

Tackling Science Communication with Early-Career Researchers

NISE network

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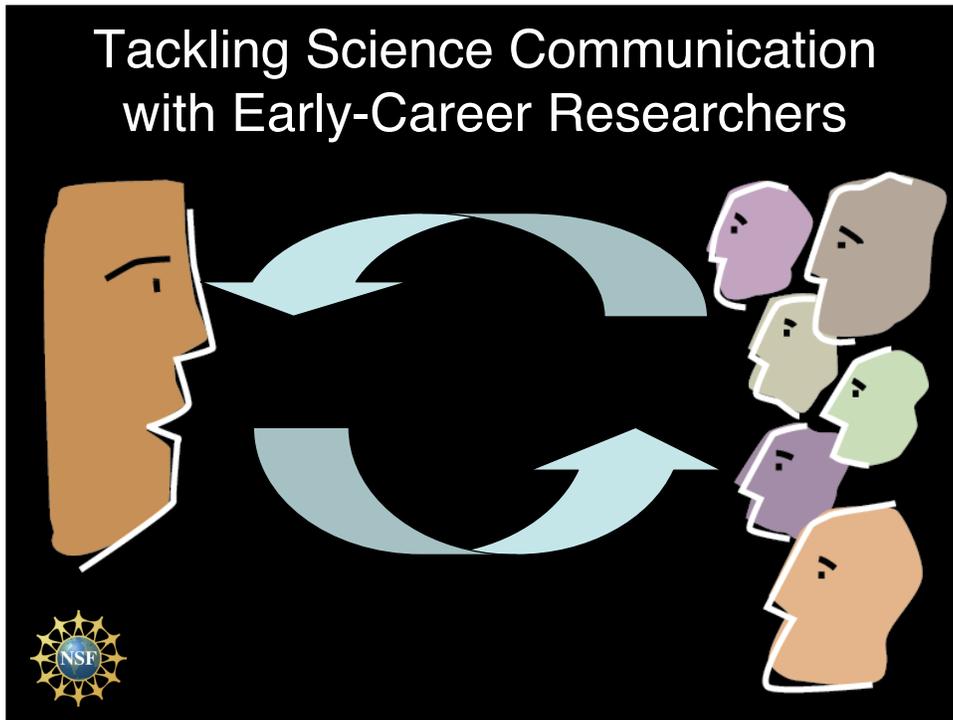
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On Tuesday – and to a lesser extent yesterday – I heard many of you mention that one of the lasting legacies of this great venture – the National Nanotechnology Initiative – is the large crop of high-quality students it has produced.

And, in particular, the quality that was mentioned over and over again was their ability to work collaboratively within interdisciplinary teams, their ability to span those fertile spaces between disciplines where - as several of you noted – innovation occurs.

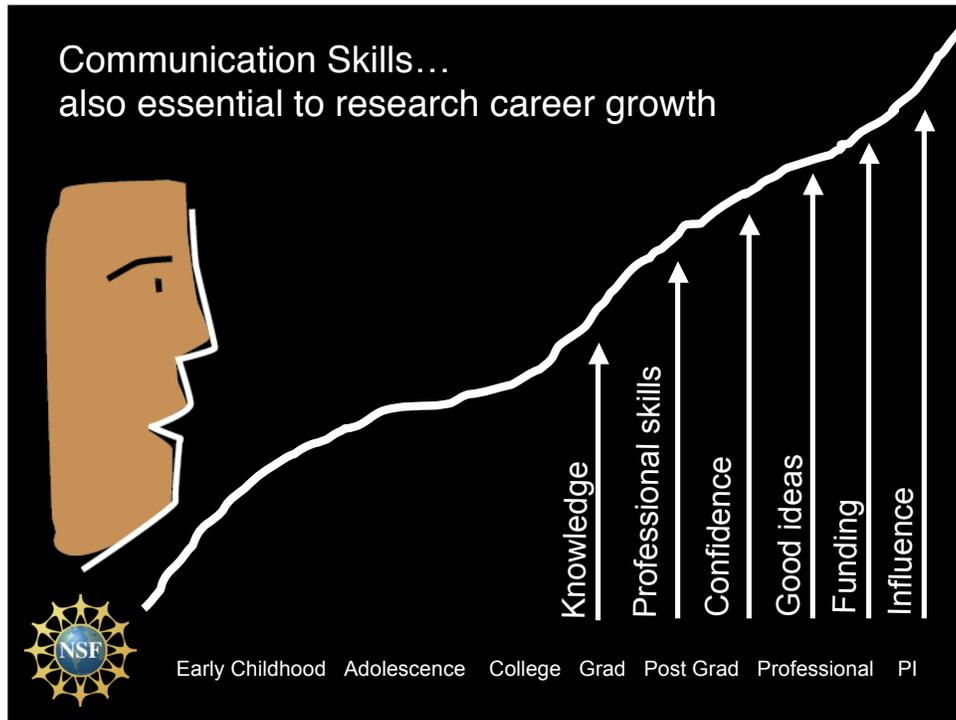
Rich Chapas – the speaker from the Industrial Research Institute – even made the point that boundary spanners are key-to all translational ventures – which depend on picking the people who can bridge the gaps between different disciplines, organizations, systems and ideas.

Tackling Science Communication with Early-Career Researchers



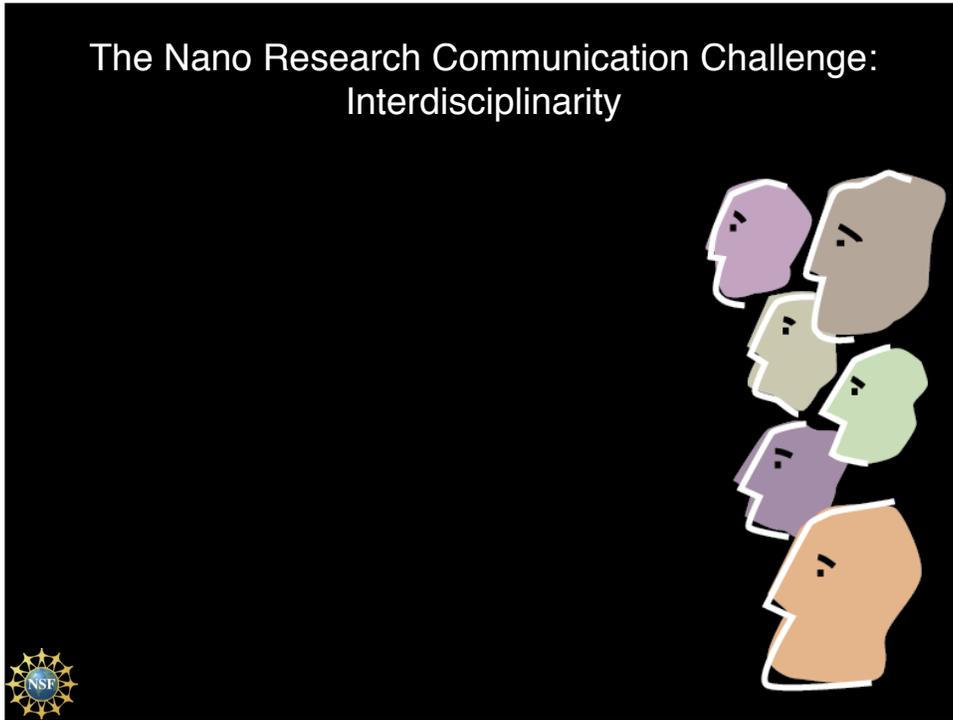
It could be that many of you are in the room here today – leaders of significant interdisciplinary research enterprises – not just because you are brilliant researchers – but also because you are skilled collaborators and communicators. You are the kind of people who can speak to the larger aspirations of the research community – articulate the broad challenges we are trying to address – and you are able to communicate that vision, that research agenda, rally people around it, and bring them together to contribute their expertise.

Communication skills are an oft-overlooked aspect of professional scientific and engineering research training. A recent SRI study reported that among the nation's engineering REU programs, 86% of students are required to deliver a final oral and powerpoint presentation on their research project, only about half of them receive any training in written or oral communication.



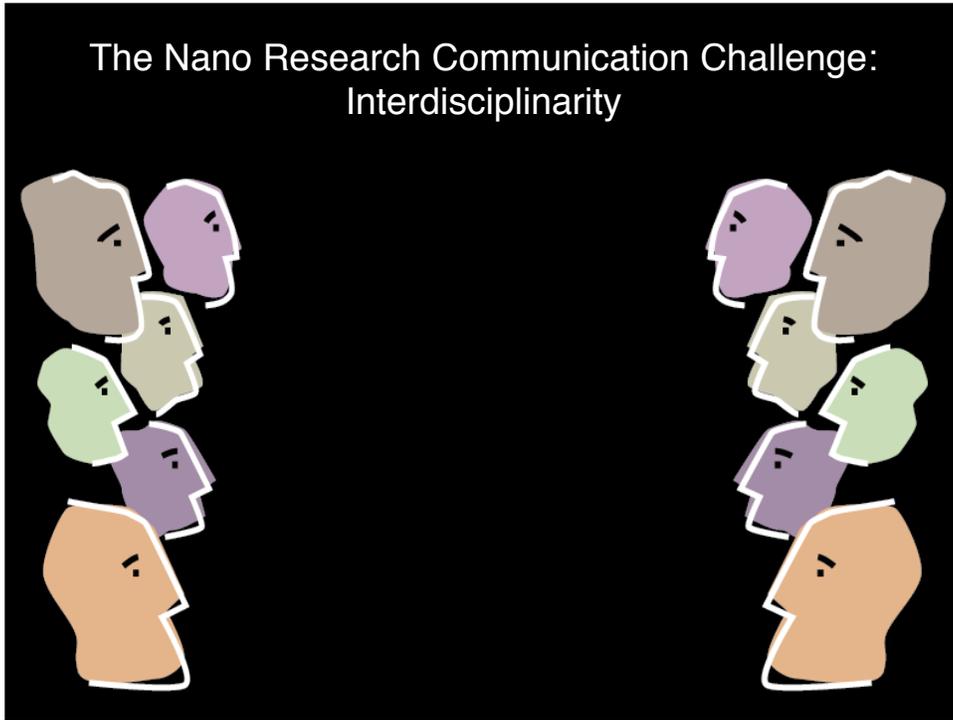
Yet, if they go on to pursue graduate degrees in science and engineering, these students will not only have to give numerous oral and written presentations and and write articles for publications, but they will soon also need to be able to write compelling research proposals to be reviewed, to report out at site visit reviews and professional conferences, as we are doing together here, and if they're lucky, to talk to potential investors.

The Nano Research Communication Challenge: Interdisciplinarity

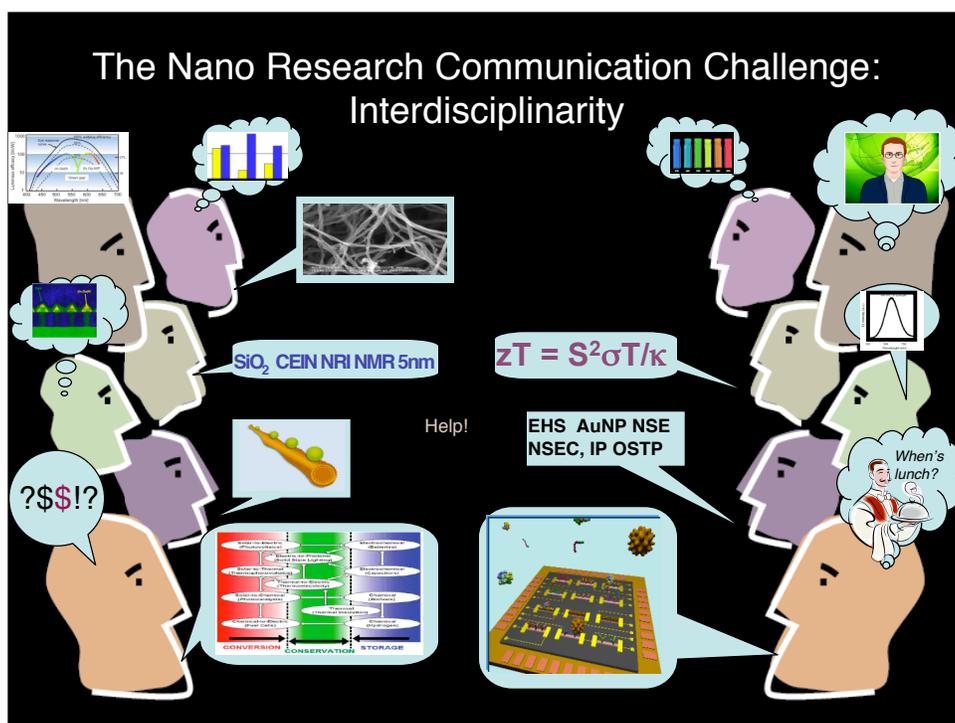


Now, in nanoscale science, the communication challenge is much greater. In this fertile field, we have biologists, engineers, chemists, medical doctors, sociologists...

The Nano Research Communication Challenge: Interdisciplinarity



theorists, instrument builders, materials scientists, and computer programmers working side-by-side,



...and needing to understand each other's jargon, symbols, diagrams, acronyms, units of measurement and equations. They have to be able to ask intelligent questions of one another and give comprehensible answers.

It could be that one of the reasons for the extraordinary quality of students that many of you noted this NNI has produced is partly due to the fact that they have been thrown into a pool together

and have had to learn how to swim and to cross these boundaries themselves, alongside you, their mentors.

But is it possible we can do a better job at helping them swim together with deliberate training in communication, and with such an effort, could we transfer some of the strength of this nanotechnology initiative to students in other interdisciplinary fields?



Now, as you have heard, the NISE Network is pairing science museums with research centers to help engage the public - and school students and their teachers – more broadly in nanoscale science. We encourage the development of these partnerships - (and please contact me if you're interested in being involved.)



As an example, at the Museum of Science, in Boston, we partner with the Harvard-based NSEC and the Northeastern-based Center for High-rate Nanomanufacturing, and over the last 8 years with their support, we've been producing a host of education outreach activities that have reached hundreds of thousands of people. We give 300 live staff presentations on nanoscale science and engineering a year, that are seen by some 17,000 museum visitors - we run bi-monthly New England Cable News story on nano research that is seen throughout New England, we sponsor the NanoNerds channel on YouTube. Some 24,000 people have seen The Amazing Nano Brothers Juggling Show, which teaches about atoms, molecules and nanoscale forces, we put out the Talking Nano DVD set and run workshops on nanoscale science for teachers.



And one of the things we've begun to explore in the last few years - and this is really at the urging of our faculty partners, is how we can help to engage research center students in thinking about the broader impacts of their research – social environmental, economic and global...



...and also in sharing their enthusiasm for what they do with the young people and families in their community, so that they can become role models. And, this is terrific, because the student researchers tend to be more diverse, more energetic, and more flexible with their time than the senior faculty, and with a little training they can become quite adept at being our partners in engaging public audiences and lighting that spark in the eyes of youngsters...

So, there is a certain confluence, we think between the notion of preparing university students to become tomorrow's research leaders and innovators - and the notion of enlisting these same students as partners in recruiting the next generation of researchers beyond themselves. And this is a notion that we've begun to test within the NISE Network, particularly at the Museum of Science, with the idea that if we can create successful professional development models, we may be able to export them to other pairs of science museums and research centers working together - or to perhaps provide them as traveling programs.



Professional Development Formats



- Summer Science Communication Workshops:
Research Experience for Undergraduates
- Graduate Students Workshops: Sharing Science
- Graduate Student Internships:
One week intensives at the Museum of Science

We've been experimenting with these three types of formats.

REU Science Communication Workshops

UMASS DONAHUE INSTITUTE

60 students:
Northeastern
UMass-Lowell
University of New Hampshire
Harvard

We've been working with the Donahue Institute to conduct evaluations of these professional development ventures. I'm going to present some of our findings from one in particular, of the REU Science Communication Workshops. The model here is that that we bring together the REU students from the three local universities that make up CHN for Session One near the start of the REU program, when they are just beginning their research project, and then we bring them back a couple of weeks before the end of the REU program, when they are developing their final research presentation. Students from the various Harvard institutes went through a set of parallel sessions,



REU Science Communication Workshops



Because we have limited time with the students and faculty, we focus in on skills that are most likely to be of immediate help to them during this summer research project. In the first session we introduce them to thinking about the broader context and meaning of their research - the real social, economic, and environmental challenges they're helping to address, and we advise them on how to begin making these sorts of inquiries with the various mentors in their labs. We figure they are more likely to feel the value of what they are doing as young scientists if they connect the sometimes infinitesimally refined challenges of an individual research project with broader social and technology goals, and that will make them better scientists.

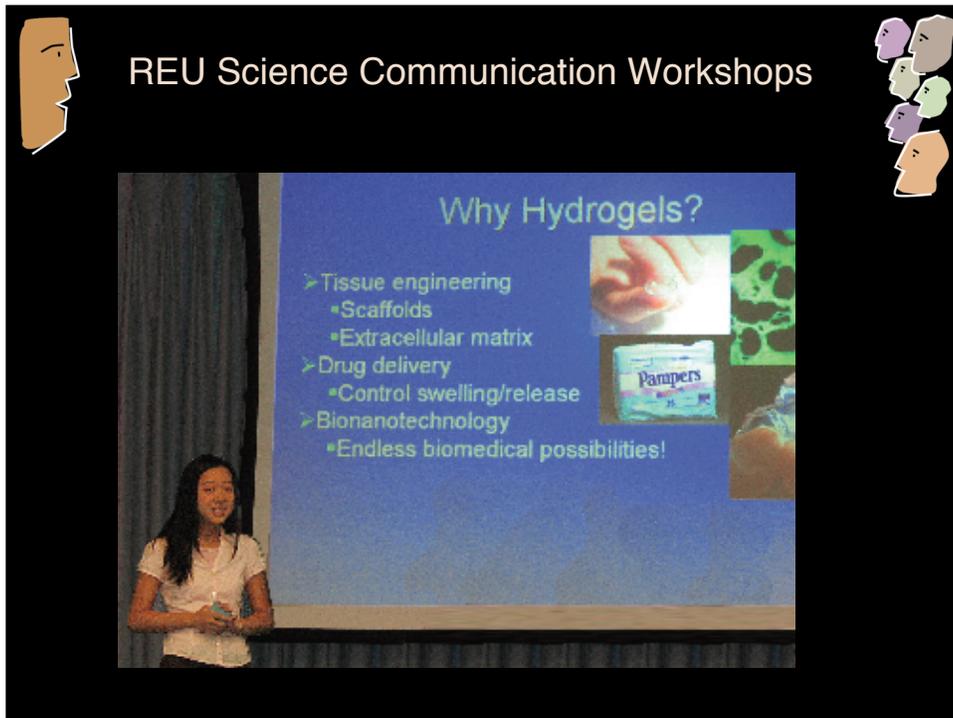


We also workshop with them basic science communication and socialization skills – like how to introduce themselves and describe their research both in terms fit for colleagues and in terms fit for their friends, families and communities.

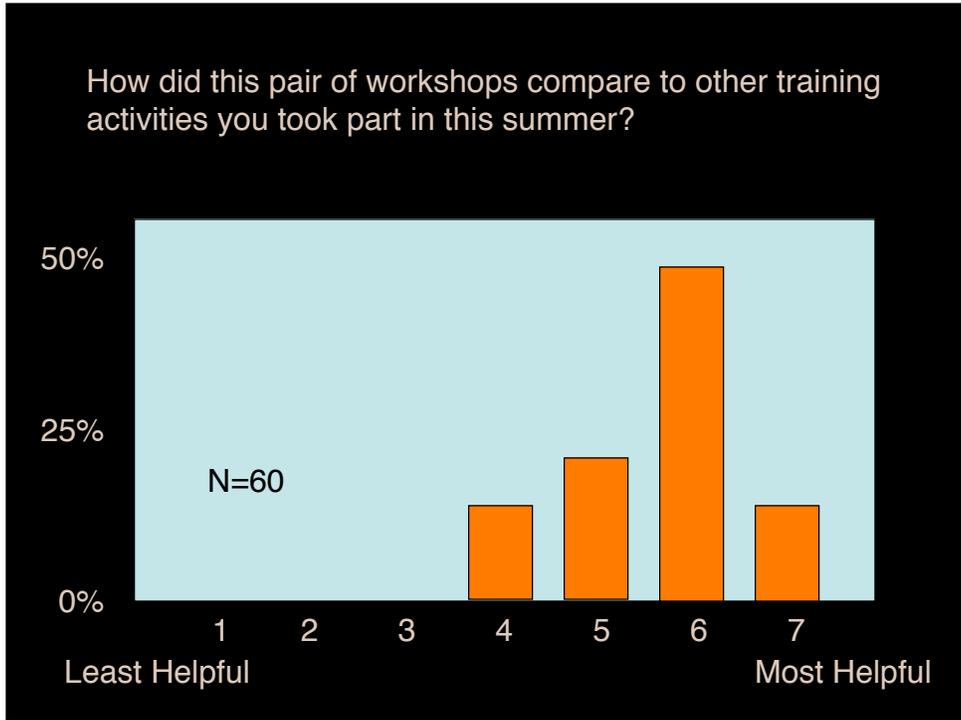
One of our hypotheses is that these teenagers will be better able to resist dropping out of their STEM focus if they feel they can still socialize and share what they do with broader circles of people.



Also during the first session, we show them the basic elements of making a good presentation; how to organize it, how to prepare themselves, how to engage their audiences, use good graphics and use language that helps them cross barriers.



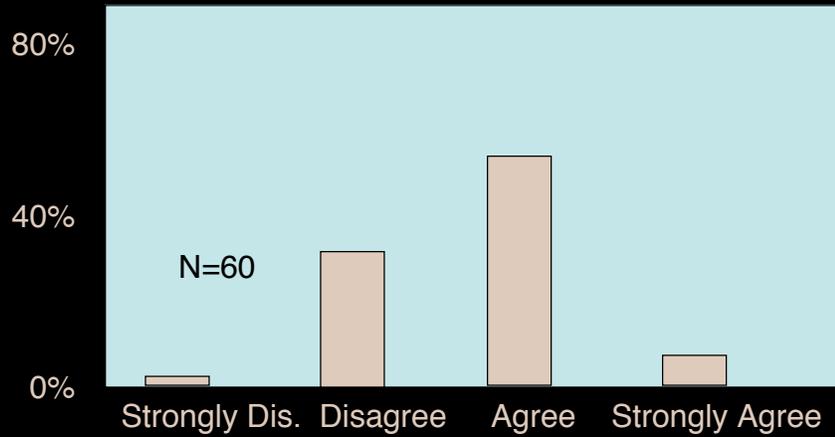
When they come back, near the end of the program, they come with the first half of their research presentation prepared and we review the skills we introduced at the beginning of the summer. They deliver those presentations in small groups with faculty and our staff providing feedback, and most importantly we train them how to supply constructive feedback to each other, both positive and critically helpful.



The students rated the pair of science communication workshops as one of the most helpful training activities they took part in this summer.

“I have a good understanding of how to present my research to science audiences.”

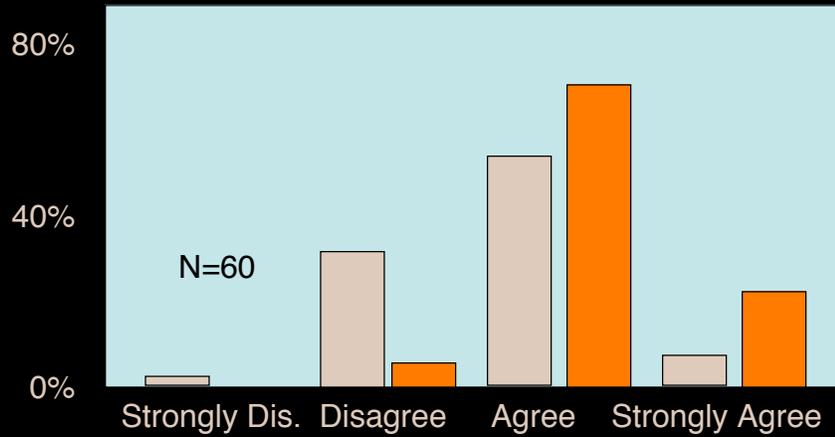
Pre-Workshop



When we asked them at the beginning of the summer how they would rate their understanding of how to present research to science audiences they were a bit cautious...

“I have a good understanding of how to present my research to science audiences.”

Post-Workshop

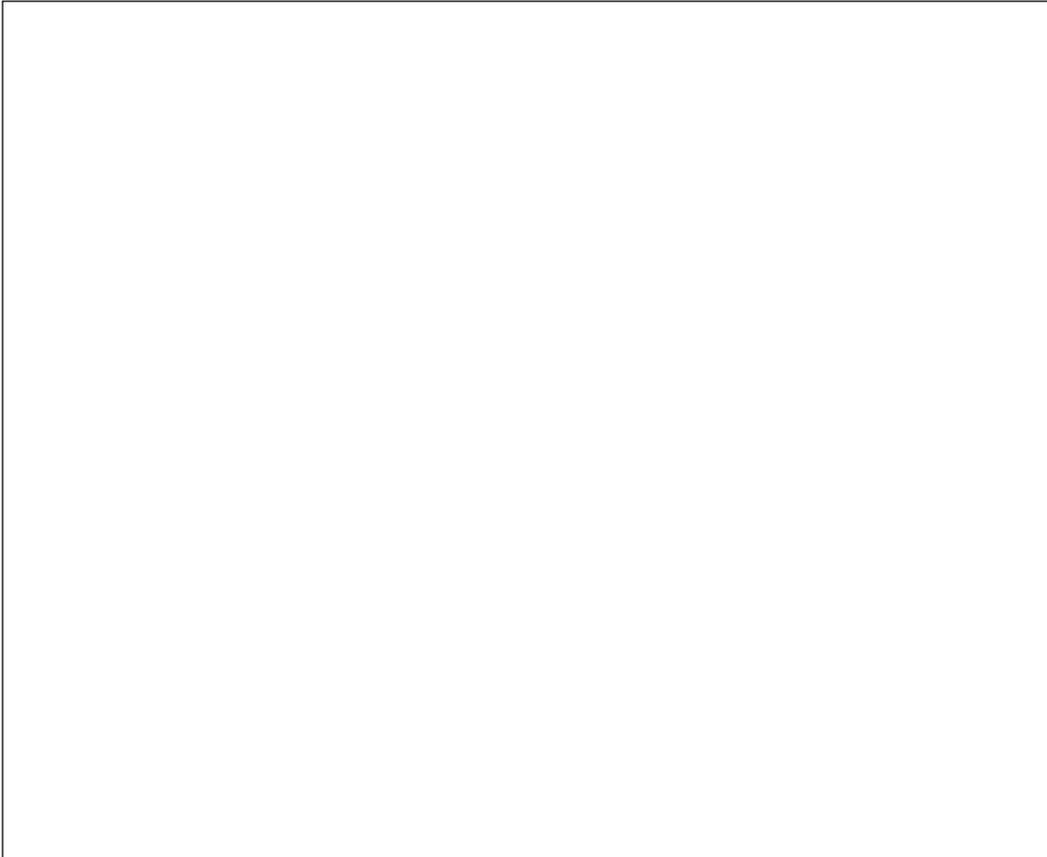


By the end of the summer, their confidence had grown significantly.

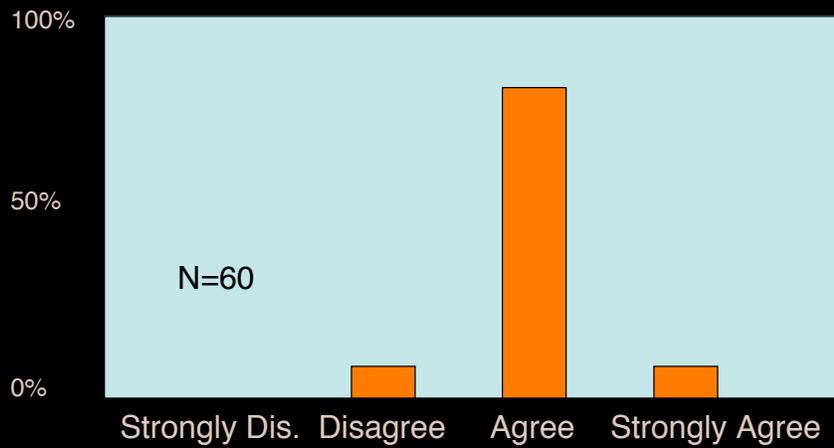
We found these results to be very similar when we asked about their confidence in addressing *NON-science* audiences.

More than 90% of students said these skills increased:

- Communicate research projects and results as a 15- minute presentation.
- Construct a professional powerpoint presentation.
- Summarize purpose and results of a research project in a 1-3 minute elevator speech to others in the same field.
- Summarize purpose and results of a research project in a 1-3 minute elevator speech to people who don't have much scientific or technical training in your field.



“Significantly increased my interest in seeking out and understanding the broader impact of my own and others’ research”



And there was this very interesting result, where 88 % of the students agreed or strongly agreed that the workshop had significantly increased their interest in seeking out and understanding the broader impact of their own and other’s research.



REU Science Communication Workshops



“I want to thank you for another excellent REU workshop. The results really showed in the final presentations, and the students’ faculty advisors were pleased...”

“All students had excellent slides, good body language, and no unexplained jargon or filler words...”

“Most also made good eye contact with the audience for the entire presentation...”

“Students clearly explained the background and motivations for their projects, the approaches they used; and their results.”

- CHN faculty member

And here are two non-quantitative results that I’d like to share with you. This is a quote from an email a faculty member sent to us after the REU program was over.



REU Science Communication Workshops



"I wish all the professors and research people would take part in such a workshop. It makes you aware that no matter how great your results are, they don't mean anything if you can't communicate them to others."

- REU student participant

"I knew I was going to learn from the workshop, but I didn't realize how much of an impact it would truly have on me. After I gave my presentation, two of my professors and a peer commented on how drastic of a change there has been not only in the way I presented the work, but also in the way I carried myself."

- REU student participant

And here are two comments from students.

We are currently doing a round of evaluation on another type of workshop program for graduate students at the two centers, which has more of an inquiry-based education focus - which I hope to be able to report on at a further date.



Science Communication Skill Building



- Good communication skills are helpful in producing strong interdisciplinary collaboration in fields like nanoscale science and engineering.
- Providing early career researchers with science communication skills training early on – even while they are undergraduates, can help them gain the confidence, perspective, and social skills that will help us retain them in STEM careers.
- The same skills that help early career researchers collaborate more effectively across disciplines can also help them become more effective teachers, public speakers, science media ambassadors, and key communicators in the broader impacts of nanotechnology in their communities and nationally.

In summary, I'd like to suggest the following

- Good communication skills are helpful in producing strong interdisciplinary collaboration and translational capacity in fields like nanoscale science and engineering
- Providing early career researchers with science communication skills training early on – even while they are undergraduates, can help them gain the confidence, perspective, and social skills that will help us retain them in STEM careers.
- The same skills that help early career researchers collaborate more effectively across disciplines can also help them become more effective teachers, public speakers, science media ambassadors, and key communicators in the broader impacts of nanotechnology in their communities and nationally.



Thank you very much for your time and attention today.

I'd like to acknowledge my collaborators from the NISE Network, the Harvard-based NSEC, and the Northeastern and Umass-Lowell-based Center for High-rate Nanomanufacturing for their substantial contributions to these efforts,



nisenet.org

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You can learn more about the Nanoscale Informal Science Education Network and find resources at nisenet.org, and you can contact me at this email address if you're interested in finding a science museum partner or for any other reason. Thank you.