculty members from all of these small, regional schools across the state, all of whom were engaging undergrads in administering these surveys, primarily at grocery stores or other similar kinds of cross-sectional gatherings," says Brunson. "It was as rigorous a sampling design as they could put together. They've gathered more than 6500 responses, and then, working with our cyberinfrastructure team, developed an innovative survey data viewer, a kind of way where you can do data visualization interactively."

This has been a huge hit across the state. The interactive data viewer allows anyone with an interest to do cross tabulations from the collected survey data – for example, water use across different age ranges – and see with relative ease whether that relationship is statistically significant. "The simplicity of the research design was

very transferrable," says Brunson. "There were explicit instructions, but the actual tool, you can hand somebody a touchscreen device and in today's society, most of them are able to figure it out immediately."

> **"WHEN PEOPLE COME TO ME BECAUSE THEY THINK IT WOULD BE REALLY COOL TO DO THIS AS A HUMAN NATURAL SYSTEMS PROJECT, IT WORKS WELL MOST OF THE TIME. WHEN THEY COME TO ME BECAUSE SOMEONE TOLD THEM THEY NEED TO HAVE A SOCIAL SCIENTIST, AND JUST WANT TO TAG INTERDISCIPLINARITY ON BY STAPLER, WHEN THAT HAPPENS WE HAVE MORE COMMUNICATION DIFFICULTIES."**

What has impressed Brunson the most about the project has been the volume of data that the students were able to obtain with so few expenses. "You need $60,000 to put a research assistant on a project for 2 years, and you get 400 responses," he explains. "Here we have 6500 responses and we didn't have to hire anybody. We're either in the academy or we're crowdsourcing. And all of this came out of brainstorming outside of a competitive grant process. You bounce ideas off of each other and somehow the project

just takes shape. Coming up with this product, this social survey data viewer, it's not something you get trained in."

Team members were selected based on interest and experience in interdisciplinary collaboration and teamwork. "When we created this program, we knew it was going to be interdisciplinary, so we did to some extent select for individuals who were bright, but who also recognized that there was a lot of value in doing this," Brunson recalls. "When people come to me because they think it would be really cool to do this as a human natural systems project, it works well most of the time. When they come to me because someone told them they need to have a social scientist, and just want to tag interdisciplinarity on by stapler, when that happens we have more communication difficulties. And so I think that the team, the whole project, with 150 people engaged, students and faculty, through all of Utah EPSCoR, we've really worked for the last four and a half years now to achieve that interdisciplinarity. One thing we've observed is how much more inter-network we are now than when we started."

It helps that the current director and associate director of the project are both very interested in the science of team science. "The new director, her leadership style and her understanding of what interdisciplinary team process is, has been critical in this," Brunson avers. "We have people

who think very deliberately about this. And I think that's important, recognizing that you can't just bring people together and you'll get into sync through osmosis. We built the team that would be best able to bring together resources to address the problem."

"We've been given money to build capacity, and we believe that that capacity is built to a large extent by enhanced collaborations across institutions. And we need to figure out how to make it work, because it has to fly on its own without the $20 million rocket booster."

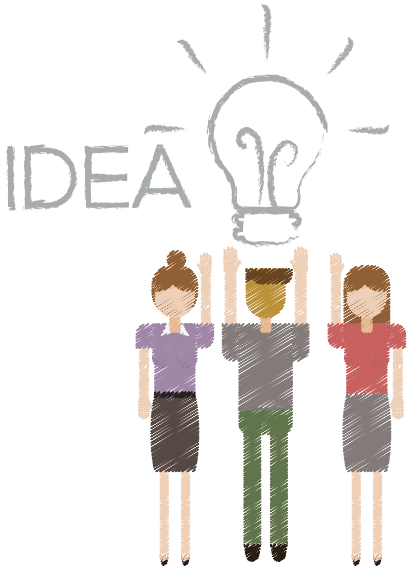
What Works — Tips & Techniques

- Make sure the primarily undergraduate institutions in your state do not get left out. Offer small grants to faculty who work with students on scientific projects.
- Include eager and skilled undergraduate students to help with EPSCoR-related projects.
- Select your team carefully, and consider the potential for interdisciplinary collaboration. Recognize that you can't just bring random people together who will get into sync through osmosis. This takes both time and effort.

- Create research designs that are simple for and transferable to outreach stakeholders.
- To stay focused, occasionally think about the potential loss of NSF funding if the team does not meet EPSCoR standards.

Resources

Thompson, J. (2013, May 12). *How to communicate in an interdisciplinary team*. Retrieved from http://www.scidev.net/global/communication/practical-guide/how-to-communicate-in-an-interdisciplinary-team.html



CARRIE BUCKLIN – ANNUAL CONFERENCE

When Carrie Bucklin started working with the Virgin Island EPSCoR team, one of her first projects was to organize the annual regional conference. There would be many important people coming in, including program officers and representatives from the NSF. This was her baby, and she wanted to raise it well.

However, she faced several challenges to making this conference a success: being new to the VI EPSCoR team, a lack of resources, the scale of the conference itself, fitting everything into a half-day event, and what Bucklin calls "Island time" – the temporal flexibility required of anyone trying to get something done in the Virgin Islands.

But Bucklin decided to take an optimistic approach to a stressful situation. "I know how stressful it is to be a presenter and not have confirmation until 2 weeks in advance," she says. As soon as she was given this role,

Bucklin decided to transform a hassle into a positive experience. The normally half-day event became a two-and-a-half-day conference, featuring field trips and meet-and-greets. “Everyone seemed to respond positively,” Bucklin recalls, adding that one of the NSF program directors labeled it as one of the most successful regional conferences she’d seen. The laid-back timing of the event played to the culture of the Virgin Islands – where a normal workday begins 8:30am, and the day is over by 4:30pm – which kept the community engaged.

> **“TRANSFORM A HASSLE INTO A POSITIVE EXPERIENCE.”**

Bucklin got the entire VI EPSCoR team to involved in the planning process months before the event. “I tried to incorporate all of their concerns, fears, and frustrations from the previous events, and I wrote out a list,” Bucklin says. “I tried to go through that list and debrief with people on an individual level, and I think that helped alleviate a lot of the stress.” From there, the buy-in was pretty immediate. Ideas from across the team were incorporated into potential solutions. “When you have a group that’s willing to give their all, that makes all the difference.”

“We converged on similar solutions organically, which

helped the team have more faith in me," Bucklin recalls of her first few months with the VI EPSCoR. "I think it's focusing on solutions, not instructions." In fact, she takes a similar approach to leadership in general. "The leader isn't telling people what to do," Bucklin says. "The leader is finding where people are getting stuck and helping guide them to a solution."

And as an EPSCoR regional leader, Bucklin cannot say enough about her team. "Our interpersonal relationships built the trust so that people knew that when you said you were going to do something, you did it," she explains. "Trust your people. They were obviously hired because they can do it. You can learn people's strengths and weaknesses. Even if you don't know people, you have to trust that they'll do their jobs."

What Works – Tips & Techniques

- Find out what past directors have done that people did or didn't like. If you ask, people will usually be honest in their reactions.
- Be honest and transparent about why you're taking certain actions, or why you choose not to. Ultimately the decision is yours, but sharing that information

with your team shows them that you respect their roles as well as your own.

- Give and receive constant feedback, as you would when teaching. Ask for formative feedback and formative assessment, and provide the same.
- Incorporate others' ideas and share how those ideas are being incorporated. Let people know that the input they are giving is being used by asking, "Did I use it properly, and if not, how can I do so better in the future?"
- Create a to-do list of things to alleviate stress. Debrief with people at the individual level about what would they think of said action items.
- Make a list of problems-to-be-fixed from previous events. As you solve these problems, update the team. These actions help to build team buy-in, as long as you follow through with those actions.

Resources

Smith, B. (2015, September 30). *How to successfully debrief your event*. Retrieved from http://www.eventmanagerblog.com/how-to-debrief-your-event

CARRIE BUCKLIN – SCIENCE CAFÉ

In the hard-working community of the Virgin Islands, the cost of living is high and time is heavily valued. Carrie Bucklin, the Director of the VI EPSCoR, knows this all too well. And when she set out to host multiple Science Cafés, where members of the community would get together with experts to discuss science over refreshments, she was glad to have her team on board.

"It's hard break into a community when you're trying to justify a science education event when, ultimately, it won't help the adults take care of their families," Bucklin explains. In a remote location like the Virgin Islands, events have to be justified based on participant cost – which takes into account monetary costs as well as time and travel. And so, Bucklin and her team went all in to design an event that would encourage community buy-in and participation.

"We wanted to create an environment that was a way for people to learn about science in a cross-cultural setting," she recalls, "and so we just went through and we figured

out how to do it and we did it." But Bucklin admits that there's much more to it than simply a positive attitude. It took the enthusiasm and efforts of the entire team to make this event happen. "I've worked in a lot of different offices on a lot of different outreach events," she says, "and the way that all of the staff just jumped on board, and the massive volunteerism from the EPSCoR team when they're already doing 5-7 jobs on top of what they were hired for, the fact that they're willing to sacrifice time with family to volunteer to do this, was really fantastic. That was the best part. Everyone was jumping in to want to make it happen."

Bucklin attributes the success of the Science Cafés to the nature of the project combined with the nature of the group. Although the faculty members of the EPSCoR team were well-versed in Science Cafés and excited to participate and contribute their ideas and networking connections, the support staff had never seen an event like this in action and were therefore more reticent in their enthusiasm. Nevertheless, everyone contributed and worked hard to make the first Science Café a success.

"Our support staff are not science people, and normally they only interact with our faculty in a science setting, which can be confusing," she explains. "They were hesitant because they only ever see the faculty in a technical space. Watching them interact like normal people and

communicate with the general community made them say, 'Okay, this can work.'" This buy-in was crucial in the success of each of the following Science Cafés.

Once the support staff witnessed the event in real time, they became equally enthusiastic and began planning future Science Cafés that would best benefit the local community. "They would use their social capital to help us," Bucklin recalls. After each event, the team would discuss what went wrong, what went well, what they liked about the location, what they about the topic, where to host the next Science Café, and which groups to hit. "Everyone had their own mini-job within the greater project, and we were always providing feedback and talking, after the first event," says Bucklin.

She attributes part of the team's success to the physical space in which they work, which used to be a townhouse but was converted into office space. Not surprisingly, it has a very homey feel. All of the non-researchers, along with Bucklin herself, work on the same side of the building, which is also home to the coffee maker and printer. This lends to a social environment with almost constant contact between the researchers and support staff, even though the researchers on the EPSCoR team are also faculty members at VI institutions with their own offices on campuses nearby. "In terms of physical space, it kind of felt

like you were right on top of each other," Bucklin laughs, "which works out well in terms of teamwork and in terms of needing to be close."

The group dynamics also lent greatly to the success of the VI EPSCoR team. According to Bucklin, everyone was happy to work together, and everyone put their all into every meeting. "This team has accomplished everything we set out to do," she says fondly. "That was my favorite part about VI EPSCoR. If we as a group made a decision to do something, it happened."

What Works – Tips & Techniques

- Make sure your team members have buy-in on a project. Teams need to be enthusiastic about taking on a project and helping it succeed.
- After big events or projects, ask: What went wrong? What went well? What did we like about this location? What did we like about this topic? Where should we do the next one? Which groups are we going to hit?
- Understand the community in which you're working. Their priorities and interests can have an enormous impact on the success of your projects.

- Nudge researchers to eliminate jargon from their interactions with non scientists and with community members. Communicate science in a way that contextualizes results. For example, make the science relevant to their everyday lives and then bring the science to a level that makes sense to the general public and not just to those of us at the University.
- Create buy-in by identifying how outreach will impact community.
- Provide dinner for parents, students or general public who come out to listen to some cool science.

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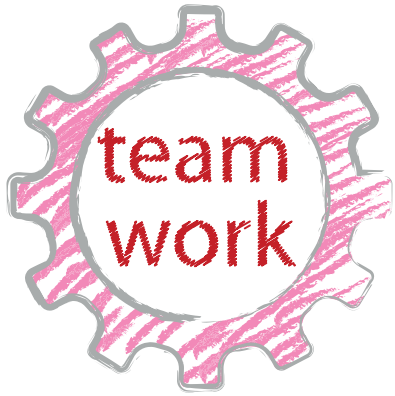

TANIA CLUCAS

As someone who was born and raised in Alaska, Tania Clucas has seen first-hand what outreach can look like in indigenous communities. So far, she has not been impressed.

"Especially being in Alaska, where we have a significant indigenous population, you really have a long history of white people coming into a community and telling people that everything they think they know is wrong," says Clucas. "And then they leave. It's a never-ending turn-style. You were pseudo-Colonial with your white liberal guilt, and you did your part for the oppressed brown person, and now you can check that off your CV and move on with your life. I've lived here all my life and I see it all the time."

That's why the Alaska EPSCoR team takes a different approach. "We make a serious effort across our program to be very collaborative with our communities," Clucas explains. "If your people have been there for 10,000 years, you probably have a pretty good grasp of your

environment, how it works, and how to live there. We can learn a lot more if we work *with* the people in the areas, instead of just working *for* them."

Clucas, with a background primarily in geography, works with computer scientists, engineers, and educators on a highly successful project: the Augmented-Reality Sandbox. Developed by the Kreylos Lab in the University of California system, this tool uses sensors and projectors to transform a sandbox into an interactive topographical map. has made continuous progress in Alaska. "We adapted it for use in our outreach and education activities," Clucas explains. "We came together with technical expertise, and we found the finances, worked to develop a curriculum around it, and conceptualized a way to make it into a mobile device instead of a pseudo-permanent installation."

In fact, the mobile unit that came out of the Sandbox was built by undergraduate students as part of a class project. In addition to successfully producing a portable version of the original tool, the seniors at University of Alaska Fairbanks got real world experience building a project while working within a budget. And they're not the only ones who have expanded on the device – the Physics department is currently working on developing a model to measure electro-potential lines. "None of us had ever thought of

that," says Clucas, "but it's all open source and it's really fun!"

In building the team, Clucas looked for people who would get results, and get the job done. She wasn't worried about social skills, so long as team members were internally motivated and complemented one another's areas of expertise, with relevant technical skills. Clucas also tried to find people who were compatible with her preferred style of management, which she describes as relatively hands-off. "I still like to keep in contact with my people to make sure they're getting the support and resources that they need," she says, "and that they're kept current on anything that comes along that they may need to know."

Clucas attributes her team's successes to the people involved. "It's been one of the more productive and satisfying groups of people to work with," she says. "Fortunately I didn't really have to train too many of these people. We kind of selected each other because we knew we worked well together, and we had the necessary variety of skills to keep things moving forward. That's probably a key reason why it was a satisfying team experience."

"We all knew where we wanted to go," Clucas adds. "We wanted to create a device, and create a mobile version of the device, and deploy the device. We wanted to have

curriculum and be able to tie what we're doing with our research and use the device to demonstrate and communicate some of the concepts that we were studying to people. And they made it happen. It was great."

When it comes to outreach, Clucas believes it's highly important to listen to what stakeholders are interested in, and what they hope to see the project achieve. "We're there with our own goals and motivations," she acknowledges, "but shoving it down their throats is not a good way to get buy-in. See what it is they're interested in. What are their motivations? Then you can figure out a way to relate your project to what they're interests are. Show them that you're relevant and figure out a way to relate to what matters to them. Otherwise you're just another person from the proverbial ivory tower telling them that what they think they know – their lived experience – is wrong."

But getting researchers on board for outreach can be difficult. "I'm very sympathetic to people who don't want to do outreach," says Clucas, an introvert who has learned to adapt. "They spent so many years getting this expertise in this thing that they're super passionate about, and now they're being told they have to do this other thing as well. And I get it."

"On the other hand," she adds, "when you take the EPSCoR

money, you take on the obligation to participate. But I don't want to set them up for failure. I want to make it as painless easy on them as possible." In order to do that, Clucas and her team offer training and opportunities for outreach improvement. She also tries to match individual researchers up with opportunities that reflect their interests and comfort zones. The faculty member who loves spending time with his own toddlers, for example, is most frequently recruited to do outreach with young children in the community. "I want to put them in a situation where they're going to be comfortable and have an idea of their audience's expectations," she says.

"MATCH INDIVIDUAL RESEARCHERS UP WITH OPPORTUNITIES THAT REFLECT THEIR INTERESTS AND COMFORT ZONES. THE FACULTY MEMBER WHO LOVES SPENDING TIME WITH HIS OWN TODDLERS, FOR EXAMPLE, IS MOST FREQUENTLY RECRUITED TO DO OUTREACH WITH YOUNG CHILDREN IN THE COMMUNITY."

To those within EPSCoR who tend to drag their feet when it comes to outreach, Clucas has some advice. "You want your science to be as robust and approached from as many angles as possible so you don't leave something out," she says. "If you engage in some good outreach and you get to

audiences that you wouldn't otherwise, you're also going to get questions or perspectives from people who didn't get the same training that you did, and therefore they're going to perceive things in a different way. That can cause you to look at things from different perspectives, and that makes your work stronger."

What Works – Tips & Techniques

- You're working with people who have highly-developed levels of expertise in their fields, but they might not have expertise in areas that seem related to a generalist. Be patient with them, and understanding.
- Remember to not invest a lot of ego into people's comments about the project. It can be difficult to work with people who don't think like you, especially in an interdisciplinary environment. Don't take things personally.
- Different disciplines have different vocabularies and different approaches. Use clarification, otherwise it can create confusion. It's okay to say "Here's what I understood from what you/we just talked about, is that correct?"

- Pick up on your researchers' interests and try to align opportunities with what you know of your researchers.
- Just because someone isn't doing something the way you would do it, that doesn't mean it's wrong. Sometimes you have to trust that it will work if you know historically they have done good work.

Resources

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TERRY DONALDSON

What do you do when you work in a small, isolated territory of the United States, and you've just been awarded an EPSCoR grant? That's what Terry Donaldson, PI of Guam EPSCoR, is figuring out. In addition to the general challenges that come with working on a large grant, Donaldson and his Co-PIs began their project with another, more human obstacle: how to convince additional researchers to make the move to Guam and join the team.

Guam has one major institution within its jurisdiction, aptly named the University of Guam. Due to the inherent collaborative nature of most EPSCoR grants, Donaldson and his team wanted researchers and collaborators from more than just the one university. But recruitment turned out to be more difficult than expected. It's tough, he explained, to get researchers from other parts of the US to uproot their lives and move to Guam for several years. For many, the benefits of an EPSCoR grant are not strong enough to outweigh the inconvenience of moving so far away.

After over a year of recruitment, the team has finally come together. The majority of the collaborators are recently hired faculty members of the University of Guam Marine Laboratory. The team is made up of a wildly diverse set of researchers: an oceanographer, a bioinformatist, two population geneticists, a genomist, a research associate with a strong background in GIS and coral taxonomy and ecology, and graduate students funded by fellowships – all from different cultural backgrounds – are now working together to research how coral reefs respond to climate change. According to Donaldson, this diversity makes communication integral to the team's success.

The Guam EPSCoR team is always working to accommodate, communicate, and collaborate with one another. As a PI, Donaldson feels especially strongly about this. "I have to take their information and try to find the best way to apply it," he says. "I'm always going to ask for advice. I always take into account anything that anybody says to me in regard to the project. That's one of the big things we're focusing on is collaboration. Not just within our institution, but across institutions."

> **"I'M ALWAYS GOING TO ASK FOR ADVICE. I ALWAYS TAKE INTO ACCOUNT ANYTHING THAT ANYBODY SAYS TO ME IN REGARD TO THE PROJECT. THAT'S ONE OF THE BIG THINGS WE'RE FOCUSING ON IS COLLABORATION. NOT JUST WITHIN OUR INSTITUTION, BUT ACROSS INSTITUTIONS."**

Overall, the EPSCoR grant has already shown great promise to the Territory of Guam. "Guam is kind of a unique place," Donaldson admits. "We have 7 undersea cables that all hit the beach here, and they're putting in fiber-optics, too. Now we've got cyberinfrastructure improvements, fiber-optics coming into our labs, all to improve our capacity and improve our infrastructure in our university and especially in the community. This project has been a magnet for infrastructural development."

But as with most teams, there are obstacles to overcome. "Things don't get things done as easily as they may anywhere else," says Donaldson. "We're isolated. So we have to make things work as quickly as possible. We have to identify what we want, what are the obstacles to getting what we want, and how do we overcome those obstacles? Because a number of the obstacles that we encounter are obstacles that would be the same if we did not have an

EPSCoR grant. We have experience in trying to overcome these obstacles."

Another major hurdle, according to Donaldson, is receiving recognition as American researchers in an American territory. To overcome this, many of the team members have been able to use their connections to other researchers and scientists within the continental US to work toward a goal. These collaborations advance not only the Guam EPSCoR team, but also advance the field of science. "You can do this as an individual with your own experience," Donaldson explains, "or you can do it as part of a team."

Of course, not every researcher is always on the same page as the Co-PIs. "We've told NSF what we're going to do, and we have to do it," says Donaldson. "We laid this out in a strategic plan and said these are the basic bells and whistles we're going to produce. I have to sometimes focus people back on that, because they're already thinking about what we can do after."

One thing that has helped his team focus was hiring a project manager. This integral role is filled on the Guam EPSCoR team by Mellani Lubuag, a woman with a Master's degree and years of experience in grant management, who initially applied for the secretary position, but was overqualified. According to Donaldson, she has been

remarkably adept at getting things done and is already vital to the team. “What’s most important is that she shows initiative and innovation,” he says. “I’ve learned a lot from her just by watching her work.”

So what qualities make for a great project manager? From his experiences thus far with Mellani, Donaldson believes a project manager should have a strong focus on the problem or challenge at hand, and a toolbox with which to solve it. She or he must be able to plan ahead, recognize what options are available for accomplishing a task, and recognize what people may be in better positions to push actions or items to fruition.

It is also imperative that the project manager respect the team members, but also be able to give gentle reminders about due dates and reports; Mellani is very good at keeping researchers on schedule, and has a positive and relaxed way of communicating with others. “She has this worldly approach to things,” Donaldson explains. “There’s some criticism that she doesn’t have a scientific background, but I can’t tell the difference so far. This project has achieved its success thus far because we have a very good project manager. That priceless piece of fruit just fell out of the tree.”

Mellani is ably assisted by Michelle (“Mitch”) Silva Aranda,

the project's indispensable grants assistant, who is currently working on a Master's degree herself. According to Donaldson, Mitch's commitment to timeliness and efficiency illustrates yet another important point: don't just hire strong researchers and organized project managers. Hire good assistants, too!

What Works – Tips & Techniques

- Work hard to maintain your focus on the challenge and project at hand. Try to use logic over emotion, and understand what it is that's needed for success.
- Check in with your team about how to utilize the research funds – don't just send one researcher or another on a spending spree without the consent and counsel of the group.
- Be able to recognize what qualities make up a good manager, and hire a very capable project manager. This will make your project flow a lot more smoothly.

PAT DUSSAULT

Pat Dussault is the former co-Director of the Center for Nanohybrid Functional Materials (CNFM), one of the two centers for Nebraska's EPSCoR team, and he just came out of a six-year grant funding period. In that time, he and his team, made up of chemists and engineers, were successful in a lofty goal.

"We annealed a group of individual investigators into a team pursuing a major goal," says Dussault of the team's success. "At the same time, we built something physical: a core facility Three of the groups in engineering had some common use of equipment already, some joint training of students already, so when we set the grant up they proposed we knock out some walls and take some of the space in their labs and create sort of a central facility for the whole center."

The end product was a center for science that housed all of the team's necessary equipment, a research office area for meetings and students at work, and even a wet lab space.

"We had a common thing that people thought about when they thought about being in the center," Dussault says, adding that the EPSCoR team was even able to run student seminars in the facility several times per year.

But the grant period wasn't an easy one, according to Dussault. From the beginning, he knew this would not be like other grants he had received. After the preliminary proposal from his chemistry-centered team was criticized for being too disciplinary, the Nebraska state EPSCoR committee suggested the group explore a partnership with a team of engineers whose proposal had also been turned away and resubmit a joint proposal. Only if the two teams collaborated would they even be considered for funding.

"We sat down with the members of the other team for the first time and talked about organizing a joint proposal area that combined our interests in bioanalysis and their interests in the research opportunities arising from the novel properties of a new class of nanomaterials," Dussault recalls. "The whole thing kind of grew out of that." Although the two teams had been encouraged to collaborate, their chances of being funded still did not seem high. However, once the leaders of the two groups began to draw some Venn diagrams, it became clear there were several areas in which genuine collaboration across the disciplines would

offer unique opportunities not open to ether group. “A lot of trust has to develop quickly,” Dussault points out.

Once it became clear that their proposal had true potential, a partnership began to emerge. “We had a lot more time to think about where the likely alliances were,” says Dussault, “and the collaborations started to form kind of spontaneously.” The resulting partnership, which self-defined as CNFM, generated an active team of more than a dozen investigators from three branches of the University of Nebraska (Lincoln, Kearny, and the Medical Center), Doane University, and Creighton University. In 2010, The Nebraska EPSCoR proposal, which included CNFM as a major component, was funded.

Things seemed to be progressing well until the CNFM team faced their first external review in the middle of their first year of funding. An EPSCoR external advisory board, which included experts in the area of the grant, advised the team that their research, while successful on an individual group basis, lacked the overall collaborative focus intended within the grant – instead, the research output was made up of a compilation of presentations and publications authored by individual members of the team. Though they each referenced the EPSCoR grant, these publications did not reflect the collaboration that was expected of their group. “It’s not obvious that you’re a group,” Dussault remembers

one reviewer saying, adding, “We realized that we would not be successful in reaching the full potential of this grant unless we had genuine collaborations which generated multiple-investigator grant proposals, presentations, and publications.”

The external review, while disappointing, served as a wake-up call for the management team. They revisited the larger goals of the grant from the perspective of how to realign CNFM research efforts to become more collaborative and to better address the high impact targets of the original proposal. Two major decisions – one a visit by the management team to the National Science Foundation, the second an all-investigator CNFM annual retreat – gave the team opportunities for this refocusing. At the retreat, the management team revisited the original Venn diagrams, emphasizing the importance of overlap between individual team members’ research interests. Dussault explains, “Only when we began to see intersections did we think, these are the places where the team has strength together, more than individually. And you could actually make some hard decisions. If you have a standalone person, you can look at whether they are scientifically isolated or whether they are an essential element in tying together several other groups.”

This was a challenging time for the management team and

included some difficult decisions about whether the current group of researchers was optimal for the future progress of the team as a whole. Some of the investigators who had been aboard from the beginning were running individually high-performing research projects and were moving in a direction different from the goals of the overall program. These researchers ultimately separated from the Center.

> **"OFTENTIMES YOU'RE JUST TRYING TO FIND A WAY TO KEEP SOMEBODY IN YOUR GROUP AND AFTER A WHILE, SOMEBODY ASKING THE HARD QUESTIONS MAKES YOU REALIZE, WE CAN'T. WE CAN'T FORM A GROUP THAT KEEPS IN EVERYBODY, THE GROUP HAS TO BE ORGANIZED AROUND SOME THEMATIC FOCUS TO BE SUCCESSFUL."**

During this process of deciding which researchers would continue to make up the team, a great balance emerged between the two co-Directors and among the management team in general. "It took a combination of tact and directness," Dussault says of the early planning process. "My co-Director had a laser-like focus on quality and product. If he thought something was not fitting, he would keep coming back to it. And that's important,

because oftentimes you're just trying to find a way to keep somebody in your group and after a while, somebody asking the hard questions makes you realize, we can't. We can't form a group that keeps in everybody, the group has to be organized around some thematic focus to be successful."

"We had to remember that this was not about right or wrong, good or bad," Dussault adds. "All of the investigators were doing high quality research. We just had to focus on the high quality research that fit the goals of the proposal."

"The group ended up much stronger as a result of the difficult (re)planning process," says Dussault. A small seed grant program, originally created by the management team to expand the reach and impact of the Center, had borne fruit in identifying several young faculty members whose research strongly aligned with that of the Center. "During year 2, we added a new investigator who became one of our breakout stars. It was a good thing in the end, but it carried some political baggage for a while." However, Dussault notes that the impact of this seed grant program was so positive that the management team re-worked the budget in the third year of the project, adding two other new investigators for the remaining three years of the grant.

There is no doubt in Dussault's mind that the combination of expertise and teamwork enabled the CNFM group to achieve success. "We had a lot of complimentary expertise, which was great," he recalls, "but what made it possible was the existence of a physical core in our facility, an intellectual core in terms of our central collaborative groups, and the strong ties that developed between those of us trying to develop collaborations bringing our individual disciplinary areas of expertise into these collaborative spaces. In the end, some of the alliances across the original boundaries became much stronger collaborations than we ever could have imagined when we drew our first Venn diagrams during the planning process."

According to Dussault, it's all about learning to work effectively with people while keeping an eye on the prize. "It really is like a very careful negotiation," he says. "You're going to have to work with these people for a long time, and you need a framework in which both individuals on the team and the larger group can be successful.

What Works – Tips & Techniques

- You have to move away from the concept of only doing what you're good at. What larger target is the group going to pursue? If the group has no focusing element, the center or program has no reason for existence.
- Establish a goal early, and check in often. What is the big prize each team member imagines? What would each regard as success for this group? Is the team making progress toward that success?
- Have a management team in charge of budgeting. Use your budget effectively, and allow for the flexibility to engage different people over the grant period.

Resources

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COURTNEY FLINT

Courtney Flint had never been part of something quite as complicated as the development of a large-scale household survey for Utah EPSCoR's iUTAH project.

When she joined the team, Flint worked with Douglas Jackson-Smith to lead the survey effort. But the project soon turned into much more than a small partnership. "This was multi-institution, multi-collaborator project, with faculty, post-docs, graduate students, and undergrads working together," she explains. With that many researchers involved, it's no surprise that the team had many different objectives for data collection. When all was said and done, twelve researchers from different institutions had collaborated on the project, the survey instrument was a whopping 16 pages of diverse questions.

"It took a great deal of effort to find common ground to develop a survey instrument that would have a singular voice to it, so that for respondents it didn't feel like disjointed pieces," Flint says. "Being able to pull this

off, with many different faculty and students with very different personalities, different objectives, cross-purposes sometimes, I see it as a great success story."

The end result was a large-scale household survey that was administered throughout three different urban areas where the team was studying urban water sustainability. The team collaborated to develop the survey instrument and a corresponding administration plan. The survey was administered over a summer using teams of students throughout neighborhoods in their three core urban system study areas.

The students who collected the data reported a 62% completion rate overall, with over 2400 responses. It comes as no surprise that the robust data set that emerged from this survey instrument is still being mined.

Flint has been involved across the board with this initiative. In addition to being second in command leading the survey initiative, she assisted with the survey design, facilitated exchanges between team members, made sure everyone's needs were met, reached out to municipalities and stakeholders for input, and trained students in field surveying. She is currently analyzing the data that has emerged, publishing papers, and presenting to local communities on the results.

Although this survey initiative is now over, some of its questions were branched off into a related iPad survey, known as the Utah Water Survey. This spin-off project, which Flint also helped to design, has brought in new faculty and students from across the state. “What started as a single survey effort has continued to grow,” she says, “bringing more collaborators from academia, but also from municipalities and beyond science communities as well. It’s such a successful team science story because it led to new students coming in and using the data.

But the success of the survey initiative goes beyond its inclusive nature. “We’ve now coupled the survey data with water use data from ten different municipalities,” Flint explains. “Now we can link actual water use with their actual survey responses, and we can compare those.”

Flint aligns the success of the initiative with the collaborative spirit shown by her team. “We knew this would be a team effort,” she says. “We knew that might be complicated, and we just embraced the challenges. We knew it would be complex and we just worked through it. Our team was not structured in a way that gave preference to certain players’ knowledge or authority. We recognized that even just our field workers had a key role to play, and we tried to create really open communication with those students so we could learn what was happening all the

way through the process. At some point, everyone had important and valuable contributions to the effort as a whole."

The team went beyond mere collaboration and focused their efforts on inclusivity. "We wanted to create the most inclusive process that we could," says Flint. "We recognized that there were people beyond academia, beyond the social scientists, who had knowledge and information that could inform our efforts, and we reached out to them in the design stage in terms of types of questions to include in the survey. We needed information from a broader community to inform our efforts, so we worked on establishing those partnerships early on."

> **"WE RECOGNIZED THAT THERE WERE PEOPLE BEYOND ACADEMIA, BEYOND THE SOCIAL SCIENTISTS, WHO HAD KNOWLEDGE AND INFORMATION THAT COULD INFORM OUR EFFORTS, AND WE REACHED OUT TO THEM..."**

The openness of their methods worked wonders. "Our process fed on itself," Flint explains. "Once you're open to ideas from multiple voices, and it helps and it makes something work better, you keep doing it that way."

One of Flint's favorite aspects of working on the iUTAH project was the team's commitment to open science and open data-sharing. "It wasn't just to check the box," she says, "it was to try to write policy, implement policy, that was as committed to sharing as we could be. We knew that ultimately we needed to be sharing not only our data, but our metadata, our methods, our process, in the most transparent way, so someone could replicate or use the data with a full understanding of what we did."

"In the mix of it, I found it to be one of the most challenging and often frustrating things I've ever done," Flint says. "But I'm teaching survey research methods now, and I find myself recognizing and realizing how cool it is, what our team accomplished, and how much we accomplished. It was a lot of work, and it was hard. As I watched undergraduate students find themselves and realize that they were making decisions, they were implementing them, they were working as a team, and they did not need me – those were the highlights. Watching them come into their own as research leaders, and team members, and followers."

What Works — Tips & Techniques

- Create a structure, plan, and/or timeline, then be prepared to throw it out the window. But do have structure, otherwise you're just paralyzed. Have organization, roles, responsibilities, and procedures, but let that be a document that you can adjust and adapt.
- Think of how much collaboration and inclusivity you're comfortable with. Inclusivity can be frustrating, and it's hard, but it can also be worth it. And when it gets hard, you have to be committed to inclusivity to power through.
- Delegate. Give others room to make decisions and take leadership. When people feel they have some ownership, they work harder. The more you allow people to have autonomy, the more they will have buy-in and commit to the process.
- Note your decision points along the way. Articulate when decision points emerge, what decision you made, and be able to justify it and document it, so everything you do is intersubjectively verifiable, and you can be very transparent.
- Try different things in terms of collaboration. If things

go well, do them again. Don't be afraid to learn by experience.

- Make sure people have a chance to speak, and be respectful of people's time and opinions.

Resources

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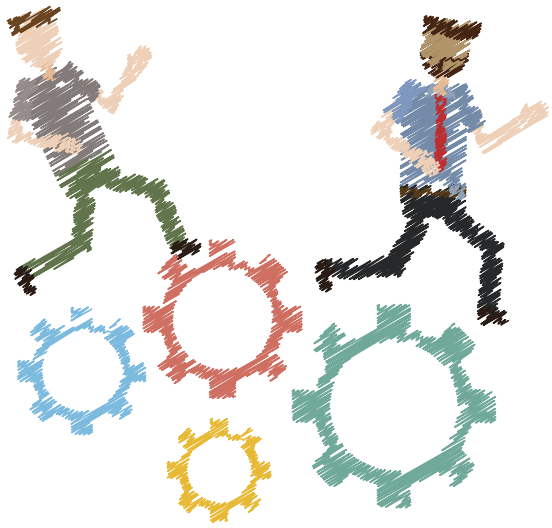

LILLIAN GAMACHE

Lillian Gamache comes from an EPSCoR region where there is a genuine interest in the environment, and in the concept and practice of team science. "In Vermont," she says, "there's a commitment to the quality of the environment."

Gamache is not a faculty member or researcher with Vermont EPSCoR. Instead, she is the Assistant State Director, Project Administrator, and Communications Director for the team. "As a team, we all contribute to the problem solving or the approach to how to tackle something," Gamache recalls, "and we all bring in our points of view, which helps us respond in a way that gets results and also addresses the different audiences we need to address in responding to issues. The Vermont State EPSCoR Director and PI is very hands-on and provides critical guidance for the team."

The science research team employs an Integrated Assessment Model (IAM) that they created, allowing them

to consider multiple factors simultaneously and gauge the consequences of any assumptions they might be making based on various scientific factors such as temperature, precipitation, and time. By focusing on assumptions and taking into consideration many diverse influences, the IAM helps decision-makers consider different future scenarios – in this case, about 40 years out – while also considering the plethora of data available to them. The team holds regular leaders and group meetings to analyze any hiccups they might encounter. In this way, Gamache and the Vermont EPSCoR team tackle problems from a process systems perspective. "The research team works through issues that are presenting themselves and troubleshoots as a team so results are achieved in a timely way," she says.

In addition, Gamache acknowledges that Vermont is known as an environmentally conscious state. This, coupled with the group's own commitment to problem solving environmental issues related to the Lake Champlain Basin, lends to their team's success. Of course, she adds, it helps that her team is made up of a hardworking and enthusiastic group of scientists. "They're just passionate about their fields," she notes. "It's authentic. They have a real connection to what they are doing."

As with most EPSCoR regions, Gamache and her team are expected to host outreach programs on several different

levels: high school, private sector, and undergraduate. In order to best utilize the expertise and resources available to them, the Vermont team has integrated different researchers with the different levels of outreach. Team leaders and subgroups meet regularly in order to discuss how the outreach is progressing and to help bridge the gaps between the researchers on the team and the public. And according to Gamache, this approach has truly helped her team to achieve what they are capable of.

"When you sign on with EPSCoR, it's expected that there will be interactions with high school students, undergraduates, and the private sector," she says, citing an "all in" approach reflected through a memorandum of understanding (MoU) within the Vermont team. "We reinforce the idea through our annual meetings, which we re-named to All-Hands Meetings. We're trying to build science research infrastructure capacity in Vermont. Without this outreach, we wouldn't be gaining as much. We strive to share that knowledge beyond our research core."

"WE'RE TRYING TO BUILD SCIENCE RESEARCH INFRASTRUCTURE CAPACITY IN VERMONT. WE STRIVE TO SHARE THAT KNOWLEDGE BEYOND OUR RESEARCH CORE."

Another aspect of outreach which the Vermont EPSCoR team focuses on is communications training. Through a partnership with the Alan Alda Center for Communicating Science, the team was able to make that happen – and then some. The Alan Alda Center helps train scientists and health professionals to effectively communicate with media, the public, and others outside of their disciplines. The ultimate vision of the center is to enhance the understanding of science on a societal and even worldwide level, which matched the outreach goals that Gamache and her team hope to achieve.

This partnership, established to introduce the idea of communicating one's science to others outside one's area of expertise, is now a part of team workforce development and training. In fact, the yearly workshop hosted by the Alan Alda Center Team is so effective that Gamache and her team usually have more interest than they can accommodate. In order to allow for more training to take place, they developed an internal training program that reinforces positive communication behaviors throughout the year. According to Gamache, the internal training has had a huge impact on communication effectiveness by sharpening attendees' skills and allowing them to practice in front of a group.

The goal is to empower local scientists – researchers, engineers, post-docs, graduate students – to discuss their

research and tell their stories in professional settings, but also community settings. The Alan Alda Center uses improvisation techniques to encourage this type of communication and storytelling, and frees scientists to discuss their work more naturally in everyday situations, connecting with their audiences on a more dynamic level. With this communication training, these stories are more relatable and more understandable to a wider audience. This is imperative not only publically, but also internally.

"We've really seen this group grow over the years," Gamache says. "We depend on each other for different points of views. We realize that without a particular voice at the table, we might not be considering something that is really integral to the problem solving."

What Works – Tips & Techniques

- Keep your eye on the bigger picture, which is to improve the region. There's a lot that goes into these programs, so don't get caught up when there are small stumbling blocks.
- Create a Memorandum of Understanding that includes team expectations. For example, it's expected that there will be outreach interactions with

undergraduates and the private sector. Reinforce that idea through periodic all hands on meetings.

- Reach out to your program director at NSF to seek clarification, support, or simply to keep the lines of communication open.
- Use an integrated communication and team system. With regular leader meetings, proactively identify blips in the progress of the project before they happen; or address them when they occur.
- Provide opportunities for scientists, students, and post-docs to tell their stories in a way that resonates not only in their professional conferences and their professional societies, but also in non-research locations (e.g. community gatherings or Science Cafés).
- Use story telling techniques and improvisation training to learn how to verbalize, write, craft, and then hone an idea through peer review in the room. As a result, you develop a much better elevator pitch.
- Apply improvisation as a way to loosen you up and drop your guard. By doing so, you start to connect with people in a really meaningful way.
- Leverage training as a way to build the team.

Resources

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success
teamwork

KEVIN GARDNER

"How do we consider and care for the environment that we depend on, and also consider and respect the needs of people on the earth?"

It's a question that Kevin Gardner and his EPSCoR team have been considering for over a year, and it's one that drives their project: The Future of Dams. "This is a project that is incredibly interdisciplinary," Gardner says of the work that he does in collaboration with colleagues across six institutions and three states. "And yet it's a project where everybody respects one another, listens to each other, respects the disciplines, their perspectives and viewpoints, works incredibly well together, and there's a lot of pride on a regular basis with this team."

Gardner is the Associate Director for the New Hampshire EPSCoR and PI of the research team that focuses on improving the use of science and decision-making around dams. His team is in the second year of their four-year collaborative project, and their advancement so far, both

internally and scientifically, has been slowly but surely progressing. And according to Gardner, that is the direct result of assembling the right group to begin with.

“There was an element of our own work to create this team, and then an element of luck when more people were brought in,” he recalls, adding that scientists needed to meet certain criteria before being welcomed aboard. When forming the team, Gardner and his colleagues looked for “the desire, willingness, and ability to work together with other people and to respect their ideas and approaches, and to be humble– so the ability to work together and contribute.”

Once the team was solidified, the next step was to ensure that everyone share leadership roles and responsibilities. “We demonstrate that there’s leadership coming from all levels of the project, from a graduate student or undergraduate student as well as an assistant professor, as well as the more senior people on the project,” Gardner says. “We also developed first thing a Governance Agreement that we ask everyone to contribute to and sign.” This agreement is more than just a document – it is proof of the empowerment and leadership that the team encourages and strives for. In meetings, Gardner and his team develop milestones and objectives for the coming year, and identify potential working groups. These

groups are then set up, allowing anyone on the team the opportunity to take on new leadership roles. This instills a level of trust in one another to take on responsibilities within the project.

In addition to the Governance Agreement, Gardner and his team started a Committee for Shared Leadership to encourage contributions from everyone involved on the project. "All the PIs and Co-PIs are on that committee, and we also have a rotating structure so that other individuals can serve on that committee as well," Gardner explains. "The delicate balance is that our objective is for the people on our project to be successful. That's how we define success. It's about those people's success."

And the senior team members will do everything they can to ensure their colleagues' success. "The overhead on these things is huge, it's just tremendous," says Gardner. "We don't want assistant professors spending their time on all of this. We've said explicitly, 'The more senior people are going to take that on. We want your intellectual leadership. That's where we want you spending your energy.'" And according to Gardner, this has helped his team be more cohesive overall. "People have a genuine respect for one another," he says, "feeling of generosity and camaraderie, and that really fosters the kind of behaviors that we like to see."

> **"HAVING THIS ONE PART OF THE TEAM THAT STUDIES THE TEAM AS A WHOLE IS PRETTY DELIBERATE AND SENDS THAT MESSAGE THAT WE ARE LEARNING. WE'RE TAKING THIS FEEDBACK AND CHANGING, ADAPTING, AND LEARNING AS EFFECTIVELY AS WE CAN AS A TEAM."**

being willing to look inward on ourselves and our team and be open to changing our behaviors and practices. It's saying we don't know how to do everything perfectly, but we're willing to try, willing to get feedback and willing to change

However, even the most cohesive teams might hit some interpersonal snags along the way. That's why Gardner's team enacted Dynamic Design Planning, where social scientists on the team confidentially interview other team members and provide feedback for the Committee for Shared Leadership. Says Gardner, "In addition to any communication approaches that we have, we also have this really effective part of the project that's focused on the team function itself. How well is the team functioning? What could be done, changed, modified to improve its function and make people more productive and feel better about it?" This reflects a safe environment where colleagues feel free to speak their minds, and it encourages humility within the

project team. “Having this one part of the team that studies the team as a whole is pretty deliberate and sends that message that we are learning. We’re taking this feedback and changing, adapting, and learning as effectively as we can as a team.”

Gardner admits that his tactics haven’t always been so honed. When asked what led he and his Co-PIs to model the behaviors that they sought from the team, he replied, “It’s probably a combination of mentors and our own experiences working in interdisciplinary teams and with stakeholders. Some of it comes from knowledge of what it takes to cross interdisciplinary boundaries and to ensure that there’s inclusion of diverse ideas.” After a pause, he laughs and adds, “It probably comes from a lot of failures, actually. One of my favorite quotes is from Winston Churchill – ‘Success is the ability to go from one failure to another with no loss of enthusiasm.’”

“Are we going too fast or going too slow? From day one we’ve been asking ourselves that question,” Gardner says. “We need to make sure everyone feels like they’re a part of the team and have input – it’s really about how inclusive is the process. It’s not just what you do, it’s how you do it.”

What Works – Tips & Techniques

- Recruit people to your team that show and have demonstrated desire and ability to work together with other people, to respect others' ideas and approaches, and to be humble enough to work on a team. Ask for and figure out how each person sees a role for him or herself in each respective project.
- Before drafting team members to the project, do some research to determine their fit with the group. Do not hesitate to prune the roster list of potential team members prior to recruitment.
- Include social scientists to perform confidential interviews with team members and study group dynamics. In addition to observation, their job is to report on general concerns, confusions, etc. that team members may not feel comfortable sharing with leaders.
- To gauge pace and performance, it helps if team leaders ask themselves, "Do people feel enfranchised? Engaged? Like they are contributing? Or are decisions being made without enough time for deliberation, thought, and broad engagement of the team?" If you want team members to display

leadership, you need to provide the time and opportunity for them to do so.

- Rather than take a "spend it or lose it" approach to managing a budget, shift the money to fund seed grants for undergraduate students.
- Incorporate a shared leadership committee that is made up of PIs and Co-PIs, and introduce a rotating structure that allows all team members, no matter their status, to serve on the committee and take on leadership opportunities. To that end, break the project down into some component parts as a means to create many opportunities for people to make leadership contributions.
- Leave room to flex and discover ideas. The teams that you bring may not be the teams that you have in year four or five.
- Create a governance agreement that everyone contributes to and signs. The document should describe how team members should communicate with each other, address conflicts and concerns, exit the group should something come up, etc. Draft it, share it, refine it, and then ask people to sign it. Leave it open for modification moving forward. Terms of the committee might include

shared leadership assumptions, identification of work groups, how to resolve conflicts on authorship, expectations as a team, data sharing, and contributions through external evaluation.

Resources

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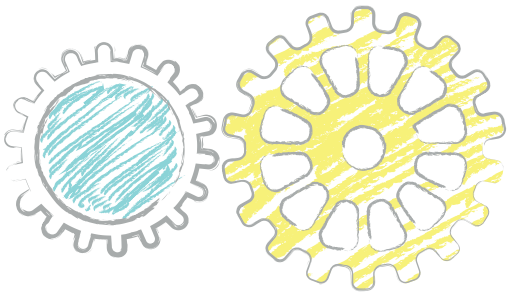

Figure 1. Gardner – Governance Document (see Appendix for complete document)

The Future of Dams Project

Governance Statement

Opening statement

This governance statement sets out shared principles to guide our work and our relationships with each other on the New England Sustainability Consortium's Future of Dams project. This is a living document, meant to evolve as our partnership evolves. Rather than offering an exhaustive catalog, this governance statement is meant to serve as a touchstone to prompt important conversations about conduct, conflict resolution, authorship, expectations, data sharing, and assessment.

Code of conduct

By signing on and contributing to this shared enterprise, we have made a commitment to each other and to the dynamic and interdisciplinary work we have proposed.

From the outset we agree to treat each other, students, colleagues, and community stakeholders with respect; to respect the diverse contributions we will make towards this joint enterprise; to respect each other's time, including keeping meetings on time and on task, delivering on deadlines, quickly responding to requests, and sharing the administrative and logistical workload of the project; and to respect each other's capacity for leadership by offering opportunities for all team members to take on important roles in the project.

We recognize that the success of this project depends upon the support and collaboration of community partners and stakeholders, and we recall our stated objective of contributing to positive societal outcomes. We understand this means treating partners and stakeholders as valued colleagues with important needs and concerns and striving to connect our research with their stated interests.

Because of the complexity and interdependence of our proposed research, we commit to regularly communicating with each other and striving to include all team members in our events and activities, as well as working to be as transparent as possible in our communication, governance, and decision making. As part of that commitment, we agree to make use of our shared communication technologies, including the team Google Sites, Groups, and Drive.

We agree to civilly raise concerns and issues with each other before they grow, and to approach members of the committee on shared leadership for assistance as appropriate, while keeping in mind that differences of discipline and opinion are an important and productive facet of interdisciplinary research.

CSL and other working groups

On this project we will strive to govern ourselves in a transparent and shared manner, respecting the skills, approaches and experiences of all team members regardless of their seniority. Our first conception of this is to establish a Committee for Shared Leadership (CSL), that we hope reflects the competing needs to keep the project on track (e.g. pay attention to engaging an external advisory board, to annual reporting, etc.), respect the ideas and contributions from all team members equally, and foster the development of early career faculty (e.g. not overburdening them with administrative duties).

To get the real work done that is going to advance our collective research agenda, we adopted the concept of working groups. Working groups may be established to help meet any of the needs on the project while being limited in time and scope. The working groups empower the team members volunteering on a particular group to advance the project.

Conflict Resolution

Despite the best intentions of everyone involved, conflicts are likely to arise. We will strive to resolve conflicts using the principles outlined in the opening statement and code of conduct above. We invite any individual experiencing a conflict to raise that concern with the CSL. In a case when a member(s) of the CSL is involved in the conflict, the concern should be brought to other trusted team members to assist in developing a suitable approach toward its resolution. All team members should agree to civilly raise concerns and to respectfully and confidentially assist in resolving those for the benefit of the team.

Authorship

Principles governing authorship should embody a spirit of inclusiveness and respect the traditions and reward structure of individual disciplines, e.g., social science; the arts; natural science.

Wherever appropriate (e.g., scientific posters), we encourage a robust approach to including participating students as co-authors.

We offer the following as a general guideline for discussing and determining authorship and author order.

- Discuss authorship and author order early and often. Miscommunications can best be managed by open, clear communication, in print if it is helpful to do so.
- Confirm author order before submitting a manuscript before publication. Many interdisciplinary teams like NEST work on multiple manuscripts simultaneously. A simple email reminder will confirm the agreed upon order.

ANDREA HOLMES

There is nothing that fuels Andrea Holmes more than being told she cannot accomplish something. That's what happened several years ago when, as an assistant professor of chemistry in a small liberal arts college in Nebraska, she decided to apply for a six-year major grant for research infrastructure improvement in the state.

"I got so much resistance from what I thought were my mentors," Holmes recalls. "People were basically telling me, 'You're shooting way too high, you need to keep your feet on the ground.'" Holmes was told that the grant was for major research institutions, not small colleges, and that she was only an assistant professor. She was shocked by the level of opposition that she came up against for wanting to apply for a prestigious grant. "In their words," she says, "I wasn't qualified to do this."

Instead of being discouraged, Holmes decided to go a different route. She contacted Pat Dussault, a fully-

endowed professor of chemistry at the University of Nebraska-Lincoln for support, and he agreed to be the lead for the project. Together, the two submitted a letter of intent and were invited to submit a pre-proposal. The pre-proposal was deemed not strong enough to be funded on its own, and Holmes and Dussault were encouraged to partner with a team of electrical engineers in a similar situation.

The teams merged and, over the course of a year, began collaborating on a new proposal. According to Holmes, this was a lengthy process with a steep learning curve, as the chemists and engineers had to learn to speak one another's languages. But they submitted their full proposal a year later, and this time, they were selected for funding.

> **"IF I MAKE UNILATERAL DECISIONS BECAUSE I AM IN A LEADERSHIP ROLE, THAT USUALLY BACKFIRES ON ME. IF I WANT MY TEAM TO TRUST IN ME, I NEED TO TRUST IN THEM."**

Since the acceptance of their proposal for funding, Holmes' team has faced a mixture of successes and failures. The successes she attributes to the strong leadership within the main team. "I never felt disrespected because I'm from a small school," says Holmes. "I was an equal contributor to

all decisions. We all had equal voting rights, we were never scared of speaking out when something wasn't correct."

And when there was failure, as happened at their first yearly review when the reviewing committee deemed their work as not living up to the grant due to the lack of interdisciplinary research, "we buckled up and we realized we had to make a change. We didn't fall apart and start to blame each other, we came together and investigated all of the reviewers' feedback, and we realized there were people we were funding who weren't contributing, and we had to make some tough decisions to get rid of those people."

"We reorganized the entire center," says Holmes, "kicked people out, brought new folks in, and set expectations and guidelines clearly. And after we restructured our whole thing, we came to our second annual review, and it was a night and day turnaround."

The most important contributor to their success was actually the acceptance of failure. "Failure did not scare us," Holmes says. "And we did fail that first year. And it has to do with the fact that we were still uncomfortable with each other's areas and we were isolated in our research foci, and then after that hit in the face, there was a fear of loss that we would not get refunded, and then we buckled up and decided, this is our money to lose."

What was most important to Holmes and her team was funding investigators who were hungry for research, but not so famous in their fields that they would take the grant money and run in their own directions. For that reason, they brought in younger investigators from many different disciplines who were excited to learn and contribute. The team gained respect for one another simply by observing each other and working together. It was a supportive environment instead of a competitive one, and that made the difference.

"When you come together as an interdisciplinary team, you become humbled really fast because you realize you don't really know anything about science at all," Holmes admits. "But if our team members are motivated, hungry, and driving forward, this positive energy transcends to all of us."

When asked to discuss the high point of working with this EPSCoR team, Holmes couldn't pick just one. "We all have had such amazing achievements," says the winner of the NSF Presidential Career Award and the 2015 Henry Dreyfus Teacher Scholar Award, adding that it can still be difficult to believe at times. "My goodness," she says incredulously, "I'm being appreciated in the scientific community!"

And it's the same excited reaction when she sees other members of her team get outstanding achievements. "As

a result of our leadership," Holmes notes, "my students won national awards, speaking engagements, Fulbright fellowships, and NSF and NIH scholarships. My postdocs won all kinds of distinctions. My colleague and collaborator, Dr. Mathias Schubert from the Department of Electrical Engineering at UNL, got an honorary doctorate at the University of Sweden. These are the high points where it shows that our hard work actually leads to good stuff. There's a reward for our hard work."

Over the years, Holmes' team has honed their process to one that is well-oiled and works for everyone. To start with, they lay out a well-organized and structured vision so that everyone on the team knows the expectations and goals. "The vision has to hit a big goal, even if it doesn't seem attainable," Holmes advises. From there, they work backwards lay out the steps and milestones that must be achieved in order to make the vision a reality. Once it is broken down in this way, the end goal becomes much more attainable.

Once everyone agrees on and understands the expectations of the team, it is time to get to work. Holmes likes to follow up regularly with her colleagues, and admits that communication is something that even the greatest scientists are sometimes lacking. "Communication is the key to success," she says. "The best form is face-to-face

communication because you can see that person's tone, look at their eyes, and quickly ask for clarification."

However, it is important to note that communication goes beyond checking in and following up. Even as a leader (or, perhaps, especially as a leader), communication is integral in keeping trust and teamwork at their highest potentials. Holmes learned that very quickly in her EPSCoR experience. "If I make unilateral decisions because I am in a leadership role, that usually backfires on me," Holmes admits. "If I want my team to trust in me, I need to trust in them."

Overall, Holmes' EPSCoR experience has been an enormous success. She attributes that primarily to her team, stating, "If one fails, we all fail. If one succeeds, we all succeed." Holmes also acknowledges the huge amount of administrative support, freedom, and trust that she has received from her school since being awarded this grant, and is grateful that her school will continue to stand behind her. But perhaps one of the strongest contributors to her success in EPSCoR has been her own perseverance. For those who doubt her abilities, Holmes has this message: "I will serve you the moon on the platter."

What Works – Tips & Techniques

- Communicate how each team member's contribution is integrated with the whole group by highlighting how achievements will make (and have made) an impact. Team science is about making sure the team succeeds, so the final product must be greater than the sum of its parts.
- Touch base with your group on a daily basis, and when problems are identified, aim to solve them as immediately.
- Position outreach as a way of strengthening one's portfolio in the eyes of funding agencies, recruiters, and tenure boards.
- Position outreach as a way to instill scientific passion in tomorrow's researchers and support the institution's enrollment efforts.
- Aim to communicate science in a digestible way that resonates with different audiences. A post-doc, for example, can introduce chemistry by discussing properties that would make "good" perfume to keep zombies away.

- Identify post-docs that are hungry to make an impression in the field.
- Rotate outreach responsibilities between team members to alleviate pressure and responsibilities.
- Set and agree upon team and project expectations. Revisit these periodically to determine your progress. If expectations are ignored consistently, cut funding for individuals not responsive to periodic feedback.
- Create a strategic plan that identifies milestones to be achieved between the current reality and the desired state. Provide training based on anticipated bottlenecks that get in the way of meeting said milestones such as running project management software.
- Invite and be open to critical feedback.
- Attend conferences together as a way to build a culture of teamwork and camaraderie.
- Periodically check in with individual team members regarding their confidence in speaking freely.

Resources

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RAY HUHNKE

Some people feel that the best part of working on a major project is the generation of accurate and applicable output. To Ray Huhnke of Oklahoma EPSCoR, there's nothing quite like working on a project with the "perfect" team. "The team concept is critical," he says, adding that this EPSCoR group was hand-selected by the leadership team. "I was able to glean out who I could rely on and identify leadership at each of the institutions I worked with. That was integral, because I could rely on them as second in commands and they could get the information I needed."

Huhnke was the research lead on and original conceiver of a 5-year Track 1 project that focused on building leadership in cellulosic bioenergy, and converting plant material through thermochemical and biochemical process to produce biofuels, bioenergy, and bio-materials and products. Between 2008-2013, the team anticipated and subsequently confirmed unique findings through their research. They also received a Research Infrastructure

Improvement Award for bringing new people in, improving laboratories, and overall providing a foundation for further research in the field.

"It starts with a vision or overall goals," says Huhnke. "When I take on a project, I envision the end before I even write the proposal. I know what the result was to be well in advance of it actually happening. It's just a matter of finding the right roads to get to that endpoint." As a rule, he doesn't do this on his own; each team member and researcher is consulted. "Each person has a critical role to the success of any team project."

Huhnke established early on with his colleagues what types of information would be needed in preparing a proposal. From there, they identified strong themes and objectives, ultimately narrowing those objectives down to specific tasks and the EPSCoR team members who would take responsibility. "Tasks were laid out that really reflected interest and expertise of the individuals," Huhnke recalls. "For the most part, everyone had a well-defined research topic to really focus on."

> **"THE INDIVIDUALS WHO MADE UP THE LEADERSHIP TEAM WERE TRANSPARENT AND LOOKED UP TO AS LEADERS, WITHOUT NECESSARILY HOLDING IMPRESSIVE TITLES."**

The leadership team proved to be integral to this process. They seemed to share a similar mentality, according to Huhnke: "We have a job to do, we have a timeline, and we're going to do our best to accomplish project goals." The individuals who made up the leadership team were transparent and looked up to as leaders, without necessarily holding impressive titles. They were professionals to whom others would go for advice. With their strong communication skills, positive attitudes, and proven track records of producing output, the leadership team set an impressive example for the rest of the group to follow.

"Maybe I was just lucky," Huhnke laughs. "You try to create the best possible environment, allowing everyone to express their opinion and how their piece of the pie fits in the overall scheme, to a point that at the end of the day, everyone feels good about what they just did." This created an ideal work environment for leaders, researchers, and students alike. "It was common admiration in being able to work together in such a great project."

Like all EPSCoR teams, Huhnke and his colleagues were required to perform outreach as part of their grant. "It's really tough to talk about the type of research that was being done to anyone other than the scientists that really understood what was happening," Huhnke admits. "That's

just the nature of it." But the challenge was accepted with enthusiasm. "The Science Museum of Oklahoma created a mobile science exhibit that involved the research theme and went around to a number of schools, especially in the underrepresented populations, to show what we were doing and how it would be important to the nation's energy portfolio," he recalls. The exhibit is still widely used and enjoyed to this day, and serves as a point of pride for the team. They also run an annual one-day event called Women in Science, where over 1000 students – most of whom are female, and a high percentage of whom are from underrepresented populations – gather to learn more about STEM.

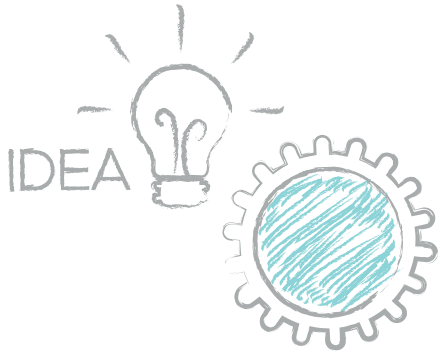
"You see young ladies become more interested in science or even technology on site," says Huhnke, "and then hear their stories a few years later that they never would have considered going into a science field until they came to this particular conference. That not only rings true, but it brings home the message that we've got to make our young people aware of their opportunities and the fact that they should not be limited by what they've been told, but open their minds as to what their capabilities are, and seek out those opportunities. We've made a small impact, but we keep trying."

What Works – Tips and Techniques

- Set very clear expectations with the researchers on your team. Emphasize that funding is depending upon involvement in outreach activities.
- Remind your colleagues of the impact they can have through outreach. Make them aware that their expertise, knowledge, and experience could make a big difference to the individuals who you're trying to reach.
- Trust and openness are important in any successful team. It's important for everyone to understand that when they are asked to complete a task, it is not a meaningless exercise that doesn't have any worth to it. Everything you do, everything you promote, has some worth and will mean something to someone, regardless of what it means to the researcher him or herself.
- Make time to socialize with individual members of the team. Be deliberate in getting to know members personally.

Resources

Kolowich, L. (2016, January 5). *17 fun corporate outing ideas and team-building activities everyone will enjoy*. Retrieved from https://blog.hubspot.com/marketing/creative-team-outing-ideas#sm.0001xs9zjw43ve1irjj29nctlyvas



DOUGLAS JACKSON-SMITH

When Douglas Jackson-Smith began working with colleague Courtney Flint on the Utah Water Survey as a workforce development project, neither one of them expected it to have the impact that it did. "We were just focusing on giving people at various ages opportunities to get involved in science," he explains. "This was a marrying of our goal to collect data and answer research questions that the EPSCoR project wanted to answer, with an opportunity to give students training in social science."

The Utah Water Survey was born out of a summer program that engaged high school students and teachers, as well as undergraduate students, in a week-long hands-on scientific experience. The first iteration was focused on physical and natural science, but there was one module within that week that was dedicated to social science. The Utah EPSCoR team wanted an activity that could be done in a couple of hours with untrained people, which could then be turned around

into results. “We wanted to give people the chance to both collect and analyze data,” says Jackson-Smith.

But it turned into much more than that. The team came up with the idea of collecting survey data using iPads in public venues. Grocery stores, as it turns out, are ideal for collecting social science data, because nearly every household relies on grocery stores on a weekly basis. The summer program participants were trained on the basic principles of social science research methodology and the importance of following protocol to get a good sample. From there, they were sent out to several different grocery stores with a short iPad survey on water usage, awareness, and concerns.

From there, the team spent the afternoon putting those numbers together in preparation for the next morning, where students would take part in a variety of hands-on analysis projects in a computer lab. The data was collected using an online system, which made the organization and compilation relatively simple. “We had the data set prepped for them and they got to play with it and look for relationships,” Jackson-Smith says. “We also had them ask questions and develop hypotheses about what they might find before we collected the data, and then those were the focus points of their analysis projects. That was the genesis of it: a one-off summer experience, but it proved to

be very popular and successful. Because we need to know what people think about water and how much they worry about water quality versus water quantity versus flooding versus climate change, and before we go out in the world to answer people's questions, we need to understand their starting points and see if they share the same concerns as we do."

In fact, so many students were interested in the survey that Jackson-Smith decided to pitch the project to the main EPSCoR team at one of their all-hands meetings. With the green light from his colleagues, he took on a leadership role and recruited colleagues from every Utah EPSCoR college and university, and even enlisted the help of some high school teachers. Jackson-Smith helped his colleagues write a research catalyst grant (RCG) to EPSCoR to provide primarily undergraduate institutions with the money to travel and hire students to conduct the surveys. These recruits made up the core team of surveyors, and they were trained and given iPads for episodes of data collection in the field. Over the course of a year and a half, Jackson-Smith and his colleagues collected data from over 7,000 respondents at 28 locations across the populated areas of Utah, and dozens of students were presented with hands-on social science opportunities.

"One of our major EPSCoR goals was to get the universities

working together, particularly relationships among the research universities, but also among the primarily undergraduate institutions," Jackson-Smith explains. "And I think this single effort became a really successful example of integrating the non-research university faculty and students into a collaborative research project."

"Going from doing science to really doing institution relationship building (which is different than just doing science), and building in real learning experiences in the arena of social sciences, that was the most innovative part," he says. "Finding a social science research activity that could be picked up by people that are only lightly trained in the social sciences, but to do something meaningful as part of a larger group, was key."

> **"FIND[. . .] A SOCIAL SCIENCE RESEARCH ACTIVITY THAT COULD BE PICKED UP BY PEOPLE THAT ARE ONLY LIGHTLY TRAINED IN THE SOCIAL SCIENCES, BUT [IS] MEANINGFUL AS PART OF A LARGER GROUP."**

But the survey went even farther than that. "The data set became, in an un-planned way, the focus of an effort to develop an online visualization tool," says Jackson-Smith. "It solved the problem of everyone having to have a computer

with software that analyzes data, and it allowed users to go straight to this website."

Several data visualization specialists on the EPSCoR team got to work on developing further iterations of the viewer website, which proved to be a useful teaching tool to train students to analyze data. This online viewer also allowed anyone to search for patterns in the data to explore drivers of water attitudes and behavior.

"This visualization tool became the unforeseen connection to how to make this potentially a resource that could be used by stakeholders who are water decision-makers," Jackson-Smith explains. "And we've tried hard to figure out how to package it in a way that non-specialists can access it and understand it and play with it. It'll be interesting to see how many of them see this as an asset. We tried to make it an asset."

Jackson-Smith has seen the success of the survey throughout Utah. Colleagues from across the state are even using the survey and viewer in their own research. "I think it was very modest in its origins, but it took on a life of its own because it was easily scaled and people found it to be accessible," he explains. "As long as people follow the rules and are careful, the data is quite scientifically sound."

However, this public data set is still under-exploited.

Opportunities to tie the social perspectives in with the biophysical observations of the EPSCoR project have yet to be completely realized. “People should be using this approach and this model, but thinking of new ways to deploy it to answer different kinds of questions,” says Jackson-Smith. “We set out to get a state-wide representative group of adults answering the same questions. I think we’ve saturated what we need to do with that. So now the opportunities are there to innovate questions that the students come up with.”

Because of their sheer scale and complexity, Jackson-Smith notes, “EPSCoR projects in general are a different animal. You have to have limited expectations. You have these sub-components and clusters of people that have success and produce output. But the project as a whole is really hard to reign in to have it be a truly synthetic, overarching thing. Aspirational goals tend to spin off into different sub-groups. You have to really force yourselves to integrate.”

What Works — Tips & Techniques

- Infrastructural support is critical. Make sure you have room in your budget to bring in the people you need in the field and in the lab.

- Invest in human personnel. Hire a point person/facilitator with good communication skills and good report with other people, who understands the importance of what you're trying to do. This person can ensure the logistical connection between researchers and non-scientific stakeholders, as well as provide training to new users/researchers.
- Utilize your undergraduate students. This is a great resource pool – they are intrinsically motivated, work hard, and pick things up quickly. Create flexibility in your budget to financially support undergraduates.
- Translate and communicate science in a way that the general public can understand and appreciate it.
- Take a sincere interest in the other disciplines with which you're working. Present to one another to help each other learn. This will strengthen your ability to connect and communicate across your team and with stakeholders.
- Get your team to a point where they feel comfortable weighing in on the science in others' disciplines.
- Integrate social sciences/structure into your research.

- Make sure you are functioning as an inter-disciplinary team. Multi-disciplinary does not mean inter-disciplinary; it's the difference between children playing with their own toys in adjacent sandboxes, and mixing sandboxes and toys to form a greater play area.
- If you notice an unexplained pattern that disrupts your research, think about it structurally and formally. Ask, "What science is there to put systematization to that behavior pattern?"

Resources

Jones, A. S., Horsburgh, J., Jackson-Smith, D., Ramirez, M., & Flint, C. G. (2016). A web-based, interactive visualization tool for social environmental survey data. *Environmental Modeling and Software, 84*, 412-426.

TERESA JOHNSON

Teresa Johnson has been involved in many different Maine EPSCoR team science efforts. But the one that stands out is the work done as part of the Maine Tidal Power Initiative (MTPI).

The research was one of 18 projects that fell under Maine's Track-1 grant, the Sustainability Solutions Initiative. The research goal for Johnson and her collaborators was to advance science related to tidal power management by working closely with stakeholders to develop relevant and useful technology.

"That project was a very successful example of team science," says Johnson. "We had a very diverse group of people, we were very engaged with the stakeholders, developers, policy-makers, regulators, and the communities in which tidal power development was occurring – including the local fishing community and local town officials."

EPSCoR funding allowed Johnson to work alongside marine biologist Gayle Zydlewski, who specializes in fish

biology, and the two shared a graduate student and a post-doc. Other funding for the MTPI, which supported oceanographers and engineers, was provided by the United States Department of Energy (DoE).

"We were all really motivated," Johnson explains. "We had this shared mission, and we all understood the importance of advancing this potentially new industry in a sustainable and responsible manner. We had a shared mission, but also a shared understanding of the complexity of the problem. We knew we needed each other's input, and we had respect for each other's disciplines. We understood that our research would not be as meaningful unless we worked together."

The team worked extraordinarily well together, something that Johnson attributes in part to successful leadership. When the team was just beginning, Johnson recalls being convinced by one of the MTPI leaders that the project was worth her time and energy, and that she had something to contribute. Looking back, she says, having leaders that inspired and brought diverse scientists together as a team was critical.

"We had a sort of shared leadership in practice," she says. "We had different components, different leaders for each area. I was the leader of the human dimensions or social

science research. Each group had a leader, but in a way that it didn't feel like a top-down sort of thing, or a rotation."

This format directly influenced how the team got to know one another. "Getting to know people is really important," says Johnson. "Over time, interacting as a team, we learned more about each other and what we did. We got past the stereotypes and got to know each other. And I think that was really important to our success."

The team worked together to compile a shared mission statement, something that truly helped them move forward with their work. "We took some time to come to an agreement on how to communicate our research and engagement agenda," Johnson recalls. "We wanted to make it clear, and at the end of the day we wanted to be objective researchers."

They also met frequently to report on progress and present new developments. Everyone was invited to these meetings, including the students that were assisting the researchers. According to Johnson, everyone wanted one another's input.

It was this outlook that influenced Johnson's work with stakeholder engagement. She was in charge of studying community concerns, perceptions, and interests around the project. "We held community meetings where we invited

the public, advertised in a local paper," Johnson explains. "We wanted to share what our work was about and find out what community members thought. We each had our own research agendas, but in the spirit of collaboration and making our work meaningful, we were willing to modify them depending on what stakeholders needed and wanted.

"WE HELD COMMUNITY MEETINGS WHERE WE INVITED THE PUBLIC, ADVERTISED IN A LOCAL PAPER. WE WANTED TO SHARE WHAT OUR WORK WAS ABOUT AND FIND OUT WHAT COMMUNITY MEMBERS THOUGHT. WE EACH HAD OUR OWN RESEARCH AGENDAS, BUT IN THE SPIRIT OF COLLABORATION AND MAKING OUR WORK MEANINGFUL, WE WERE WILLING TO MODIFY THEM DEPENDING ON WHAT STAKEHOLDERS NEEDED AND WANTED."

After the community gave their input, the team went to work implementing the necessary changes. Then they did it all over again. "That was part of our agenda in the human dimensions component of the project," says Johnson. "We engaged our stakeholders through our research and through community meetings. It was really important to us that we returned to the community with our findings."

In addition to those community meetings, Johnson and her team conducted semi-structured interviews with key informants that represented different groups in the communities. They hosted focus groups and sent out mail surveys for those people who weren't likely to attend public meetings. This level of outreach made a huge impact on the team, and the community as a whole. "It was an opportunity for us to come together with stakeholders over a shared interest. It was very rewarding," Johnson says. And by making the effort with their community, the team was able to do everything they could to ensure the project was a great success.

What Works – Tips & Techniques

- Frequent two-way communication is crucial. It helps people develop trust, respect, and understanding in one another.
- Include all levels of researchers – including students – in team meetings and decisions.
- Engage with the community in ways that work for them. Don't limit yourself to infrequent stakeholder meetings. Make sure your community has every opportunity to understand and be involved in the science, from interviews to focus groups, and from community meetings to mail surveys.

Resources

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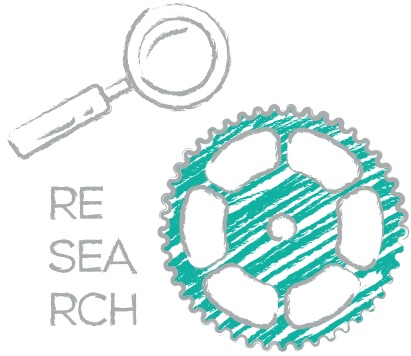

LAURA LINDENFELD

Laura Lindenfeld has seen the good, the bad, and the ugly of working on teams. Now the director of the Alan Alda Center for Communicating Science at Stony Brook University on Long Island, Lindenfeld is a social scientist with years of experience studying collaboration. Some of her work has focused on how EPSCoR teams can collaborate more effectively with each other and with stakeholders from outside the university. Her role of observing different teams in similar environments has given her the distinct advantage of an outsider's perspective – a perspective that she was more than willing to share.

"While there are many wonderful success stories, not all stories are good ones," Lindenfeld warns. "There's a lot of real stress, and there are a lot of challenges. At the same time, there are important opportunities, and we can learn from team science about how to build better EPSCoR teams."

She begins by highlighting what tends to work well for different teams. Conducting a study together with her

Ph.D. student Bridie McGreavy, who is now an Assistant Professor, and a team of researchers at the University of Maine, Lindenfeld uncovered noteworthy results. “The teams that went out of their way to ensure that all team participants got to contribute to a democratic process around decision-making, whether or not the decision that was ultimately made by a PI or team lead was what they wanted, they functioned better,” she says. “Every different member of the team had the opportunity to provide access to decision-making, they knew their input was valued, they felt safe providing input.”

“It made the work with external stakeholders better,” Lindenfeld adds. “Those teams that practiced those kinds of democratic values in their team decision-making and in the way that they structured their interactions, they were much more successful with the communities they worked with.”

Through the years, Lindenfeld has seen first-hand what makes a team successful. Two of her colleagues in particular stand out as prime examples. Teresa Johnson, a marine social scientist, and Gayle Zydlewski, a fish ecologist, were working together on the Maine Tidal Power Initiative, which was supported by Maine’s Sustainability Solutions Initiative as a sub-project of a five-year EPSCoR grant. “I have rarely seen an interdisciplinary collaboration across social and biophysical sciences that worked the way theirs

did," Lindenfeld recalls. "They treated each other in such respect and dignity, their students really were welcomed into an atmosphere of collaborative listening and learning. And these women, together with a group of engineers, leveraged the capacity of EPSCoR to work with a company, Ocean Renewable Power Corporation, to launch the first tidal turbine that was feeding energy into the US grid. They worked with communities, they did fisheries studies, they did assessments based on what fishermen told them, they created community gatherings… it was just so powerful, and they worked together so beautifully as a team, and with the postdocs and students as well."

The team was focused on several issues, including fish populations and making sure local fishing communities – whose lives are regularly influenced by fluctuating industry and regulations – understood that this project would not hurt their livelihood, but rather enhance it. It was slow, careful work. The team took the time to ground themselves in the community, showed respect for one another, and integrated graduate students as full members of the team. All of this, according to Lindenfeld, made a profound difference in their overall success. "They used basic research strategies, informed by a community and stakeholder input, addressing a real-world need," she recalls. "It was designed to make a difference."

Of course, not all teams work well together, and not all teams achieve success. “I’ve seen a lot of indignity go down on these projects,” Lindenfeld notes, “a lot of power plays, a lot of nastiness. And there’s a lot of pressure that leads people to do that, like concerns about making tenure. You have to invest in the process. It takes a while. People have to discover how it works so they’re not afraid of it.”

Through her own observations and studies, Lindenfeld has seen what makes teams work cohesively. The formula, as it turns out, is anything but simple: there should be a democratic system of input and decision-making, ample face-to-face time, explicit communication practices, clear expectations, and a common vision. And the key ingredient that ties it all together is leadership.

“Leadership matters so much,” she affirms. “You must have a team leader who can both inspire people, but also help put in place an orientation to a process. An orientation to a process is absolutely essential for a team to function. You cannot just throw people together and expect them to succeed collaboratively. You have to give them some guidance and support. And I think that has to be role modeled by leadership that’s empathic, humble, and willing to listen.”

> YOU HAVE TO INVEST IN THE PROCESS. IT TAKES A WHILE. PEOPLE HAVE TO DISCOVER HOW IT WORKS SO THEY'RE NOT AFRAID OF IT."

Leadership, however, is not a universally defined concept. "Some people get stuck in just managing and they don't see beyond that horizon," says Lindenfeld. "To me, management is organizing the trains and making them go. Leadership is opening up the possibilities and supporting your team so they can do their best work. It's helping people thrive and strive and achieve, and keeping that aspiration frontier open for them. Good leadership provides consistency, hope, empathy, trust. When leadership does that, it's leading. When EPSCoR projects do that, they're leading. That's when I've seen these projects really thrive, is when they have leaders in place who pave the way for people to do their best jobs."

Ultimately, what makes a team successful is a combination of the people involved and the way they interact with one another. "You don't just add people and stir," Lindenfeld says. "It does not work that way. For relationships function like this, they have to be built on mutual respect. They have to be built on humility."

What Works – Tips & Techniques

- Invest in a strategic planning consultant to guide you to develop an organizational structure that works. If EPSCoR won't fund it, ask your university to put up the funds.
- Talk to other EPSCoR directors and interview them to find out what documents, materials, and processes they have that might accelerate your process of growth.
- If you're building your EPSCoR team from scratch, surround yourself with great colleagues, chosen according to different strengths they bring to the table, to co-lead.
- Bring in a facilitator to develop a cohesive learning organization with the team leads that can be adaptive, honest, and transparent with each other, and that shares the same values.
- Lay out a clear plan for the work to be done and a set of benchmarks to document progress.
- Give people an agenda in advance to respond to. Let them know they can be part of the process and contribute along the way.

- Don't bring in social scientists at Step 8, when you want someone to communicate what you did. This is about working together from the outset to assess what is happening in the real world and what is needed. Gather information in empirical, data-driven ways, let that data tell you a story, and utilize that and your team capacity to deliver research that really matters to society.
- Support graduate students and postdocs. They are part of the team, and they have some ownership of the project.
- Junior faculty can have weight put on them to do too much administrative work on EPSCoR grants. It's better to have a team that handles the administrative paperwork so the faculty members can focus on what they need to do.
- Use facilitators and mediators when it comes to conflict management. When there's conflict, deal with it. You need to have a clear conflict management system. You shouldn't be afraid of conflict; it's about different ideas, and you should embrace it and utilize it. When you shut conflict down and think you're avoiding it, you're not doing anyone a favor.

BRIDIE MCGREAVY

Bridie McGreavy is anything but bored. Over the past several years she has been a part of multiple large projects, from the University of Maine's $20 million Track I EPSCoR grant to create a state-wide network of sustainability science teams, to a post-doc position in Safe Beaches and Shellfish, to a 4-year project around the Future of Dams. McGreavy has seen well over 100 faculty members and students be brought together with more than 300 stakeholders to create teams around different issues of landscape change, and she herself has studied those teams, their successes and communication strategies.

"It's been an incredible thing to be a part of for me personally," she says of her experiences thus far. "Through all of the work I've been involved in with EPSCoR projects, we've had some major successes in linking our science with decision-making at municipal and state levels."

One of the most valuable efforts for McGreavy was the collaborative work associated with the Safe Beaches and

Shellfish Project with the New England Sustainability Consortium. On this project, the team worked with stakeholders such as clammers and representatives from the Maine Department of Marine Resources to answer key questions they posed. For example, they asked the team: How well is the shellfish management program working? What are the current social and environmental problems that people in the shellfishery are facing? Given these problems, what does success in shellfish management mean? How can the use of science help improve management? How do we define success in the shellfishery? Do scientists come to shellfish meetings? What type of information do they share? Do stakeholders in the industrytrust this information?

To help answer these questions, McGreavy and her team conducted 41 interviews with 39 individuals who have been working in the shellfish industry for an average of 27 years. "I presented analysis and recommendations for what's working and what could be improved to the Maine Shellfish Advisory Council, as well as at the Maine Fisherman's Forum," McGreavy explains, "and many of the people there were directly involved with the research. It was a unique and interesting challenge to provide the interpretation back to the people who had helped contribute to the research and who would need to be involved in advancing

the recommendations. I wanted to get it right from their perspective, and I wanted it to be useful for management."

"Our team identified 5 key recommendations that the Shellfish Advisory Council and Maine DMR could address, and in the last month and a half I've seen them advance multiple recommendations," she continues. "One was that they focus on leveraging an annual learning event called Shellfish Focus Day at the Fishermen's Forum. This is one of the most important yearly events in the shellfishery. There are ways to improve how shellfishermen and other stakeholders participate in and access the scientific information that is shared there."

In a related collaborative research project on the Safe Beaches and Shellfish Project, team members worked to provide recommendations related to water quality decision-making with the end goal of reducing mudflat closure times due to rainfall and polluted run-off. In accordance with Maine Department of Marine Resources (DMR) regulations, if 2 or more inches of rain fall within 24 hours, areas of the coast are completely shut down for clamming for up to two weeks. While this policy can help protect public health, DMR was hoping to fine-tune the decision-making process to reflect how different watersheds might respond differently to rain events, with pollutants and bacteria flushing out more quickly in some areas.

The blanket coastal closures are problematic because they prevent shellfishermen from digging clams until the mudflats re-open. McGreavy and her team helped facilitate the partnership between biophysical researchers, namely Sean Smith and his Watershed Process and Sustainability Research Group, to advance a more accurate system for closures by identifying characteristics that might make one watershed more vulnerable to pollution than others. This is known as the Coastal Watershed Vulnerability Analysis, and in the long-term will help the DMR make more accurate decisions about coastal closures during periods of heavy rainfall.

“We have multiple stakeholder partners who have been centrally involved in this,” she adds, “receiving the work that we’re doing and incorporating it into their decision-making. And that’s been really gratifying as a researcher.”

But it hasn’t been a cakewalk, and the team has relied heavily on collaboration and flexibility as they continue moving forward. “At the midpoint of the development of our research partnership, we started to hear from stakeholders that they needed a different approach,” recalls McGreavy. “They needed to sit down with us. They needed to be involved enough in the science that they could talk cogently about it and justify the change in management. So we had to shift to much more discussion-oriented sessions

so they could be involved in the way they needed to be involved. And that was essential."

McGreavy's team has learned to work together effectively, and with stakeholders, policies, and end goals in flux, that's no small feat. "It in part comes from a recognition that there are certainly some best practices for collaboration and teamwork, but what we've learned is that there is no one-size-fits-all," she explains. "It's helpful to have a host of flexible strategies that teams can use to adapt to the needs of their own particular situation or context. So having a way to keep the pulse on the organization, its needs for information, and its preferences for how we work together – things as routine as how often we meet, and for how long, and where – is key."

McGreavy and her team follow a process that intends to be dynamic, fluid, and iterative. At any one time, one or more of the following steps might be in action: intensive information gathering – drawing on multiple sources (secondary documents, informal interviews, news media) for information on stakeholder concerns and the current state of science; group deliberation – identifying key stakeholders and an initial set of research questions that are of interest to the team; providing feedback and inviting participation from key stakeholders; and moving into knowledge co-production – using different techniques

to bring diverse knowledge streams together to get an enriched understanding about the topic. This process is constantly adapting, McGreavy says, and is time-consuming.

> DIVERSITY IN A TEAM CAN BREED TENSION AND CONFLICT. IT'S INEVITABLE. FACE IT, HARNESS IT, AND STICK WITH IT."

Of course, she notes, there will be times when fiscal or professional motivation is stronger than the motivation to advance sustainability. When such situations arise, McGreavy tries to build the team around shared commitments. This maintains the diversity of an interdisciplinary team while also supporting a shared goal. "The ontological differences and inherent diversity will never go away and are essential for learning from each other, for innovating, for being creative," she says. "Diversity in a team can breed tension and conflict. It's inevitable. Face it, harness it, and stick with it."

More than anything, McGreavy acknowledges that the process is messy and sometimes difficult. "We're set up to learn from failure and to adjust when things aren't working," she says. "It's not perfect, and there are complexities. But having a learning organization approach with effective and flexible governance agreements

promotes adaptability. Finding ways to work through any difficulties, and to keep going and keep showing up at these meetings and keep advancing the work together is gratifying. It's an ongoing effort that's changing, and there are these moments of beauty and excitement, and other days it's a slog-fest. But that's how collaboration gets done, and we end up successfully linking science with decision making. It is incredibly rewarding."

What Works – Tips & Techniques

- Pull from publications on collaborative learning and the science of team science.
- Look at decision-making processes, and set up governance documents that allow you to identify how you're going to make decisions together. If you have a starting point, or some examples or models, you could start there and then refine your process depending on what your needs are.
- Attend to communication technologies: help groups have face time and interpersonal connections, especially if they're spread over geographic distances, that allow groups to create an archive of information, in part so that people can track their own decision

making and progress over time, but also because organizations are changing all the time.

- Have a repository of information, in part so that people can track their own decision making and progress over time, but also because organizations are changing all the time. New team members should be able to step into this ongoing conversation and get up to speed efficiently. Too many repositories can get confusing, so try streamlining to only one.
- Go beyond thinking of communication as just talk, and begin to see it as a dynamic host of symbols used to make meaning, form relationships, make decisions, and form the organizations in which we live.

SHANE MOEYKENS

The New England Sustainability Consortium (NEST) was the primary focus of Maine EPSCoR for three years. Shane Moeykens came on as director in the third year of the NEST project, where his efforts were split between team organization and stakeholder engagement.

NEST focused on beach safety, shellfish, and pathogens and bugs that exist in shellfish that are harmful to humans if consumed. The priorities of the project included communication framework; human dynamics and how team members viewed one another in terms of their contributions and competencies; and knowledge systems. “NEST is this concept of having a consortium of scientists tackling tough scientific, societal problems, and how those scientists engage with the general public, and understanding what the most effective strategies are,” says Moeykens. “That was the core focus of NEST. The problem can change, yet the scientific engagement on sustainability, on some topic, that’s what’s common. The interest is what the most effective methods are for those researchers and

how they work together, and more importantly how they engage with the general public."

Moeykens was most impressed with the group dynamics of the team. "These are multidisciplinary projects, so it's a very common problem for things to be lost in translation," he explains. "The decision-making is interesting in that there's lots of different hypothetical models that can be employed: the teams can be completely self-directed, or you can have one person, the PI on the grant, making all final decisions on everything. And in the end, in terms of the researchers involved on this project, their preference was for there to be a group of people. So teams can brainstorm and iterate, but in the end they would float a recommendation up, and then they preferred that recommendation reviewed by a smaller group, versus a single individual."

Having come on to the project in its third and final year, Moeykens did not have much to do with setting the collaborative tone and execution. "When I came on board, the project was being executed extremely well," he recalls, "right down to the graduate level."

But even the most perfect projects have to start somewhere. "These projects, they don't just come in the mail, pop them out of a box, working well-oiled and highly efficient," Moeykens advises. "They require work up front

to fine-tune and hit that plateau. This project was already at the plateau when I came on board. I think that what changed is, people have to understand, what are the priorities of the project? They're infinite at the beginning and then you have to reduce it down to areas of focus and organize around those areas of focus."

In order to increase individual involvement from the EPSCoR researchers, the team held a biannual one-day workshop. Impressive and relevant speakers were invited, and enthusiasm levels ran high. Partnerships and teams formed at these events and all output was captured and circulated to leadership team. "It just gets people coming together and sitting together, and synergies come from that," says Moeykens. "I think most important is better awareness of what everyone is doing and where there is overlap." In addition, the team hosted at least six guest lecturers per year to present talks that were meaningful to the topic at hand. "What really made a difference in that project was the empowerment and the buy-in of faculty and students both," he says. "They were really engaged."

"Team empowerment is one of the most important things that's been studied in the field of business in the last 30 years," he avers. "You need to have people fully bought into the project, versus sitting off in the corner of the room. If you have these distributed researchers across the state

actually collaborating, working together, and understanding what they're doing, and leveraging each other's work and recommendations for joint activities, that's the ideal, but it's not an easy place to get to."

> **"WHEN YOU SIT DOWN AND THE MASTER'S STUDENT HAS THE SAME LEVEL OF INPUT AS THE PROFESSOR, THAT'S EMPOWERMENT."**

It's all worth it in the long run. "When you sit down and the Master's student has the same level of input as the professor, that's empowerment," Moeykens reflects. "I've seen very few projects in my entire life that achieved the level of things that project did. It really impressed me."

Working on successful projects backed by large grants takes a lot of work. "Abstractly everything looks great," Moeykens admits, "but when you look at it on a detailed level of who's doing what, when, things don't always line up. There's a lack of clarity, a lack of understanding, a lack of awareness. We spent a lot of time circling back to the beginning. You can't bring hundreds of people to work together randomly on their own self-interests. It needs to be continuously calibrated back to the objectives of the original grant. That's been the greatest difficulty. It takes a lot of dialogue."

What Works – Tips & Techniques

- Make sure you utilize face-to-face, live, physical meetings. Electronic communication can be fruitful when relationships are more developed, but the best way to get to know your team is in person.
- Avoid building a team of individuals with their own separate agendas. A common problem on Track-1 grants is that professors join a team around a specific research area, but really bring their own individual interests. If they never embrace the collective interest or scope of the grant, the reviewers of the proposal can pick up on it.
- Identify the priorities of the project. It can be overwhelming at first, but you have to reduce them down to areas of focus. From there, you can organize your project around said focus areas.
- Recreate the status quo to one of communication and engagement. Proactively force team members to get together. Get to the point where people feel excited and energized to be involved.
- Bring in speakers to energize your researchers, and then organize functional team meetings following the provocation. In this way, you can leverage team project work on top of the guest lecture activity.

Resources

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Figure 2. Moeykens – Governance Document (see Appendix for complete document)

1. Governance Philosophy

SEANET is a state-wide research network focused on sustainable ecological aquaculture that harnesses the collective capacities of researchers, institutions, and stakeholders in Maine to address how academic research can advance fundamental scientific discovery while leading to the sustainable expansion of aquaculture. At its core, SEANET is concerned with increasing the scientific basis for decision-making around sustainable ecological aquaculture in the coastal zone, a goal that requires close collaboration and interaction with diverse stakeholders from across our state, and can serve as a model at regional, national, and international levels.

This context is important because it requires a commitment on the part of all project participants to an ethos that values stakeholder and community engagement and believes in the mission of producing science that aligns with societal needs. This commitment, in turn, requires dedication to collaborative, team science approaches and excellence in not only disciplinary but also interdisciplinary scientific methods and results, which are essential to forming a highly functioning interdisciplinary research team that can achieve societal impacts.

The over-arching SEANET governance philosophy is to foster strategic and productive collaborations by providing faculty, students, and partners with structure, support, and voice. The SEANET governance structure and management processes aim to support the research network through coordinating efforts among the University of Maine (UMaine), University of New England (UNE), other Institutes of Higher Learning (IHE) partners, stakeholders, external partners, and a diverse group of public and private organizations and citizens. This document describes governance processes for managing SEANET's financial and human resources aimed at building a strong regional consortium. Specifically, this document focuses on the management of SEANET under NSF RII Track I EPSCoR funding.

2. Governance Model and Structure

The SEANET Management Structure includes a Management Team (MT) with two sub-components: an Administrative Management Team (AMT), which includes the SEANET Office, ESPCoR Office, and Vice President for Research Office leadership; and a Science Management Team, made up of the Co-PIs on the grant (SMT)]; a Stewardship Council (SC), an external Technical Advisory Board, an external SES Advisory Board, and an external Stakeholder Advisory Board. Faculty from UMaine and UNE have leadership roles on the SMT and SC.

3. Roles and Responsibilities

3b. Science Management Team (SMT)

Teresa Johnson, Co-PI (UMaine)
Barry Costa-Pierce, Co-PI (UNE)
Peter VanWalsum, Co-PI (UMaine)

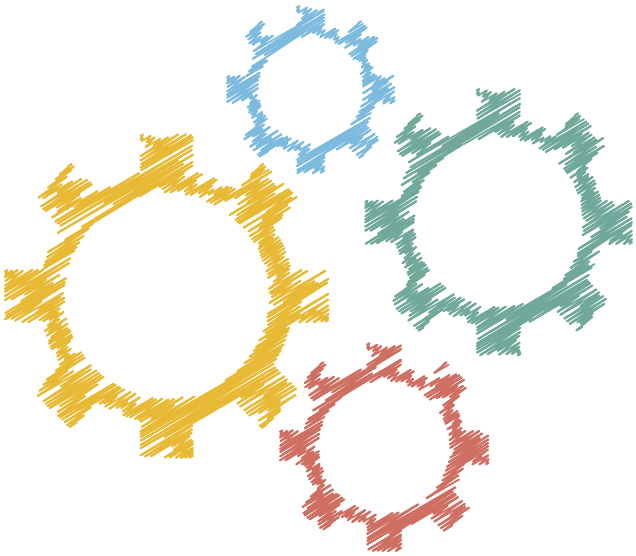
AMT and SMT Roles and responsibilities
These two elements of the Management Team are collectively responsible for the overall scientific, programmatic, organizational, and administrative leadership of SEANET. The AMT focuses on administrative support to the SEANET research enterprise while the SMT focuses on achieving scientific excellence and ensuring the scientific integrity of the project.

Primary responsibilities of the AMT include:

- Management of all programmatic, fiscal, and administrative components of the EPSCoR Track I project to ensure that all activities conform with research goals and with institutional and NSF guidelines, including the review of participant research plans, outcomes, and progress to ensure synergy and successful progress toward achieving overarching goals and objectives;
- Development, maintenance and adaptive management of the organizational structure, policies, and procedures;
- Management of institutional and cross-institutional involvement and interactions;
- Management of personnel and new hire processes, procedures, policies, issues, etc.;
- Utilization of on-going feedback loops from assessment and evaluation and mapping of these to ensure short- and long-term strategic institutional and human capacity program development and implementation for continued success of SEANET beyond the EPSCoR funding;
- Representation of SEANET at internal and external meetings;
- Administration of and assistance in forming the structure and charge of project committees and taskforces; and
- Administration of all project advisory groups, including NSF's EPSCoR Office, the project's external Technical Advisory Board, Stakeholder Advisory Board, and NSF-sponsored external review processes, and reporting (e.g. AAAS).

Primary responsibilities of the SMT include:

- Oversight of the development and implementation of a SES framework for the SEANET project;
- Development of a process to foster interdisciplinary interactions between research themes;
- Development and maintenance of project scientific integrity, alignment, and integration;
- Provide leadership on scholarly conventions, works and facilitation of new interdisciplinary extramural funding opportunities;



ANUPMA PRAKASH

Have you ever taken over a large project somewhere in the middle? Was it a 5-year project surrounding a $20 million grant, and did you come in to take over in year three? That's exactly the situation that Anupma Prakash was facing when she took on the role of PI and Project Director for the Alaska EPSCoR team.

Despite the difficulty of transitioning into a leadership role halfway through a team's five-year stint, Prakash looks back positively on the experience. Her project team was large and diverse, and members had to step out of their disciplinary comfort zones and work together to answer larger questions about the adaptive capacity of Alaska's diverse communities in the face of climate change.

"The fact that we could converse confidently in a large interdisciplinary team and understand each other makes me very proud," Prakash says. "Establishing a common language and then getting a common data stream, a common strategy to integrate, and all of the elements

together for the project, that's definitely big for project success and has brought together new partnerships and seeded new connections that have gone a long way."

Over their five-year grant, the team used physical, biological, social, and data-driven approaches to answer the question, *How do physical changes in the landscape affect the animals, and how do human communities adapt?* Social scientists on their team conducted interviews with the stakeholders affected by Alaska's changing environment, and were themselves interviewed by several students about the stakeholder experience. These data were then compiled and analyzed, and are now being shared with a wide audience through workshops and published reports.

Their success as a team, according to Prakash, stemmed in part from their face-to-face meetings. Although their remote meetings and telecons were very useful, the in-person meetings were integral to the Alaska EPSCoR group, spread as they were across the state. "Those were the most important meetings," says Prakash. "Many of the products that we have developed, the concepts and ideas were seeded during these meetings. There is room for expansion and for creativity out there. And the creative elements come out during these meetings."

Beyond the remote and face-to-face meetings, Prakash did

everything she could to instill a culture of openness and communication within the group. “Communicating any way, every way, through every possible avenue, any time you can, definitely helps,” she avers. “When I took over I ramped up communication efforts.” Prakash encouraged smaller group meetings for individuals collaborating on projects, biweekly telecons with team leaders, and using social media to share their progress and discoveries. She even emailed out monthly PI updates that featured three highlights from the team’s work that month, and added these updates to the Alaska EPSCoR website.

“People don’t connect to science directly,” says Prakash, “they connect to science through people.” Her team used Facebook to provide information and updates on the successes of the people involved in the various projects, meaning that family and friends could see the impacts that individual team members were having in the field.

> **“PEOPLE DON’T CONNECT TO SCIENCE DIRECTLY. THEY CONNECT TO SCIENCE THROUGH PEOPLE.”**

Of course, social media wasn’t the only way that the EPSCoR team used to keep the Alaska community involved. Prakash and her team took full advantage of every outreach opportunity they could. “This is a lot easier in Alaska than

I've seen in many other states," she admits. "Part of it is the culture of Alaska. We're a geographically diverse state but we have low populations. Communities are our stakeholders. It's a very community-driven state. Fairbanks, which is the second largest city, has only 30,000 people. You feel connected by default."

Prakash reiterates why her team has been able to make a significant impact in the school districts proximal to their research sites. "The university and the school systems in general are pretty well connected through Science Fairs, through scientists going out to the schools, not just through EPSCoR," she says. "What happens in a structure like this is, that connection and bonding already exists, but EPSCoR helps to strengthen those, give those resources, provide those opportunities. So we find our researchers are much more open to outreach and much more interested in outreach than many of the other groups that I've talked to."

Of course, there may be other EPSCoR teams for whom outreach doesn't come so easily. Prakash advises that they use their EPSCoR communication and public information officers to ease the outreach burden. "Communication specialists are skilled in helping researchers translate their research findings and key messages into easily understandable terms. Some of our researchers found this very useful in establishing community connections."

"This is a larger project," Prakash reminds her fellow PIs. "EPSCoR has these resources. Spend your time and energy where it's most productive, and they'll help. We put in resources to design services for graphics, proof reading, scientific reading, making sure we had the funding to make our research papers open access, and that really made a difference. Every little bit helped."

"As a PI you need to ensure resources are there, everything keeps moving smoothly, and people who need to connect can get connected," she says. "You're keeping the morale and spirit up, the enthusiasm up, and together you're making the bigger picture."

What Works – Tips & Techniques

- Run free-flowing brainstorming meetings that include open-ended questions, such as: "What about this? Have you thought about this? Can we try this? What are all the ways we can...? How might we...? What if...?" These questions allow for more novelty.
- Find a good facilitator to run your meetings. This person should have the ability and tools to manage dominant personalities and guide conversation so

that team members have opportunities to speak, express themselves, learn from each other.

- Hold face-to-face meetings in pleasant, neutral environments – away from team members' universities or workplaces – so that you are free and dedicated to do what you are there to do.
- Create PI updates that go out via email. These are shorter emails that highlight points and accomplishments of the month. This can also be converted into PDF format and put on a website.
- Create a Facebook page for sharing updates and highlighting team member accomplishments.This serves as a way to communicate stories of success that connect to people and to potential STEM students.
- Identify a communications manager to manage social media and reports, simplify research results, improve researcher presentations through slides and other media, and communicate science in interesting ways.
- Leverage NSF and EPSCoR communication officers and your public information officer to assist your scientists with outreach strategies and approaches.

- Seek tenured or established faculty that are intrinsically motivated to lead the teams. These individuals are not pressured to obtain tenure and are therefore more likely to work on the project based on interest and enthusiasm.
- Create a structured framework that is supported by a common goal, but leave flexibility for team members to explore how goals might be accomplished and adapted. With that end in mind, team members are inclined to integrate their diverse fields together so that they learn a common language, get a common data stream, and then agree upon a common strategy related to the project.
- Take away the bureaucratic responsibilities from team members, such as setting up meetings, looking at schedules, making sure that they're spending their energy in the right places, and paperwork. Encourage them instead to dedicate that time and energy to the work at hand: generating science and delivering on outreach.
- Leverage the strengths of different team members. For example, if the strength of a team member is writing, support this person by providing graphic and illustration assistance for presentations.

- Leverage undergraduate students that can benefit from service learning. For example, if students are social scientists, let them conduct stakeholder interviews and utilize the data to solicit feedback and write progress reports.

Resources

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MATHIAS SCHUBERT

Some engineers and chemists walk into a research lab... No, this isn't the start of a joke. For Mathias Schubert, it was the start of his Nebraska EPSCoR career. It all began when he and his colleague, both engineers, submitted a proposal for EPSCoR funding. They were informed that their proposal was rejected, but with a twist: the EPSCoR office suggested a collaboration between their team and a team of chemists in a similar situation.

The two teams joined together and worked hard to submit a more interdisciplinary proposal, and this time, they were approved for funding. The newly-formed team began setting visions and goals of what they could accomplish together scientifically, and according to Schubert, the high point of the experience was when those visions were achieved.

"Labs came together, and students started to work between the labs," he recalls. "We were putting together different researchers from really different disciplines,

from core physics and core chemistry, to fundamental biological sciences, and in between there were engineers, civil engineers, environmental aspects, and they all rallied together around a central team, and it was beautiful and cross-disciplinary. And this was pioneering."

Schubert shared his leadership responsibilities with Pat Dussault, the lead chemist of the team. While Schubert specialized in creating ideas and inspiring people, Dussault, the more senior scientist, was able to transmit decisions that were not as favorable to the group. Together, the two had a dynamic that drove the team forward.

The team evolved over time. "The first three years, we rotated new people in," Schubert says. "We were looking for people who were enthusiastic enough to not just take the money and run." Those people were usually younger scientists that they found through screening and through calls for proposals. "Find the ones that are very serious about their science, who want to do science that is fairly high quality," he advises. "Find those who appreciate having the NSF grant. They don't have to be successful yet, they should want to be a part of it. Those are the ones who in the end turn out to be very valuable assets."

> **"FIND THOSE WHO APPRECIATE HAVING THE NSF GRANT. THEY DON'T HAVE TO BE SUCCESSFUL YET, THEY SHOULD WANT TO BE A PART OF IT. THOSE ARE THE ONES WHO IN THE END TURN OUT TO BE VERY VALUABLE ASSETS."**

Unfortunately, the evolution of the group required letting go of some of the original members. In the second year, Schubert and the leadership team had to cut one of their PIs. "This was not a nice process, but we had to do it," Schubert says, adding that big fish don't usually work well together. "We were interested in collaboration."

In order to maintain progress, the management team met weekly and the entire EPSCoR team, including students, attended monthly meetings. Over the years, the meetings became more sophisticated. The team was able to add summer courses and even invite national speakers to present for colloquia.

"Those meetings were driven by a purpose, and that purpose was to share scientific insight, create new ideas, explain ideas, invent ideas, and so on," says Schubert, "so the meetings would be led by whoever was most in charge of that topic. It wasn't the same person always

leading them. The responsibility was very even, and everyone had a say."

The monthly meetings were also recorded and transmitted using Adobe Connect, enabling traveling team members to still tune in. "I was often listening in to these from Sweden or Germany, or wherever I was," Schubert recalls. "That became very effective."

It's a day and age when major campuses start to recognize that in order to remain competitive and move forward, they have to integrate different disciplines, according to Schubert. "I realize that all of us want to do something better. Maybe I can't go any further because I don't know who cares. But all we have to do is talk to each other, and all of the sudden our research becomes purposeful. We could start writing papers we hadn't been able to write before."

The efforts of the Nebraska EPSCoR team did not go unnoticed. Several team members, including faculty and students, received prestigious awards because of their work on the project, a point of pride for Schubert. "We were naturally driven by wanting to do something that the world would pay attention to," he says. "We wanted to leave a dent. It doesn't matter where you are, it doesn't matter who you are, you can do high profile science anywhere."

What Works – Tips & Techniques

- Invite post-docs, students, and national speakers to make presentations. The information exposes the group members to new areas of research and offers further opportunity to connect as a team.
- An EPSCoR state should become as strong as a non-EPSCoR state, but there is no mechanism that actually fosters that. Teams and funders should try to bring the two worlds together some way, somehow.
- The purpose of the EPSCoR grant should be to encourage competition on the national and international level.

Resources

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PIPS VEAZEY

Pips Veazey has been studying state-based EPSCoR leadership groups in order to discover what it is that effective team science leaders need to know or be able to do if they want their teams to succeed. Working with group concept mapping – a research methodology in which people brainstorm ideas or responses to a prompt, then sort statements into conceptual groupings in order to create a concept map – Veazey has gained plenty of insight into what works in helping EPSCoR teams succeed.

Veazey recalls a recent proposal-writing experience for a large interdisciplinary project. There were dozens of people from many different campuses working on the proposal, with a core leadership team of eight individuals. The proposal had been unsuccessful the previous year, so the team was hoping to succeed with a new state-wide NSF proposal on socio-ecological systems. To Veazey, the development of that proposal was a teamwork experience she won't soon forget.

"Everybody on that team had an important role to play, and everybody else on that team knew what that role was," she recalls. "We felt like we had the right people at the table. We kind of hit the road running, and I think that was a benefit."

The team wasn't brought together purely by luck. Each individual had worked with at least one other person before being brought into this proposal-writing process. "We all had ties somehow," says Veazey. "It wasn't a brand new relationship." That foundation of previous experience made it easier for Veazey to attend to the more social aspects of working with the EPSCoR team.

"I was able to notice how people were feeling, and do things to try to promote better relationships among team members," she says of her own role. This included "touching base with someone individually or having a meeting with a couple of people, or offering an alternative idea that I knew somebody may like, that might be accepted differently if it came from me."

> WE MET IN PLACES THAT HELD THE IDEALS OF WHAT THIS TEAM WAS ALL ABOUT. THE LOCATION OF WHERE WE WERE MEETING WAS IMPORTANT – A PLACE THAT WAS CONDUCIVE TO OPEN THINKING AND BEING ABLE TO SHARE THINGS, AND IT WASN'T SOMEBODY'S HOME TERRITORY. LUXURY HAD NOTHING TO DO WITH IT. IT NEEDED TO BE A PHYSICALLY BEAUTIFUL, OPEN, AND INSPIRING PLACE."

According to Veazey, it was a combination of personalities, culture, and environment that made this team shine. "This group had a really good sense of humor on top of different personalities or quirky personalities," she says. "Everybody felt a sense of importance in what we were doing. So we had fun dinners together, and we tried to meet off-campus as much as possible. We met in beautiful places. We met in places that held the ideals of what this team was all about. The location of where we were meeting was important – a place that was conducive to open thinking and being able to share things, and it wasn't somebody's home territory. Luxury had nothing to do with it. It needed to be a physically beautiful, open, and inspiring place."

There were three main managers sharing a leadership role within the group, and Veazey was one of them.

Within that decision-making body, "there was respect and trust and acknowledgement that this team could do things well, and had the capacity to do something really good," Veazey reflects. "There were a couple of people on our larger leadership team who really had the interdisciplinary leadership we needed. They were able to guide conversation, they had a vision of what they wanted to do but they didn't have the detail yet. They were extremely inclusive of everybody's ideas. They were expansive thinkers. They provided enough guidelines so we had focused conversations. They really promoted the participation of everybody."

When it comes down to it, according to Veazey, it's trust that makes a team work well together. "There's this interest in trying to understand what other people are bringing to the table, and as you work together you feel the reliance upon each other," she says. "And people may not identify that as trust, but as an academic you can see, trust is being built here."

What Works — Tips & Techniques

- Have work retreats in beautiful places to allow for inspiration. These retreats don't need to be luxurious, but they should be aesthetically appealing

and they should have a strong internet connection to allow people to keep up on the essential emails without becoming distracted and worried about piles of email building up.

- Make sure everyone sees the value in what they're doing. If they aren't invested and engaged, it can lead to a lack of trust and a negative team experience.
- Encourage humor within the team in addition to intellectual stimulation. When things get too serious, the whole process begins to break down.
- Create a shared mental model and consider concrete team agreements as ways to identify team function and guide group activity.
- Don't assume that all members of your team have experience in interdisciplinary team science. Provide them with an orientation.
- Don't be afraid to identify someone with excellent facilitation skills to guide rich dialogue.
- Create concept maps to organize and represent the knowledge in the room. Circles, boxes, and other shapes can be drawn to include concepts and relationships.

Resources

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LEADERSHIP IN TEAM SCIENCE

EFFECTIVE LEADERSHIP APPROACHES

What sort of approaches contribute to an effective team science environment? What characteristics lend themselves to a productive team dynamics? When confronted with situations that are ill-structured, ill-defined, or complex, what do leaders do to redirect the performance of their teams? Great leaders do not balk at the first sign of a challenge. They seek strategies and implement solutions to overcome obstacles that get in the way of team performance.

Teams do well when they clearly understand what is expected of them. From the very beginning, an effective leader may co-create a governing document with the members of the team, a signed document that establishes how the group will function. Many of our interviewees suggested that a leader stays true to these agreed-upon norms and is willing and able to take action to ensure the

team is working fluidly with the ideals presented within this document.

Another way in which leadership is demonstrated within scientific teams is through the delegation of tasks. It is very likely, of course, that administrative problems will arise that do not fall within the team's scientific sphere of influence. In such situations, persistent and supportive leaders may remove administrative burdens from the team as a whole and instead assign that work to a coordinator.

In our interviews, leaders were described as inclusive, connected, proactive, open, tolerant of ambiguity, and playful. They were shown to be attentive to detail and looked to remove blocks and obstacles to their teams' success. Leaders encouraged a rotation of leadership responsibilities and were deliberate in preserving the dignity of all members, regardless of title. In short, they were seen as stewards of effective science teams.

The following is a compilation of tips and suggestions that we extracted from our interviews. Although these may not be applicable to all situations, we believe that academic and scientific teams might easily adapt many of these suggestions. It is up to you to decide what works for your team. We suggest you look for ways to substitute some attributes of these tips to best suit your needs, combine

them with other tips, adapt them to alternate contexts, modify them, put them to other uses, eliminate pieces, or rearrange the attributes to see what you can apply to your scientific team come Monday morning.[16]

TEAMBUILDING

SOLVING PROBLEMS TOGETHER

- Talk to one another in such a way that a solution for one researcher's challenge brings the other's challenge further along. This can inspire everyone involved to write interesting papers, and research becomes purposeful and fulfilling.
- Go to conferences as a team and leverage the information received to work on challenges together.
- At conferences, incorporate your team's project into the guest lecture activity as a means to inspire ideas.
- Trust in each other's capabilities by working toward a mutual understanding and appreciation for each other's disciplines and contributions to the team.

16 MindTools. (n.d.). *SCAMPER*. Retrieved from https://www.mindtools.com/pages/article/newCT_02.htm

MENTORING

- Create mentoring plans that support graduate students, post docs, and mentors through professional development workshops.
- Invest the time to identify gaps in skills among team members, and provide support to fill those gaps.
- Invest the time to identify what new skills, experiences, and goals each team member would like to obtain, and support them accordingly.

ORIENTATION

- Make orientation a collaborative effort to provide information for members who have never been in a team project setting concerning the kind of study. Include answers to the following questions: What does team science look like? What is it going to feel like? What is going to be expected? What are some of the challenges faced in team science? What is owed to the team? What does the team owe each member?

LEVERAGING STRENGTHS

- Identify the skills and motivations of each member. Be deliberate in creating a skill-to-task fit and a skills-to-motivation fit.

DIGNITY

- Spot power plays and any poor treatment of team members, and manage these situations with norms that nurture respect and stability.

BUILDING CONNECTIONS WITH EACH OTHER

- Initiate activities that open the doors for team members to find things that they have in common with one another (e.g., food, music, hobbies).
- Carve out the time for non-business conversations to occur.

SHARED LEADERSHIP

SOLVING PROBLEMS TOGETHER

- Don't be afraid to give others some room to make decisions and to take leadership; have a rotating structure so that everyone has the chance to serve on leadership committees.
- Delegate and give all team members responsibility, from freshman undergraduates to post-docs to full-time researchers. When team members feel that they

have some ownership, they work harder toward the shared goal.

- The more people are allowed to have autonomy, the more they are inclined to buy in and contribute to the process.

GUIDE THE GROUP BY ENABLING IT

- Find where people get stuck in your team's process and help guide them. Help them find a solution.
- Create a social structure that is conducive to positive team performance and communication.
- Keep in contact with members of the team to make sure that they're getting the support and the resources that they need, and that they don't feel abandoned.

GROUP CONNECTIONS

INTEGRATION OF CONTRIBUTIONS

- Organize off-site retreats. The setting should be

at a place where participants can escape from distractions, where they dedicate a day or a day and a half to working and talking.

- Off-site retreats are preferable to the use of technology such as WebEx. This prerequisite allows team members to know each other and avoid the potential for 'flaming' (hostile and insulting interactions between team members over the internet).
- Invite national speakers to off-site retreats and other meetings to encourage new thinking within your team.
- Map how each member's skills will contribute to the team. Create a process map of the team's approach to conducting work and show how each member supports the process.
- Bring in social scientists (acting as organizational psychologists) *at the beginning* of the team's formation so they can observe and engage in group-process work to help enhance the group's team performance.
- Create shared mental models of how the group will work together.

IMPROVISATION

- Contract a faculty member from your university's theater department or from an outside organization to come and facilitate improvisation during meetings or off-site retreats. Improv encourages team members to relax and helps them to drop their guard. Improvisation begins to connect people in meaningful ways and helps to free up the imagination.

CONNECTING WITH PEOPLE UNLIKE ONESELF

- Find ways to connect team members with individuals from unrelated fields or that are otherwise not like them. Inversely, do the same for members of the community.

ESTABLISHING COMFORT WITH ONE ANOTHERS' FIELDS

- Invite to your meetings faculty members or experts who can deliver courses or presentations that are unrelated to team members' areas of expertise.

ALLEVIATE ADMINISTRATIVE AND LOGISTICAL WORK

- In some schools, a center exists to alleviate administrative work related to research and outreach. If such a center exists, utilize it. If a center does not exist, find a point person willing to take the lead on this. This allows team members to focus on the science.

CREATE A CLEAR AND COMPELLING VISION

- Start from scratch and lay out a clear vision that is understood and agreed upon by everybody. If there is no vision, then team members will not have an end goal to work towards.
- Keep your eye on the bigger picture. Why did members form this team? What do you and the team regard as success for the whole group? Is progress being made toward that success?
- Whenever you take on a project, know the end goal before you even write the proposal.
- Take time to hammer out a shared mission statement. Always keep that mission statement in mind and prioritize accordingly.

TEAM SCIENCE PROCESS

Whether we are aware of it or not, most effective team science experiences are effective in part due to the processes that they employ.[17] . This brings up some questions: Are there steps that every team can take to nurture collaboration among team members? Are there guidelines for the deliberate matching of team structures and documents and the underlying processes? How are decisions made to advance team and funder goals? What steps make up the creative process of a productive team? How do groups get back on track when they veer off course?

Based on our interviews, most effective teams have a solid understanding of their collaborative processes that support sound decision-making and problem solving, and that preserve the well-being of the group.

Teams do well when they infuse the study of and attention to social science throughout their existence – from

17 Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*(3), 77-124.

formation to disbandment. Teams are reflective of how individual members function, behave, complete tasks, and solve problems, and not all individuals have compatible approaches. According to our interviewees, social scientists are able to act upon group dynamics that interfere with open communication, and do so in a timely way. When social scientists are present in an interdisciplinary team, they tend to operate with an intention to continuously improve creative and scientific collaboration. Their problem-solving processes are made explicit to those with whom they are working, which provides the team members and leaders with discussion points for possible improvements.

There is an understanding that difficult but respectful discussions are crucial to a group's health, and that such decisions must not be avoided. With this in mind, we believe that the presence of social scientists on a team (not necessarily the science alone) can add to the success of a group.

USE A STRUCTURED PROCESS

USE OF A STRUCTURED PROBLM SOLVING PROCESS

- Integrate democratic values into each step of your team's decision-making process.

- Allow for problem-solving process to be recursive and iterative in among the steps of the process. Each phase of the process does not necessarily have to be independent; depending on the situation, a team can gather information, provide constructive feedback, and produce output simultaneously.
- Your team should have concrete experience to fully understand and empathize with those mostly affected by challenge at hand. The process for gathering this experience includes reflective observation, conceptualization of the challenge, and active experimentation to explore solutions.
- Pay specific attention to diversity and how different team members approach the different phases of a challenge.
- Processes should be flexible enough to accommodate the various styles of how members learn and take in information.
- Set up team governance documents that allow you to identify how you're going to make decisions together.
- Share some ideal models for decision-making that will help you accomplish your objectives. This allows

team members to have a jumping-off point before they refine their model to fit their needs.

- Utilize communication technologies to help team members establish and maintain interpersonal connections, especially if they are spread over large geographic distances. This encourages teams to create an archive of information, which allows new and veteran members to track the team's decision-making and progress over time.
- Use multivariable statistical programs to efficiently group or cluster hundreds of ideas. This approach helps to turn ideas into more workable or manageable solutions.
- Use a collaborative software program to actively engage researchers and leaders to visualize solutions to complex problems and develop a conceptual framework. This collaborative computing and display technology for data visualization, modeling, and simulation aids in addressing cross-disciplinary issues on local, national, and international levels.

DECISION-MAKING

- Team members need to feel that the team leader is putting forth an effort to make things work for

individual members and the entire group. The team leader needs to be approachable and open to team member needs.

- Permeable team boundaries are crucial. Have open conversations amongst team members to determine where they are truly contributing to the vision and end goal, and allow for smooth transitions into and out of the team as needed.

- As a team leader, think about how much collaboration and inclusivity you're comfortable with. If you find you're getting too far beyond your comfort zone, you may have to rethink your approach to team collaboration and inclusivity.

SHARED DECISION-MAKING

- Offer solutions to fix problems, yet solicit the thoughts of the group. Go through each point about what can and cannot be fixed and implement changes where possible.

- Every individual on the team should have the opportunity to provide input to decision-making. By valuing each team member's input, the process becomes inclusive and can encourage members to broaden their thinking.

DATA GATHERING

- To help improve the problem-solving process, gather information intently and from multiple sources of information.

MAINTAIN OVERSIGHT OF ASSIGNMENTS AND PROJECTS

PROACTIVE AND CRUCIAL CONVERSATIONS

- Work backwards. Lay out your project milestones step by step in reverse order and establish deadlines to reach those milestones moving forward. Every time there is a meeting, reference these action plans. Ask: What stage are we at in planning? What needs to be fixed? What is not working right now? Move forward from there.
- Although you have a plan and a time line, do not wed yourself to them. Be prepared to adapt.

STRATEGIC MANAGEMENT

- Consider the different phases that teams typically go through using Tuckman's model of group

performance: Forming, Storming, Norming, and Performing.[18] Initially individuals begin to go through an orientation process. However, as they get to know each other, member differences may lead to a Storming stage fraught with tension, which is where many groups get stuck. The groups that find ways to overcome these differences move on to a Norming stage, which comprises member cohesion and acceptance of differences. In the Performing stage, the group becomes flexible and functional.

- Put a structure in place that comprises a vision, mission, and value statement. Your structure should also include what the group plans to produce, and how many times team members should report during the year.

PERFORMANCE EVALUATION

- Consider tenure guidelines and make sure that outreach performed as part of the team experience is counted toward tenure requirements.

FOLLOW-UP

- Follow up on progress on a regular basis. Conduct meetings with your team as is helpful for your team.

18 Bonebright, D. A. (2010). 40 years of storming: A historical review of Tuckman's model of small group development. *Human Resource Development International*, *13*(1), 111-120.

- Do not let too much time go by without touching base with any your team members.
- Be flexible enough that when a problem is presented, you are able to quickly address it or take action on it that day. Waiting to address a problem or challenge can set teams back in their progress.
- Encourage or require team members to submit time and effort reports (within the context of EPSCoR).
- Hold team meetings on a monthly basis to connect, look back at the strategic plan, and review the agreed-upon timeline and deliverables.

EARLY PLANNING

- Aim for planning nine months in advance.
- Have a kick-off meeting to introduce the planning process for your team.
- Dedicate a (seemingly) inordinate amount of time to planning.
- Identify team priorities and organize around them. Then study the communication flow within and among those areas or across the overall project to improve how team members will talk to each other.

MAKE TOUGH PERSONNEL DECISIONS

- Be able to make some tough decisions early on by asking those who do not deliver as promised to leave the team. Do not enable poor individual or team performance. In these cases, be willing to cut investigator funding. It may be difficult because sometimes these people have a high stature, but if you come together as a management team, the team will respect you and ill respond favorably.
- Communicate personnel decisions that may not be received favorably in a clear and concise manner. In the end, the team will appreciate the transparency.

MANAGE AND SHAPE GROUP DYNAMICS

- Find someone to be responsible for studying and shaping the collaboration of the team.
- Leverage a governance document to do team performance check-ins.
- Track the team's own decision making and progress.
- Facilitate meetings that invite team members to

reflect on the team's group process. Make sure that all people have a chance to speak.

- Encourage team members to confront their different mindsets about what is and is not important to study.
- Help each individual on the team to see their own piece of the puzzle and feel they're contributing to a greater whole.
- Have teams talk explicitly about their own communication, expectations, roles, and responsibilities.
- Facilitate dialogue and create a pathway forward so all members provide input throughout the whole process.

STRATEGIC PLANNING CONSULTANT

- Consider bringing in a strategic planning consultant from the outside or from a respective department.

SHARED MENTAL MODEL

- Help people create a shared identity within the group so they feel as though they are working toward a shared goal.

- Draw on literature surrounding boundary objects. A boundary object facilitates communication by bringing people of diverse interests, disciplines, or values together and allowing them to have a shared conversation about said object.[19] [20]

JOB-TO-PERSON FIT

- Examine each team member's best fit based on his or her skills.
- If prospective members are not willing to perform certain required tasks, assess the situation. You may not want to invite those people to be part of your team.

ETHNOGRAPHERS AND SOCIAL SCIENTISTS

- Find an ethnographer (or social scientist) to observe the group decision-making process. Ethnographers can help the group unpack how differences in experience can shape their collaboration and the eventual outcome of the team.

19 Star, S. L. (2002). Infrastructure and ethnographic practice: Working on the fringes. *Scandinavian Journal of Information Systems*, *14*(2), 6.
20 Star, S. L. (2010). This is not a boundary object: Reflections on the origin of a concept. *Science, Technology, & Human Values, 35*, 601-617.

DEBRIEF EVENTS, PROJECTS, AND MILESTONES

- Have people reflect on work that the team has completed.
- Have the team discuss what they learned about how they work together.
- Examine how decisions are being made and how making those decisions could be improved.
- Explore what might be the best way to approach the next grant project.
- Debrief after conferences (i.e., one of your sponsored events) about what people did and didn't like.

COMMUNICATION

INTERDISCIPLINARY COMMUNICATION

- Interdisciplinary groups have different vocabularies and different approaches; sometimes the same terms mean completely different things in different fields. There may not be a common vocabulary as of yet, so get some clarification. Resolve technical "language" differences among group members of

different disciplines by listing all of the jargon as a group. This will help team members to arrive at a shared understanding of the terms within the data.

- Create a social norm among the team members to ask for clarification when they do not understand.
- Set ground rules or group norms to prevent disrespectful or demeaning conversations.
- Ideally, bring in facilitators to manage and preserve the norms, and to facilitate healthier discussions.

DISTILL IDEAS

- One approach for understanding dense ideas and distilling them down to very simple concepts is to use metaphors or analogies, drawings, 3D models, stories, etc. Iterate with checking for understanding.

COMMUNICATIONS TRAINING

- Contract with organizations, consulting firms, or experts that work to improve the quality of communication within teams.

COMMUNITY UPDATES

- Ramp up communication via the web and social media.

- Produce public broadcasting network documentaries of success stories that can be leveraged to tell the story of your team's progress to the wider community. If not documentaries, what might your team produce?
- Find local media that may be interested in communicating research studies, outreach, and research results. Work with your institution or drive the message out as a team instead of waiting for people contact you when they think something is of interest.
- Keep your community and followers up to speed with what's new.
- Create short emails that highlight key points of the month, and also post the content of the emails to your website or social media.

COMMUNICATING SENSITIVE TOPICS FACE-TO-FACE

- Face-to-face communication is always preferable with someone you don't know well, especially if the topic is important or sensitive.
- Be aware of how you present yourself, of how you present your materials, and of how you present your event to your audience. Make sure your

communication comes off in a healthy, meaningful, engaging way.

BE AN OPEN BOOK

- It is important to communicate and rely on each other. Everybody has to be an open book and willing to share. Have this as a group norm.
- Identify a person on the team who can be very direct and pragmatic, can help cut to the chase, asks the hard questions, and brings team members back to the core mission.

BUY-IN

COMMUNICATE OUTREACH BENEFITS TO TEAM MEMBERS

- Connect the outreach that needs to be completed to the personal interests of the team members charged with providing outreach.
- Emphasize that outreach experience and success can improve one's profile and résumé.
- Bring home the message that by providing outreach,

team members are making young people (future scientists) aware of their opportunities.

BUY-IN THROUGH PROBLEM FIXING

- The team needs to perceive that, by working together, they can fix many of the problems that the project is facing.

TEAM SCIENCE OUTREACH

WHAT INCREASES GENERAL PUBLIC ENGAGEMENT WITH SCIENCE?

How do institutes of higher education encourage faculty and students to engage in science outreach? How do these institutes increase mutual collaboration among community stakeholders? How do teams broaden participation outside of their institutes? How do teams increase general public interest in math science and engineering? A common thread among our interviewees suggests that members of the community must be included in key conversations among funded teams in order to maintain active interest and input.

Science can sometimes appear inaccessible to the non-scientist. As a consequence, opportunities are frequently missed to fully engage potential community partners. And of course, outreach goes beyond community engagement: prospective students may shy away from pursuing science that is perceived as complex and is never properly

explained by experts. This sentiment was repeated time and again by the scientists we interviewed as one that is not limited to EPSCoR projects alone.

In our interviews, we have found that the teams that are deliberate in taking a user-friendly approach to science in promotional literature, presentations, and conversations are more likely to generate greater interest in community partnerships or applications to STEM-related academic programs.

USER-FRIENDLY COMMUNICATION

- Consider ways to simplify research design and make research transferable.
- Communicate your science in a popular way (like a TED talk).
- Create outputs that children can relate to in your outreach efforts.
- Involve communication experts to help create slides that explain your research. Let them figure out how to package your research in a way that non-specialists can access it, understand it, and play with it.

STAKEHOLDER INVOLVEMENT

- Recognize that there are people beyond academia and social sciences who have knowledge and information that could inform your efforts. Reach out to them in the design stage of your project.
- Establish partnerships early on.
- Invite participation from key individuals throughout the project and process.
- Conduct semi-structured interviews with key informants that represent different groups within the community.
- Hold focus groups for interested community members.
- Let the team's social scientists interview your stakeholders and ask, "What do you feel about this issue?"
- Host engagement sessions to give stakeholders the opportunity to give your team feedback throughout the entire research process.
- Identify a representative sample of the different types of stakeholder interest in the community. Ask

people at one of your public meetings, "How would you like to receive information?"

PROMOTION OF EVENT

- Invite parents, students, or general community members to come to a dinner hosted by your group. They get to listen to some cool science and get a free meal.
- Record meetings and seminars and transmit them via live streaming software.

LEVERAGE STUDENTS

- Train undergraduates who show a lot of potential to help with research and/or outreach. Don't underestimate what they can do.
- Recruit undergraduates through a Research Experience for Undergraduates (REU) program or some other scholarship program.
- Find ways to prune a little bit of money out of your budget to support students.

CLIMATE IN TEAM SCIENCE

COLLECTIVE PERCEPTIONS OF BEHAVIORS, ATTITUDES, AND FEELINGS THAT DEPICT LIFE WITHIN TEAMS

Successful teams are not born overnight. In fact, most interdisciplinary teams probably wish for a manual or training on successful team science. After all, how is a sense of team belonging created? What characteristics of a social team setting might contribute to cohesiveness? What resources have been made available to support team science? Which structural elements of collaboration supported a group's performance (e.g., formation, size and duration, organization, and technological practices)?

Climate involves the behaviors, attitudes, and feelings of team members, which are grouped to form an overall perception of the team's social setting. Positive and negative perceptions can stem from both psychological or physical attributes.

Our interviewees talked often about the underlying support they received from their institutions or funders

to express themselves freely or to try new approaches. Each team member's perception of the team experience was highly influenced by how he or she was treated – the more autonomy and trust received, the more positive the experience. It was also iterated that the distribution of resources (e.g. funding) to support post-doc or undergraduate students similarly impacted member perceptions around team climate – the more funding allocated to such early-career scientists, the more enjoyable the climate.

TRUST

- Respect and trust your group by acknowledging that the team can do things well, and that they have the capacity to do something really good.
- If you want your team to trust you, then you need to trust them. The team needs to see the leader's dedication to the research and the team environment – both positively and through a willingness to put a stop to detrimental behavior.
- Support colleagues that have to stand up in front of an audience that is extremely critical. Some members may not have the same savvy as you to overcome

concerns related to limitations so help to defend the research and output the team produces if you can.

- Celebrate many successes to prevent or minimize envy. Envious team members tend to be distrusted.

SOCIALIZING

- Show interest in the research being conducted across the team, as well as team members' backgrounds and interests. Go out to dinner and have personal conversations in addition to talking about what's happening at the team level.
- You need to have time to not only get to know each other, but also to share non-work interests.

STAFF SUPPORT THROUGH RESOURCES AND OPPORTUNITIES

- Provide seed grants or smaller grants to Primarily Undergraduate Institutions (PUI) faculty for projects where they can engage undergraduates.

- Support and encourage post docs to take on outreach assignments (e.g., create and coordinate camps from scratch; leverage camps for their teaching). Influence post docs by connecting the assignments with professional appointments (e.g., two post docs were given appointments in other institutions of high caliber because they developed outreach programs with high school and middle school campers).

SENSE OF EQUITY

- Permit all team members to exercise equal voting rights.
- Break the project down into component parts, which offers multiple leadership opportunities in those working groups.

SAFETY

- Create a climate where people do not worry that team members will jump down each other's throats or challenge each other in inappropriate ways.
- Create norms where judgment can be deferred, whereby members feel safe to express their views.

RESPONSIVENESS

- Make it a goal to provide quick replies to questions and requests from team members.

RESOURCES

- Provide resources towards design services that help the scientists to disseminate information in an aesthetic and simple way.
- Create seed grants with any extra money (which might stem from unexpended funds from a much larger grant), and use them to provide administrative support for team members.

PLAY AND HUMOR

- Organize field trips, social events, and activities that will get team members to laugh and enjoy themselves.
- Leverage the team members who are the “class clowns” or pranksters to help liven up a teamwork building exercise, retreat, or meeting.

OPENNESS

OPENNESS TO TOUGH FEEDBACK

- Find a colleague from your university who is charged with the responsibility of interviewing, in confidence, the members of a team to identify what helps and hinders team performance.

HUMILITY WITH ONE'S OWN DISCIPLINE

- Push team members into domains that are outside of their comfort zones or outside what they were normally doing.
- Assume you know very little (despite being a great scientist).
- Your team will never be greater than the sum of its parts if everyone works in a fractured and independent manner.

OFF-SITE VENUES

- Have off-site retreats at neutral venues. Team members get to see one another, but in a different setting.

- Meet in beautiful places. Meet in places that hold the ideals of what your team is about, such as a very pristine area.

HUB SYSTEM

- Encourage team members that work across campus to come and talk to each together.
- Create a semi-permanent physical infrastructure in association with your project and research. The location becomes a place with which team members can identify.
- Create spaces for people to show up and to participate in ways that work for them.

FREEDOM TO EXPLORE AND DISCOVER

- Identify a common goal, but leave room for team members to adapt and explore.
- The teams that you bring together in year one may not be the teams that you have in year four or five. Afford each team the same room for exploration.

- Find out to what extent the university or universities stand behind each team member. Can researchers do the kind of work that they want to do without their university checking every single step of what they do?
- Free up the researchers' time to allow them uncluttered thinking time in a positive environment.

DEBATE

- Make it a point to have team members learn from each other when tensions arise. Find ways to harness the differences. First and foremost, face conflict, and then work through it.
- Encourage people to push back against other team members and the team leaders in affirmative ways.
- Be willing to communicate in a frank way and say when something is getting away from what the core mission.

TEAM SCIENCE MINDSET

WHAT ARE THE CHARACTERISTICS THAT MAKE UP A MINDSET CONDUCIVE TO TEAM SCIENCE?

Sometimes it can seem like some teams just have "it" – that special something that drives them to excel both in collaboration and output. So what are the qualities, skills, traits, and other attributes that distinguish highly performing teams in science? Which personality traits contribute to more effective team science? And what types of motivations, cognitive abilities, experiences, and social skills might be conducive to group performance?

Based on our interviews, a team member's ability to put the goals of the team above self-interest is without question a well-received characteristic. Members of the team should not be egotistical; these groups work best when each team member honors the dignity of every other member of the team. The more successful teams are persistent, open to tough feedback, and not easily rattled by setbacks. They are likely to adapt quickly when veering off course. These

teams fully understand that their group experience will not be easy, but they nevertheless let the bigger picture drive performance and conduct.

VALUE OF QUALITY

- Extend patience as a way to enhance output quality.
- Go back to the end goal to remind the team of what was agreed upon involving quality of the output.

TREATMENT OF OTHERS

- Take the time to build rapport with people to increase enthusiasm and interest in the assignments. This is a skill you might see in a good teacher.
- Select team members who will be respectful of others. Be deliberate in excluding disruptive personalities that just don't work well with other people.

A SAFE ENVIRONMENT FOR SPEAKING ONE'S VIEW

- Periodically check for psychological safety. People should not be scared of speaking out when something is not correct or when mistakes occur.

- Celebrate learning from mistakes.
- Make sure that you hear from every student, graduate student, faculty member, and stakeholder. Use open-ended questions to draw out points of view. Recognize that you might not be considering something that is really integral to your team's efforts.

PLAY NICE

- During the construction of a governance document, identify the implications of treating others poorly. Identify behaviors and actions that are perceived negatively.

PRESERVING DIGNITY

- Check periodically that small schools do not feel disrespected when working among the large schools.
- Master-level students should feel they have the same input as a full professor sends a message of inclusion.

GET TO KNOW PEOPLE AT A PERSONAL LEVEL

- Touch base with each person of the team individually.

- Find commonality among the team members and organize excursions around them. Mutual respect and camaraderie can stem from these activities.
- Get to know each team member to understand how they think about their involvement as something additional to their normal workload. Negotiate terms of involvement based on what you discuss.
- Gauge team members' passions and what their personalities might lend. Some members of the team may enjoy the research, others the teaching, the outreach, or the administration.

BE OPEN TO UNDERGRADUATE STUDENT SUPPORT

- Involve students in the roles that they can play within the group.
- Recognize that training undergrads is relatively inexpensive.
- Give students a voice; when everybody has the opportunity to be heard, students function better as team members.

TEAM ADAPTABILITY

- Make teams agile so they can adapt to a changing situation or context. Build this expectation and mindset.
- Provide structure, a plan, and a timeline – and then be prepared throw it out the window.

THERE IS NO "ONE SIZE FITS ALL"

- Internalize the notion that one size does not fit all. It is helpful to have a host of best practices, but be ready to identify, adapt, and provide learning around those best practices.
- Scan and keep the pulse on the team and its needs for information and its preferences for how it works together. Adjust accordingly.
- Things considered mundane and routine as in how often will the group meet, for how long, and where, can serve as discussion and negotiation starting points for an adapted design for creative collaboration.

RECOGNIZE THAT YOU DO NOT HAVE CONTROL

- Recognize that, ultimately, you won't have much

control. This is a complex system comprising an organization, people, processes, and sometimes competing goals. There will exist constraints and demands on team members' time and one of the most important things that you can do is to create spaces for people to show up and to participate in ways that work for them, and to create processes within those spaces so that people can engage in learning and develop a mutual understanding.

- Get content knowledge about the other disciplines on the team that will allow team members to have more effective conversations, and allow them to negotiate differences in how they understand the world.
- Pull people in different ways as opposed to pushing them. It's especially important in an academic setting where a culture of independence exists. If members feel like they're being over-managed or told what to do, they may be more inclined to leave the team.

PROBLEM SOLVING

- Invest the time and energy to fully explore the problem space. Find problem-solving tools that can supplement the current tools for identifying the challenge.

PROACTIVE THINKING

- Recognize which people on the team are in the best position to push tasks through in certain situations. For example, a local scientist might be the best person on the team to advocate for community buy-in.

CHARACTER

TRANSPARENCY

- Constantly monitor the extent to which you make decision-making and processes transparent. Facilitate dialogue and create a pathway forward so all team members have input.
- Be willing to make difficult decisions. If you do not, you risk hurting your team. Sometimes you have to weigh team member input and make an executive decision. Your team may not always like it, but they will respect your transparency.

TRUST IN EACH OTHER TO SPEAK HONESTLY

- Create an environment where people are not uncomfortable saying what they really think, yet be

sure to make explicit the communication preference of each team member. There will most likely be conflicting preferences, so compromise will be necessary.

RESILIENCE

- Even when your work is going well, it can be very challenging. Staying with the difficulty is essential.
- Recognize that diversity will breed tension and conflict. That is inevitable. Do not be afraid of that – instead, find ways to harness it.

OPENNESS

- Be open to ideas from multiple voices.
- Have team members invest time in learning about areas of study that are unrelated to their own fields of research or expertise. This encourages simple, effective communication and can lead to more novel ideas.
- Identify the important elements of the research that the team is attempting to accomplish.
- Train people and create a context where they have to learn about each other's work enough to feel comfortable. Weighing in on the science in other

people's disciplines is a really important part of a successful interdisciplinary project, and it requires at least a mindset or an organizational structure that facilitates it.

LEARN FROM FAILURE

- Set up the team to learn from failure. Adjust when things aren't working. Research can be very complex, so encouraging that kind of learning is essential.

INCLUSIVE SENSITIVITY

- Be sensitive to how inclusion comes across to the people involved in your outreach. You don't want local community members to feel like you came in, you saved things, you did your part for the oppressed person, and now you've checked that off of your CV and moved on with your life.

HUMILITY

- Screen candidates for humility.
- Take a sincere interest in other disciplines. Assume you will learn something.
- Don't talk down talk down to each other or jockey for power.

METHODOLOGY

HOW WE GATHERED THE DATA

You may be wondering how we collected and categorized the hundreds of ideas you have just read. To build this repository, our team crafted and shared a set of interview questions to help interviewees stay focused on their peak experiences, their times of great success, and the overall positive aspects of their work on an EPSCoR team. Maintaining this positive bias is much more difficult than it seems; most of us have been trained to learn from – and therefore focus on – our mistakes. Some scholars have suggested, however, that we may learn more from our successes.[21]

We strongly believe in this approach, and that asking participants to immerse themselves in memories of achievement stirs up pride and boosts energy. Interviewees become more open, and show an eagerness to share and build on their most effective ways of working. As

21 Whitney, D., Cherney, J., Trosten-Bloom, A., & Fry, R. (2004). *Appreciative team building: Positive questions to bring out the best of your team*. Lincoln, NE: iUniverse, Inc.

we worked through our questions in each interview, we guided participants to stay on track with what worked, and encouraged them discover how they made their best a constant reality. Below are the questions we asked our interviewees:

[Script] *In teams, sometimes we put aside our personal agendas to create a "Let's do it!" mindset. The focus on action can be great, as we discover great capacity within ourselves to break through with resiliency and to achieve surprising results.*

With this context in mind, describe a time when you were most proud--a high point, when you contributed directly to an EPSCoR team which kept its eyes on the prize – that maintained a "Let's do it!" mindset, and because of this mindset, achieved a lot.

1. *What was the nature of the project?*
2. *Reflect on: "root causes of success"*
3. *What was the high point of working in that team?*
4. *What did you discover working in that team?*
5. *What were your best qualities, or the "Let's do it!" mindset/ qualities that helped the team succeed?*
6. *Who in the university and/or organization got you into*

a "let's do it" mode? What makes working with them so special?

7. *What made up the steps in work process(es) that the team applied?*

8. *As a result of your teamwork—please fill in the blank—the team went on to accomplish _____?*

9. *Imagine you had a magic wand and could have three wishes granted to improve follow-through on EPSCoR projects related to research, STEM education, workforce development and cross-collaboration among industry, education and government. What would they be?*

The individuals who were selected for these interviews were researchers, faculty members, staff, or administrators from EPSCoR teams, past and present. Irrespective of their roles, each interviewee had experienced success as part of a team and was willing to talk about it. Our main focus was to recruit from EPSCoR participants who wished to actively engage in their respective projects and sharing their learning. In total, 19 subjects were interviewed to produce 20 stories.

We used the software QSR NVivo for Mac to code key words or sentences that appeared to suggest a construct at play involving team science. From these codes, constructs

were grouped based on common themes and in some cases subcategories were also identified. NVivo is useful for just such a process, as it handles text with the ability to edit, visually code, and link digital documents as they are created and filtered. Furthermore, QSR NVivo stores, locates, sorts files and can generate frequency of response results.

To be clear, the coding process was executed as a means to organize information and allow for more efficient peer-to-peer learning, not for a qualitative study grounded by theory. To that end, this book was written to capture the ongoing stories of success that many researchers, faculty members, staff, and administrators are working every day to encourage positive and productive results as part of scientific teams.

APPENDIX

This Appendix expands on excerpts found within the "Tales from the Front Line section of this book.

"Tales from the Front Line" Kevin Gardner – Governance Document (full)

NEST New England SusTainability Consortium

The Future of Dams Project

Governance Statement

Opening statement

This governance statement sets out shared principles to guide our work and our relationships with each other on the New England Sustainability Consortium's Future of Dams project.

This is a living document, meant to evolve as our partnership evolves. Rather than offering an exhaustive catalog, this governance statement is meant to serve as a touchstone to prompt important conversations about conduct, conflict resolution, authorship, expectations, data sharing, and assessment.

Code of conduct

By signing on and contributing to this shared enterprise, we have made a commitment to each other and to the dynamic and interdisciplinary work we have proposed.

From the outset we agree to treat each other, students, colleagues, and community stakeholders with respect; to respect the diverse contributions we will make towards this joint enterprise; to respect each other's time, including keeping meetings on time and on task, delivering on deadlines, quickly responding to requests, and sharing the administrative and logistical workload of the project; and to respect each other's capacity for leadership by offering opportunities for all team members to take on important roles in the project.

We recognize that the success of this project depends upon the support and collaboration of community partners and stakeholders, and we recall our stated objective of contributing to positive societal outcomes. We understand this means

treating partners and stakeholders as valued colleagues with important needs and concerns and striving to connect our research with their stated interests.

Because of the complexity and interdependence of our proposed research, we commit to regularly communicating with each other and striving to include all team members in our events and activities, as well as working to be as transparent as possible in our communication, governance, and decision making. As part of that commitment, we agree to make use of our shared communication technologies, including the team Google Sites, Groups, and Drive.

We agree to civilly raise concerns and issues with each other before they grow, and to approach members of the committee on shared leadership for assistance as appropriate, while keeping in mind that differences of discipline and opinion are an important and productive facet of interdisciplinary research.

CSL and other working groups

On this project we will strive to govern ourselves in a transparent and shared manner, respecting the skills, approaches and experiences of all team members regardless of their seniority. Our first conception of this is to establish a Committee for Shared Leadership (CSL),

that we hope reflects the competing needs to keep the project on track (e.g. pay attention to engaging an external advisory board, to annual reporting, etc.), respect the ideas and contributions from all team members equally, and foster the development of early career faculty (e.g. not overburdening them with administrative duties).

To get the real work done that is going to advance our collective research agenda, we adopted the concept of working groups. Working groups may be established to help meet any of the needs on the project while being limited in time and scope. The working groups empower the team members volunteering on a particular group to advance the project.

Conflict Resolution

Despite the best intentions of everyone involved, conflicts are likely to arise. We will strive to resolve conflicts using the principles outlined in the opening statement and code of conduct above. We invite any individual experiencing a conflict to raise that concern with the CSL. In a case when a member(s) of the CSL is involved in the conflict, the concern should be brought to other trusted team members to assist in developing a suitable approach toward its resolution. All team members should agree to civilly raise concerns and to

respectfully and confidentially assist in resolving those for the benefit of the team.

Authorship

Principles governing authorship should embody a spirit of inclusiveness and respect the traditions and reward structure of individual disciplines, e.g., social science; the arts; natural science.

Wherever appropriate (e.g., scientific posters), we encourage a robust approach to including participating students as co-authors.

We offer the following as a general guideline for discussing and determining authorship and author order.

- Discuss authorship and author order early and often. Miscommunications can best be managed by open, clear communication, in print if it is helpful to do so.
- Confirm author order before submitting a manuscript before publication. Many interdisciplinary teams like NEST work on multiple manuscripts simultaneously. A simple email reminder will confirm the agreed upon order.
- The lead author should keep all co-authors

informed of a manuscript's status and include them in conversations about revisions. The lead author should also communicate the most current version of a manuscript title and author order once the manuscript has been submitted. This will help to refine reporting practices so that the same manuscript does not appear with different titles.

- When confusion or conflicts arise, please utilize the NEST's conflict management processes to help facilitate an open, clear resolution. Authorship disputes can arise easily, and open communication can help to ensure a respectful, productive environment for collaboration.

Team Expectations

NEST faculty and students represent a collaborative, interdisciplinary, and cross-institutional team. The project values the development of a strong, communicative team and the establishment of an inclusive, integrated graduate student cohort. NEST participants are expected to:

- Attend seminars, student proposal and dissertation defenses, and related research and engagement activities.

- Participate in team meetings and group meetings.
- Use the internal website, which includes a calendar, documents and meeting notes.
- Maintain current information of research activities in the Track 2 Data Outcomes Portal.
- Provide timely information for annual reports to NSF and for project evaluation.
- Adhere to NSF's expectations for data management and sharing and comply with the project data management plan.
- Acknowledge funding support: All research products, including papers, presentations, and other intellectual materials produced under the grant, must include this statement: "Support was provided by a National Science Foundation EPSCoR Research Infrastructure Improvement Track 2 FEC award (# IIA-1539071)." Logos for NEST, NSF, NH EPSCoR and participating institutions are filed on the team website.

Data Sharing Policy

It is the intent of NEST to operate in the spirit of collaboration, and this spirit extends to the sharing of data and information

among project personnel and beyond with the larger scientific community. While there may be good reasons to not immediately release data (such as to check data quality), it is the policy of NEST to share data as openly and quickly as possible. A formal Data Management Plan covers many more details of data management and sharing, and should be reviewed by researchers. Included in the Data Management Plan are firm deadlines by which data must be shared, metadata requirements, and data citation policies. Researchers generating data and/or using data generated by others on this project must abide by the letter of the Data Management Plan or identify aspects of the plan that need to be changed.

External Evaluation and Assessment

External evaluation is a component of the NEST grant project that is mandated by NSF, and the continuation of our funding will be partly based on the results of this process. All project participants should respond to requests for information or participation regarding evaluation and assessment, including AAAS site visits, Advisory Board meetings and a Reverse Site Visit at NSF. NSF has a new data portal that all researchers will have to use. This will likely take a few hours per year. Team members should recognize this, and be willing to input their data in accordance with the required timelines.

Acknowledgement of Agreement

Add your name below to indicate you agree with the following statement:

I have read the NEST Future of Dams Team Governance Statement and agree to abide by the guidelines laid out.

Name	**Date**

Primary authors of this Governance Agreement:

Caroline Gottschalk Druschke*
Kevin H. Gardner [+]
Art Gold*
David Hart^
Bridie McGreavy ^
Emi Uchida*

Author affiliations:
* University of Rhode Island, S. Kingston, RI

+ University of New Hampshire, Durham, NH

^ University of Maine, Orono, ME

"Tales from the Front Line" Shane Moeykens – Governance Document (full)

The Sustainable Ecological Aquaculture Network (SEANET) Governance Policy

POLICY NUMBER:	SEANET Policy 001
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AUTHOR:	SEANET Management Team (input from GSAC)

Signature	
DATE APPROVED (1):	6/1/2017
APPROVED BY:	Shane Moeykens, Associate Project Director
Signature	
DATE APPROVED (2):	6/1/2017

APPROVED BY:	David Neivandt, Executive Director

DOCUMENT HISTORY

Version Number:	Edited by (job title):	Effective Date:	Details of editions made:
1.0	Management Team	9/16/2015	First approved version
2.0	Graduate Student Affairs Committee	10/14/2015	Incorporated SEANET faculty into student advisory committees (page 7)
3.0	Management Team	8/18/2016	Updated Co-PI list
4.0	Assoc. Project Director	6/1/2017	Added personnel updates, Stewardship Council cadence, EPSCoR logo, addition of SES Advisory Board, additional SES Committee

1. Governance Philosophy

SEANET is a state-wide research network focused on sustainable ecological aquaculture that harnesses the collective capacities of researchers, institutions, and stakeholders in Maine to address how academic research can advance fundamental scientific discovery while leading to the sustainable expansion of aquaculture. At its core,

SEANET is concerned with increasing the scientific basis for decision-making around sustainable ecological aquaculture in the coastal zone, a goal that requires close collaboration and interaction with diverse stakeholders from across our state, and can serve as a model at regional, national, and international levels.

This context is important because it requires a commitment on the part of all project participants to an ethos that values stakeholder and community engagement and believes in the mission of producing science that aligns with societal needs. This commitment, in turn, requires dedication to collaborative, team science approaches and excellence in not only disciplinary but also interdisciplinary scientific methods and results, which are essential to forming a highly functioning interdisciplinary research team that can achieve societal impacts.

The over-arching SEANET governance philosophy is to foster strategic and productive collaborations by providing faculty, students, and partners with structure, support, and voice.

The SEANET governance structure and management processes aim to support the research network through coordinating efforts among the University of Maine (UMaine), University of New England (UNE), other Institutes of Higher Learning (IHE) partners, stakeholders, external partners,

and a diverse group of public and private organizations and citizens. This document describes governance processes for managing SEANET's financial and human resources aimed at building a strong regional consortium. Specifically, this document focuses on the management of SEANET under NSF RII Track I EPSCoR funding.

2. Governance Model and Structure

The SEANET Management Structure includes a Management Team (MT) with two sub-components: an Administrative Management Team (AMT), which includes the SEANET Office, ESPCoR Office, and Vice President for Research Office leadership; and a Science Management Team, made up of the Co-PIs on the grant (SMT)]; a Stewardship Council (SC), an external Technical Advisory Board, an external SES Advisory Board, and an external Stakeholder Advisory Board. Faculty from UMaine and UNE have leadership roles on the SMT and SC.

3. Roles and Responsibilities

3a. Administrative Management Team (AMT)

Carol Kim PI (UMaine - OVPR)

David Neivandt (UMaine - OVPR)

Paul Anderson, (UMaine - SEANET)

Shane Moeykens (UMaine - Maine EPSCoR)

3b. Science Management Team (SMT)

Teresa Johnson, Co-PI (UMaine)

Barry Costa-Pierce, Co-PI (UNE)

Peter VanWalsum, Co-PI (UMaine)

AMT and SMT Roles and responsibilities

These two elements of the Management Team are collectively responsible for the overall scientific, programmatic, organizational, and administrative leadership of SEANET. The AMT focuses on administrative support to the SEANET research enterprise while the SMT focuses on achieving scientific excellence and ensuring the scientific integrity of the project.

Primary responsibilities of the AMT include:

- Management of all programmatic, fiscal, and administrative components of the EPSCoR Track I project to ensure that all activities conform with research goals and with institutional and NSF

guidelines, including the review of participant research plans, outcomes, and progress to ensure synergy and successful progress toward achieving overarching goals and objectives;

- Development, maintenance and adaptive management of the organizational structure, policies, and procedures;
- Management of institutional and cross-institutional involvement and interactions;
- Management of personnel and new hire processes, procedures, policies, issues, etc.;
- Utilization of on-going feedback loops from assessment and evaluation and mapping of these to ensure short- and long-term strategic institutional and human capacity program development and implementation for continued success of SEANET beyond the EPSCoR funding;
- Representation of SEANET at internal and external meetings;
- Administration of and assistance in forming the structure and charge of project committees and taskforces; and

- Administration of all project advisory groups, including NSF's EPSCoR Office, the project's external Technical Advisory Board, Stakeholder Advisory Board, and NSF-sponsored external review processes, and reporting (e.g. AAAS).

Primary responsibilities of the SMT include:

- Oversight of the development and implementation of a SES framework for the SEANET project;
- Development of a process to foster interdisciplinary interactions between research themes;
- Development and maintenance of project scientific integrity, alignment, and integration;
- Provide leadership on scholarly conventions, works and facilitation of new interdisciplinary extramural funding opportunities;
- Serve as the primary contact with the External Technical Advisory Board, the Stakeholder Advisory Board, and the External Evaluator;
- Leadership of the Stewardship Council;
- Assessment of the technical quality of research projects;

- Assessment of research progress against Strategic Plan benchmarks to identify potential shortcomings, and with support from the SEANET Research Network Director recommend corrective actions or project scope changes.

While not restricted to the following, the assessment of the technical quality of research projects by the SMT considers:

- Alignment with and progress against the Strategic Plan and related benchmarks.
- Single disciplinary, interdisciplinary, and transdisciplinary publication records of respective projects.
- Degree of alignment with the SEANET SES framework and/or ability to contribute to sustainability considerations with SEA.
- Peer review feedback from the Stewardship Council and Science Management Team (Co-PIs).
- Periodic review and input from the Science Advisory Board.

  In order to ensure that technical leadership maintains final authority on allocation of research resources, approval from the SMT is required to

introduce a new project within SEANET. Similarly, approval from the NSF Program Officer is required if significant changes are made in regard to the overall scope of the project.

The Administrative Management Team meets in person/virtually on a bi-weekly basis, and interacts via phone and e-mail several times a week.

The Science Management Team also meets weekly or as needed. The Science Management Team meets with the Administrative Management Team monthly. The SEANET Research Network Director and the SEANET Research Coordinator staff all Science, and Administrative Management Team meetings.

Roles of PI on the Track 1 Award

Carol Kim, Vice President for Research and Dean of the Graduate School, Principal Investigator and David Neivandt, Associate Vice President for Research and Graduate Studies (Executive Director and PI proxy as necessary)

- Responsible for overall approval of policies, procedures and budgetary decisions for the EPSCoR research program.
- Participates in the combined MT meetings at least

quarterly and receives advice from MT and SC on all aspects of management of the research program.

- Serves as the primary liaison with the National Science Foundation program officer.

Roles of Individual Co-PIs on the Track I Award

Although the PIs and co-PIs collectively share responsibility for guiding the project, individual co-PIs may take on particular roles vis-à-vis the project. Costa-Pierce, VanWalsum, and Johnson constitute the Science Management Team and attend Administrative Management Team meetings and other meetings as relevant. One Co-PI serves as chair of the Stewardship Council (described below).

Science Management Team Membership:

Teresa Johnson, co-PI, SEANET Science Director (Social Sciences)

Tenured professor at UMaine.

- Directs all social science research through theme leaders.
- Provides co-leadership to the EPSCoR Research Network.

- Conducts and develops collaborations on basic social science research relevant to EPSCoR priorities.
- Develops strategies to ensure effective achievement of social science objectives.
- Monitors and evaluates completion of tasks and projects facilitated by Maine EPSCoR.

Barry Costa-Pierce, co-PI, UNE SEANET Science Director (Biophysical Sciences)

Tenured professor at UNE, Graduate faculty at UMaine.

- Directs the activities of the EPSCoR biophysical sciences research program area through theme leaders.
- Provides co-leadership to the EPSCoR Research Network. Conducts and develops collaborations on basic biophysical research relevant to EPSCoR priorities.
- Develops strategies to ensure effective achievement of biophysical scientific objectives. Monitors and evaluates completion of tasks and projects facilitated by Maine EPSCoR.

Peter VanWalsum, co-PI, SEANET Science Director (Chemical Engineering)

Tenured professor at UMaine.

- Directs the activities of the EPSCoR engineering sciences research program area through theme leaders.
- Provides leadership to the EPSCoR Research Network.
- Conducts and develops collaborations on basic engineering sciences research relevant to EPSCoR priorities.
- Develops strategies to ensure effective achievement of engineering scientific objectives. Monitors and evaluates completion of tasks and projects facilitated by Maine EPSCoR.

Administrative Management Team Membership:

David Neivandt, Associate Vice President for Research and Graduate Studies (Executive Director and PI proxy)

- Provides day-to-day oversight and direction as necessary of the management team and hence all aspects of the SEANET program.

Paul Anderson, SEANET Research Network Director

- Develops statewide infrastructure and human resources.
- Oversees extension of SEANET research to the three bioregions and collaboration with research partners.
- Translates EPSCoR research findings into practice.
- Develops new collaborations and enhances existing collaborations with regional, national, and international organizations to develop Maine aquaculture seafood economy using scientific findings and translates findings into policy.
- Assists with liaison activities for the Maine EPSCoR Program with NSF and other State and Federal organizations, AAAS, and other organizations as necessary.

Shane Moeykens, EPSCoR Associate PD (PDA) and Project Administrator (PA)

- Provides professional leadership, vision, and overall program management for the Maine EPSCoR office.
- Executes budget planning and fiscal execution of the

project in collaboration with the SEANET Research Network Director.

- Guides project participants with respect to NSF guidelines, and identifies any compliance concerns to the MT for consideration and resolution.
- Responsible for societal impact milestones through execution of workforce development and outreach activities, interfacing with industry, non-profit, and government agencies as required to maximize project impact for the state of Maine.

3b. Stewardship Council

Carol Kim, Vice President for Research

David Neivandt, Assoc. VPR and SEANET Executive Director

Shane Moeykens, Maine EPSCoR Director

Paul Anderson, SEANET Research Network Director

Meggan Dwyer, SEANET Research Coordinator

Teresa Johnson, Associate Professor of Marine Policy, School of Marine Sciences, Co-PI

Barry Costa-Pierce, Professor and Director of Marine Sciences at UNE Co-PI

Peter van Walsum, Associate Professor of Chemical Engineering

Mario Teisl, Professor of Economics

Denise Skonberg, Associate Professor of Seafood Science

Ian Bricknell, Professor of Aquaculture

Kim Huguenard, Assistant Professor of Civil Engineering (SEANET new hire)

Damian Brady, Assistant Professor of Marine Sciences (SEANET new hire)

Laura Rickard, Assistant Professor of Communications and Journalism (SEANET new hire)

Carrie Byron, Assistant Professor of Marine Sciences at UNE (SEANET new hire)

The project includes three research themes and two cross-cutting themes. UMaine and UNE faculty serve as co-leaders of research and cross-cutting themes to ensure communication across the research themes and across disciplines. This multi-institutional approach creates a core faculty group that plans and implements activities with

an interdisciplinary and collaborative perspective. Theme leaders communicate with their respective theme teams to ensure ongoing collaboration. MT and SC members also serve as theme co-leaders, ensuring functional redundancy.

The Stewardship Council is chaired on a rotational basis by one of the Science Co-PIs of the project, each taking the chair role for one year at a time.

SC Roles & Responsibilities

The Stewardship Council (SC) meets at least quarterly and implements proposals from the Management Team (MT) with regard to the management of the research program, and the workforce development program embedded in the research program. Theme leaders and co-leaders are members of the SC.

As the research is implemented it is possible that some of the planned activities are not able to be accomplished due to a multitude of challenges that require an adaptive management approach. These challenges include changing personnel, limited resources, poor performance, or shifting priorities. As such, the MT creates a culture within the project that encourages theme leaders to be open about these situations, and work to identify them as early as possible. In consultation with the SEANET Office (Research Network Director and Research Network Coordinator), a

determination is made about options to resolve the issue and/or to bring it to the attention of the SC. If these types of challenges become common across themes, the SC is able to provide a higher order assessment of the situation. Ultimately a recommendation is made to the MT about how to address the situation. If this results in a significant change in scope of the project or a reprogramming of resources, clearance is sought from the NSF program office by the Project PI.

Several function-specific committees, under the Stewardship Council, work on the operationalization of the SEANET research and ensure continued progress towards the anticipated outcomes and goals of the project. These committees include: Graduate Student Advisory Committee, Undergraduate Student Committee, Special Events Committee, Data Management Committee, Reporting Committee, Workforce Development Committee, and Conflict Resolution Committee.

Research Theme Leaders

The implementation of the research for SEANET is split into three biophysical themes and one human dimensions cross-cutting theme. Each Theme has two co-leaders that represent a mix of disciplines. Theme co-leaders either sit on the SC or report to the SC periodically.

Theme Leaders are experts in their field and are responsible for leading research activities and guiding faculty and collaborative partners in the Thematic Area, assuring quality results, integration with other Thematic Areas, and impacts at regional, national and international levels. They are expected to be familiar with the international ecological aquaculture science priorities, status of and priories of Maine's aquaculture and fisheries industries, the concept of Social-Ecological Systems, and to be aware of the strategic issues related to aquatic foods and coastal resources, particularly in the New England Region.

Theme leadership is critical to ensuring that the research taking place by the faculty and associated students is in line with the strategic plan and reporting benchmarks. Problems and challenges with meeting the expectations of the strategic planning framework are first identified by the theme leads and then brought to the SEANET office to help further resolve the issue.

3c. EPSCoR offices: Roles and Responsibilities

EPSCoR Office staff bolster the effectiveness of project coordination and management by providing staff and expertise for administrative and financial management,

communications, workforce development and outreach. The ME EPSCoR office is responsible for all interactions with their state governing body (MIEAB).

EPSCoR Office staff responsibilities include coordination and implementation of: workforce development activities; joint conferences and workshops; AAAS evaluations; data collection and reporting; finances; communications; faculty and student appointments; and general oversight of project compliance and progress. EPSCoR office staff also take part in MT, SC, project meetings and committees where applicable.

3d. Team Expectations

SEANET faculty and students represent a collaborative, interdisciplinary, and multi-institutional team. The project values the development of a strong, statewide team, and the fostering of the next generation of leaders in ecological aquaculture by the establishment of an inclusive, integrated undergraduate and graduate student program. To this end, students, postdocs, and faculty alike are encouraged to participate in the broader SEANET cohort-building by attending seminars, student proposal and dissertation defenses, and other related research and engagement activities.

- "All Hands" Meetings - SEANET faculty and students are invited and expected to participate in "All Hands" meetings and consider themselves as part of the team. Since the SEANET project is statewide in scope, these "All Hands" meetings take place periodically throughout the state in the bioregions where many of the partners can host and participate.

- Research and Teaching - Research conducted with SEANET funds needs to align with the project's key goals and help advance our collective progress in achieving the aspired objectives and outcomes as described in the strategic plan. Throughout the course of the grant, MT and SC members review faculty and student research plans, outcomes, and progress to ensure synergy and successful progress toward achieving our overarching goals and objectives. SC members communicate with the theme teams about the development of research plans, progress towards meeting our goals and about the overall alignment and integration of the project.

- Stakeholders - Given our emphasis on and commitment to stakeholder and community engagement, all faculty, postdocs, and graduate students supported by the project are expected to give at least one public presentation to stakeholders

and other external audiences through the life of the grant. We encourage more engagement and presentations to diverse audiences as appropriate.

- Reporting - All SEANET participants are required to contribute to project reporting by completing annual activity reports. All research products, including papers, presentations, and other intellectual materials produced under the grant, must acknowledge NSF and Maine EPSCoR appropriately. In all respects, project participants must adhere to NSF's expectations for data management and sharing. Participants are expected to utilize the project's online management software to ensure successful cross-institutional collaboration and communication. Workshops and other forums are organized in cooperation with the Maine EPSCoR office to ensure that all participants understand these expectations.

3e. Postdoctoral Researchers / Graduate Students / Undergraduate Students

SEANET postdocs, graduate students, and undergraduate students are full-fledged team members. This means that they are invited and expected to participate in "All Hands"meetings, theme team and other meetings, and

to consider themselves as part of the SEANET team. The research they produce for their dissertations and theses must align with their project's key goals, be interdisciplinary, and help advance the collective progress in achieving the aspired objectives and outcomes as outlined in the Strategic Plan.

SEANET coordinates aquaculture and aquatic food systems sustainability science courses, and graduate students are expected to participate annually in at least one course. Course load decreases over the term of the project for graduate students, but regular interactive, single-credit readings courses provide ongoing opportunities to maintain the connectivity across the graduate student cohort. Undergraduate students are invited to participate as appropriate.

Post docs work with other team members under the guidance of their mentors to advance the project's goals and objectives. SEANET post-doctoral researchers and graduate students are encouraged to submit to journals relevant to SEANET and the NSF and present their findings at SEANET related conferences.

***All *post-docs, graduate students and undergraduates* conducting research must complete training in Responsible Conduct of Research and provide appropriate documentation to the EPSCoR Office.**

3f. SEANET Office Staff

SEANET Office staff provide support to the Management Team and SC in the management of all programmatic, fiscal, and administrative components of the NSF RII EPSCoR Track I project to ensure that all activities conform with research goals, the Strategic Plan, institutional guidelines, and NSF terms and conditions. SEANET Office staff also provide support to project faculty, students, and partners.

4. Technical Advisory Board & Stakeholder Advisory Board

The Technical Advisory Board and Stakeholder Advisory Board provides informed guidance to the project and serve as allies and advocates in the project's aim to advance a Sustainable Ecological Aquaculture Research Network in Maine. These boards help to support the project by providing feedback on progress in building the research network and in meeting the scientific goals of the project. Additionally, board members assist with expanding the network to other researchers and stakeholders nationally and abroad. The boards also assist in promoting the mission of SEANET by identify opportunities for communicating the work to scientific and public audiences.

The boards meet annually face-to-face with the SEANET

leadership and project team. SEANET Research Network Director Anderson (UMaine) serves as the primary contact and liaison to the Stakeholder Advisory Board and the Technical Advisory Board. Written feedback developed by these boards is reviewed by project leadership and used to develop response plans and facilitate adjustments. The feedback is also provided to the NSF during the annual reporting period.

5. Committees

Guided by input from project participants and staff, the SC creates committees, as necessary, to support SEANET. Initial standing committees warranted by the NSF RII Track I Award include: Graduate Student Advisory Committee, Undergraduate Student Committee, Special Events, Data Management, Reporting, **Workforce Development Committee, and Conflict Resolution Committee. These committees respectively are designed to enhance the experiences of students and to foster strategic communication and outreach activities.**

5a. Committee Chairs and Members

The Committee Chair is responsible for recruiting members for their committee and for filling vacancies on

their committee as they occur. The SC may work with the Committee Chair to provide guidance on this process. The Committee Chair reports periodically on progress to the monthly SC meetings.

A committee member is expected to spend the time and effort necessary to properly discharge the responsibilities of members required to complete the work of the committee. Accordingly, a committee member is expected to regularly attend meetings of the committee and to review prior to meetings material distributed in advance for such meetings. A committee member who is unable to attend a meeting is expected to notify the chair of the committee in advance of the meeting.

5b. Graduate Student Affairs Committee

Chair: Mario Teisl

Responsibilities:

- Design and implement Graduate Student Coursework;
- Plan and implement Graduate Student and Postdoctoral Mentorship program;

- Provide representation on Conflict Resolution Committee;
- Lead graduate student and postdoctoral research search processes, when relevant;
- Perform annual reviews of graduate student performance.

5c. Special Events Committee

Chair: Denise Skonberg

Responsibilities:

- Organize special events including workshops and social events;
- Organize seminars;
- Assist with other off-site gatherings including “boot camps”, retreats, and bioregional planning meetings.

5d. Economic Development Committee

Chair: Shane Moeykens

Responsibilities:

- Link WFD activities to SEANET research to ensure broader impacts of research;
- Coordinate workforce development initiatives;
- Provide ideas for SEANET Research Highlights;
- Coordinate website revisions and updates;
- Provide input into SEANET print materials development;
- Provide input into media connections.

5e. Undergraduate Affairs Committee

Chair: Markus Frederick

Responsibilities:

- Develop procedures for crafting SEANET related job descriptions;
- Develop procedures for recruiting and filling undergraduate internships;
- Develop a process for tracking undergraduate performance and reporting;
- Assist with the aggregation of undergraduate

research outputs and other metrics that feed into annual reporting to the NSF;

- Develop opportunities for undergraduates to present their work orally or through posters, and identify opportunities for recognition of meritorious performance.

5f. Reporting Committee

Chair: Shane Moeykens

Responsibilities:

- Develop a system for SEANET research and WFD participants to report their activities at least quarterly;
- Develop a system for managing the reporting data in a manner that is useful to the operations and management of the project as well as for annual reporting to the NSF.

5g. Data Management Committee

Chair: Kate Beard

Responsibilities:

- Develop systems for storing and archiving SEANET Data;
- Work with other entities such as NERACOOS to develop data analysis and synthesis capacity and ensure that the SEANET data is of adequate quality for these activities;
- Provide training opportunities for all SEANET participants in the data management plan elements such as SEAFile;
- Implement and oversee the data sharing policy (below).

5h. SES Committee

Chair: Teresa Johnson

Responsibilities:

- Lead the development of an SES Framework that provides a common language and conceptual view of the system to assist interdisciplinary and multidisciplinary collaboration;
- Assist the implementation of the SES Framework as a

tool to develop SES research questions, hypotheses, and data collection;

- Provide opportunities to increase the capacity and awareness of SES research across SEANET.

5i. Conflict Resolution Committee

Chair: David Neivandt

Responsibilities:

- Respond to situations where there is an appearance of a conflict of interest on the part of SEANET participants and/or their institutions;
- Lead the investigation of potential conflict of interest situations and make recommendations regarding next steps to the Management Team;
- Implement the Conflict Resolution policy (below).

6. Data Sharing Policy

It is the intent of SEANET to operate in the spirit of collaboration, and this spirit extends to the sharing of data and information among project personnel and with greater scientific community at large. While there may be

good reasons to not immediately release data (such as to check data quality and intellectual property protection), it is the policy of SEANET to share data as openly and quickly as possible. A formal Data Management Plan covers many more details of data management and sharing, and is reviewed on an ongoing basis by researchers. Included in the Data Management Plan are firm deadlines by which data must be shared, metadata requirements, and data citation policies. Researchers generating data and/or using data generated by others on this project must abide by the letter of the Data Management Plan.

7. Conflict Resolution Process

Conflict emerges as an inevitable part of collaboration. Having an effective mechanism for addressing conflict as early as possible ensures a strong, collaborative team dynamic. Different types of conflicts necessitate different responses. Generally, team members may approach a member of the MT to ask for assistance in addressing a conflict. Some conflicts necessitate the involvement of other individuals and resources, especially when they are of a more serious nature or involve a power differential.

Conflicts among faculty members:

Should conflicts arise among different faculty members that

cannot be addressed on a person-to-person basis or via the facilitation of the MT, project participants are encouraged to seek support from the Office of Human Resources (UMaine: http://umaine.edu/hr/).

Student conflicts resolution process:

Should conflicts arise related to students that cannot be addressed on a person-to-person basis, the matter should be brought to the attention of the Conflict Resolution Committee. Students or faculty who have a student-related conflict may contact the project Conflict Resolution Committee chair (David Neivandt). The chair reviews the issues at hand and help identify strategies for addressing the issue in a fair and timely fashion. Students who feel there is a conflict with one or more of the faculty may also contact the Conflict Resolution Committee chair to bring attention to the issue at hand.

8. Authorship guidelines

General Principles

As is common across many diverse disciplines, the concept of authorship implies that the individuals listed as authors have made a direct, substantial intellectual contribution to research design, data interpretation, and/or the writing and drafting of the respective paper. There is variation

across disciplines and journals regarding authorship policies. SEANET's guidelines are meant to help establish general parameters about what constitutes authorship and what processes should help determine authorship and authorship order.

Generally, authorship contribution consists of individuals who:

- are closely involved in conceptualizing and designing the research or concept explored in the manuscript; or
- assume responsibility for data collection and interpretation; or
- participate in drafting the manuscript; and/or
- approve the final version of the publication.

Lead Author and Authorship Order

As a general practice, authors are listed in an order commensurate with their contributions to the respective manuscript. For some journals, first and/or last order carry particular meaning, so practices sometimes vary in an effort to maintain consistency with disciplinary norms and the expectations of a particular journal.

Lead/Corresponding Author should be granted to the individual who has assumed overall responsibility for the manuscript. Typically, this person serves as the managerial and corresponding author, and provides a significant contribution to the research, conceptual, and writing effort. Frequently, the lead author moves the manuscript forward, both intellectually and in a managerial sense. This means that the lead author structures the process and provides drafts to individual co-authors for their review and consent. The lead author is also responsible for the integrity of the work as a whole and ensures (sometimes in cooperation with the PI, especially if the lead author is a graduate student) that data are complete, accurate, and interpreted in a reasonable, ethically responsible fashion and citations are accurate. Lead author status must be clarified as early as possible to avoid confusion.

Co-authors. Co-authorship implies that contributors participate sufficiently in the work to have earned the status of co-author. Co-authors must participate in developing the manuscript to take responsibility for appropriate portions of content, input, and editorial assistance. Approving manuscripts in draft or final form implies consent to authorship to the lead author who is managing the submission and publication process. There is no standard format for co-authorship order. Authorship

order is discussed at the beginning of a project and may be revised as appropriate. Some manuscripts list co-authors in alphabetical order, while others list them in terms of individuals' relevant contributions to the project.

Typically, students list their faculty mentor as co-author, when that faculty member has met the general criteria for co-authorship.

Acknowledgments. Formal acknowledgement is appropriate for individuals who may have made a minor contribution to a manuscript, but do not meet the criteria for authorship (e.g. staff, editorial assistants, etc.). All manuscripts submitted or published that utilize SEANET resources must acknowledge NSF, award #IIA-1355457.

SEANET Processes and Authorship

The following is a general guideline for discussing and determining authorship and author order:

- Discuss authorship and author order early and often. Miscommunications can best be managed by open, clear communication, in print if it is helpful to do so.
- Confirm author order before submitting a manuscript before publication. Many interdisciplinary teams like SEANET work on multiple manuscripts

simultaneously. A simple email reminder confirms the agreed upon order.

- The lead author must keep all co-authors informed of a manuscript's status and include them in conversations about revisions. The lead author should also communicate the most current version of a manuscript title and author order once the manuscript has been submitted. This helps to refine reporting practices so that the same manuscript does not appear with different titles.
- When confusion or conflicts arise, please utilize the SEANET's conflict management processes to help facilitate an open, clear resolution. Authorship disputes can arise easily, and open communication can help to ensure a respectful, productive environment for collaboration.

9. Crediting EPSCoR, NSF, and SEANET

ME EPSCoR & NSF Credit: The following statement and logos must appear on any materials, publications, posters, websites, etc. that involve any research, education, or other activities supported by the Maine EPSCoR award:

Supported by National Science Foundation award #IIA-1355457 to Maine EPSCoR at the University of Maine.

EPSCoR Journal publications: Must include credit that "This material is based upon work supported by the National Science Foundation under Grant No. IIA-1355457 to Maine EPSCoR at the University of Maine."

10. External evaluation and assessment

External evaluation is a component of the SEANET grant project that is mandated by NSF, and the continuation of our funding is partly based on the results of this process. All project participants respond in a timely manner to requests for information or participation regarding evaluation and assessment.

The external evaluation and assessment for this project has three components:

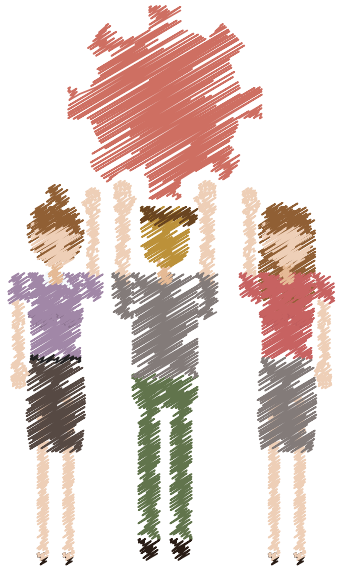
1) External Evaluation by contracted experts

2) AAAS site visits

2) SEANET Technical Advisory Board, Stakeholder Advisory Board, and SES Advisory Board

3) Internal team research and assessment of communication and collaboration

Note: This document is a living document developed collaboratively by the SEANET Management Team. This document is reviewed on an ongoing basis to evaluate programmatic efficacy and facilitate change as needed.



ABOUT THE AUTHORS

- John Cabra is an Associate Professor at the State University of New York, Buffalo State's International Center for Studies in Creativity where, as part of a team, he focuses on teaching, assessing, and researching the science of creativity.

  John specializes in facilitating and accelerating scientific and interdisciplinary innovation as part of his work through Knowinnovation. John has written journal articles, book chapters, and books in the areas of business, technology, engineering, and creativity. In 2017, he co-authored the book *Organizational Creativity: A Practical Guide for Innovators and Entrepreneurs*.

  Website: http://creativity.buffalostate.edu/

  LinkedIn: www.linkedin.com/in/JohnFCabra

  Email: cabrajf@buffalostate.edu

- Julia Figliotti is a Creative Specialist and Facilitator at Knowinnovation, an international facilitation company with a focus on scientific innovation. With a Bachelor of Arts in Writing and a Master of Science in Creativity from SUNY Buffalo State, she specializes in academic writing and storytelling. Julia has published web articles, journal articles, books, and chapters on education and creativity.

  Website: http://knowinnovation.com/our-team/julia-figliotti/

  LinkedIn: https://www.linkedin.com/in/juliafigliotti

  Email: julia.figliotti@knowinnovation.com

- Andy Burnett is CEO of Knowinnovation, a company dedicated to accelerating scientific innovation through the application of deliberate creativity. He earned his BSc in Management Science at Loughborough University and a MSc in Creativity and Change Leadership at State University of New York College at Buffalo.

  Website: http://knowinnovation.com/our-team/andy-burnett/

  LinkedIn: https://www.linkedin.com/in/andyburnett

  Email: andy.burnett@knowinnovation.com