UMASS DONAHUE INSTITUTE • RESEARCH & EVALUATION GROUP

Center for High-rate Nanomanufacturing

Research Experience for Undergraduates

Evaluation of the Summer 2010 Program

Contents

Introduction

Funded by the National Science Foundation (NSF), the Center for High-rate Nanomanufacturing (CHN) brings together three universities with unique strengths in nanoscience and nanomanufacturing: the University of Massachusetts, Lowell (UML); Northeastern University, Boston (NEU); and the University of New Hampshire, Durham (UNH). The University of Massachusetts Donahue Institute (UMDI) is conducting the five-year evaluation of CHN's education and outreach activities. The evaluation uses multiple sources of evidence to analyze project processes and outcomes. Using quantitative and qualitative methods, UMDI is documenting innovative and promising practices and exploring program outcomes for faculty members, undergraduate and graduate students, and targeted K-12 students and teachers. Research areas include the influence of CHN's activities on the following:

- Increasing interactions among faculty and students from the three participating institutions;
- Increasing awareness of the importance of science and technology;
- Motivating students, particularly women and underrepresented minorities, to become interested in and better prepared for STEM (science, technology, engineering, and mathematics) careers; and
- Preparing students for careers in research and manufacturing related to nanotechnology.

The evaluation plan is structured to meet the following objectives:

- Measure the program's effectiveness in achieving its stated goals and objectives;
- Provide timely and meaningful formative feedback on program implementation and quality; and
- Support documentation of the project model and its outcomes for future dissemination and replication.

This report represents one component of the larger evaluation. It provides information on the CHN Research Experience for Undergraduates (REU) which occurred during the summer of 2010. Undergraduates work with professors, postdoctoral fellows, and graduate students during the 10-week program to conduct nanomanufacturing-related research in laboratories at UML, UNH, and NEU. Research projects included a literature review of relevant material, informal presentations, formal PowerPoint presentations, and hands-on activities and research related to a topic in nanoscience or nanomanufacturing. REU students also receive training in ethical issues in nanomanufacturing and participate in workshops at the Boston Museum of Science focused on improving their science communication skills. The report is organized into the following sections:

- **Method** – Provides a narrative description of the report, including a description of the measures, response rates, and data analyses.

- **Results** – Reports research findings in the following categories: Demographics/Background, Program Impacts, Student Impressions, and Science Communication Workshops.

- **Conclusion –** Provides a brief summary of main findings.

- **Appendices –** Includes the web-based survey, focus group questions, and Science Communication Workshop surveys.

Method

The evaluation of the 2010 REU program included the following three data sources:

1. A web-based survey that participants completed at the end of the program.
2. Focus groups conducted with program participants.
3. Surveys conducted before and after each of two Science Communication Workshop days.

At the end of the REU program, participants were asked to complete a web-based survey and a focus group. The survey solicited demographic information about program participants, and both measures asked students about their impressions of the program and their suggestions for program improvement. The survey measure and focus group questions included both fixed-response and open-ended items and are included in Appendix A and Appendix B. Questions and rating scales from the web-based survey and focus groups were designed by the evaluators and reviewed by the CHN Program Coordinator. Changes were then made through an iterative process of drafts and feedback.

During the final week of the program the REU students each received an email with a link to the survey on the Survey Monkey website and assurance that their responses were confidential. During their focus group sessions, students were reminded about completing the survey, and those who did not complete the survey received email reminders one and two weeks later. All but one student responded to the survey, and all but one student participated in a focus group.

An additional measure was devoted specifically to the Science Communication Workshops at the Museum of Science. The REU students completed surveys before and after each of the two workshops (Appendix C). Both sets of measures were developed by the director of the workshops at the Museum of Science in collaboration with UMDI.

Fixed response items were analyzed using standard quantitative and descriptive techniques, assisted by PASW 18 and Microsoft Excel. Open-ended responses were analyzed using a standard qualitative technique that involved multiple readings of the data and the assignment of themes around recurring ideas. Once themes were identified, each response was coded by its appropriate theme, and patterns that emerged are described in the report.

Results

This section provides an overview of the 2010 Research Experience for Undergraduates program, including participant demographics and background, program impacts, student impressions of the REU program, and a section devoted to the Science Communication Workshops. The total number of valid responses for each question may vary because some individuals did not respond. Response percentages exceed 100% for some questions that permitted multiple responses per respondent.

Demographics / Background

Demographic information is reported based on students' responses to the Web-based survey (N=30). Fifty-nine percent were male, and 41% were female. Sixty-three percent were Caucasian/White (N=19), 17% were Hispanic/Latino (N=5), 13% were Asian (N=4), and 3% were African American/Black (N=1). One student did not respond to this question. None of the students reported having a disability.

Thirteen students (43%) reported that they were completing their REU at UML, eleven (37%) at NEU, and five (17%) at UNH. One student did not respond to this question. Not all students were enrolled at the university where they completed their REU. Of the 30 respondents, nine (30%) were enrolled at UML, four (13%) at the University of Puerto Rico, and two attended each at Lafayette College, Middlesex Community College, NEU, and UNH. One student attended each of Brown University, Columbus State University, INSA de Rennes-France, Robert Morris University, UMass Boston, University of Connecticut, University of Maryland, Villanova, and Williams College. Twenty-three percent had just completed their freshman year, 37% had completed their sophomore year, and 33% had finished their junior year. One student had completed the senior year and one student did not answer this question.

Students reported that they had learned about the REU program through their academic advisors (27%), another faculty member (33%), a friend (23 %), or through the CHN website (23%). One learned about REU by attending a workshop, and three were invited to attend.

Academic majors of REU students were mainly in engineering and chemistry as shown in Table 1. For most students, post-graduation plans included graduate school or full-time employment in a STEM-related field. One planned to find full-time employment outside STEM fields and one in the field of STEM education (see Table 2).

Table 1. Academic Concentration	N	%
Chemical Engineering	7	23%
Chemistry	4	13%
Electrical Engineering	4	13%
Mechanical Engineering	4	13%
Physics	2	7%
AB Engineering and Economics	1	3%
Biochemistry	1	3%
Bioengineering	1	3%
Biology	1	3%
Industrial Engineering	1	3%
Materials Science and Nanotechnologies	1	3%
Math	1	3%
Material Science and Nanotechnologies	1	3%
Plastics Engineering	1	3%
Physical Science	1	3%

Table 2. What are your plans after graduation?	N	%
Pursue a Master's degree	17	57%
Pursue a Doctoral degree	8	27%
Find full-time employment related to STEM	12	40%
Find full-time employment not related to STEM	1	3%
Find full-time employment in STEM teaching or education	1	3%
Don't know	3	10%
Other	0	0%

Program Impacts

Participants were asked how their ability level in eight areas changed as a result of their participation in the REU program. All results are shown in Table 3. Sixty-seven percent reported that their ability to find information using library data resources had increased a little or a lot, and 93% reported that their ability to condense a literature search into a coherent written introduction increased a little or a lot.

Ninety-three percent reported that their ability to understand how a particular science or engineering challenge relates to a larger goal or application increased a little or a lot, and 97% reported that that their ability to construct a professional PowerPoint presentation increased a little or a lot.

All students reported that their ability to communicate their research projects and results verbally as a 15-minute presentation increased a little or a lot. Ninety-four percent reported that their ability to summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to other researchers in the same field increased a little or a lot, while 90% reported that their ability to summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to nonscientific audiences increased a little or a lot. Ninety-seven percent said that their ability to demonstrate new technical skills increased a little or a lot as a result of their summer research experience.

Table 3. Student Perception of Change in Ability Levels

	Increased a Lot		Increased a Little		No Change	
	N	%	N	%	N	%
Find information using library database resources	9	30%	11	37%	10	33%
Condense literature search into a coherent written introduction	9	30%	19	63%	2	7%
Understand how a particular science or engineering challenge relates to a larger goal or application	15	50%	13	43%	2	7%
Construct a professional PowerPoint presentation	21	70%	8	27%	1	3%
Communicate a research project and results verbally as a 15-minute professional presentation	20	67%	10	33%	0	0%
Summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to other researchers in the same field	14	47%	14	47%	2	6%
Summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to people who don't have much scientific or technical training in your field	16	53%	11	37%	3	10%
Demonstrate new technical skills	14	47%	15	50%	1	3%

Students were asked how their level of awareness and interest in certain areas changed due to their participation in the 2010 summer research experience. Results are shown in Table 4. Ninety-seven percent said that their awareness of broader societal implications of new technologies related to nanotechnology increased a little or a lot. Seventy percent said that their interest in pursuing a graduate level degree related to nanotechnology increased a little or a lot, while 23% reported no change and two students reported that their interest decreased a little.

Three-quarters of students (74%) reported that their interest in finding a career in research and manufacturing related to nanotechnology had increased a little or a lot. Fifty-seven percent reported that their interest in finding a career in science education and/or engineering education had increased a little or a lot, while the remaining 37% reported no change. One student reported that his or her interest decreased a little. Last, 73% of students reported that their preparation for careers in research and manufacturing related to nanotechnology had increased a little or a lot.

Table 4. Student Perception of Change in Awareness and Interest

	Increased a Lot		Increased a Little		No Change		Decreased a Little		Decreased a Lot	
	N	%	N	%	N	%	N	%	N	%
Awareness of broader implications of new technologies related to nanotechnology	17	57%	12	40%	1	3%	0	0%	0	0%
Interest in pursuing a graduate level degree related to nanotechnology	6	20%	15	50%	7	23%	2	7%	0	0%
Interest in careers in research and manufacturing related to nanotechnology	8	27%	14	47%	7	23%	1	3%	0	0%
Interest in science education and/or engineering education	11	37%	6	20%	11	37%	1	3%	0	0%
Preparation for careers in research and manufacturing related to nanotechnology	12	40%	10	33%	5	17%	3	10%	0	0%

Twenty-six students responded to an open-ended question that asked about the program's impact on their academic, career, and future plans. Five said that the experience affirmed their plans to pursue research or helped them determine whether research was the right path for them. Twelve reported that the program provided insight regarding what they wanted to do in the future, and seven reported that it encouraged them to pursue graduate study. Three noted that the program gave them better skills (e.g., knowledge about nanotechnology, research skills, and making presentations).

Students were asked a question similar to this topic during focus groups -- how the REU program influenced their desire to work in a science, technology, engineering, or mathematics career. Across the campuses, in general, the students became more interested in careers in these fields because they enjoyed the experience they gained in the labs and the hands-on work was what really convinced them that they would like to attend graduate school and then do research for a career. However, one student was heavily inspired to go on to a masters or doctoral program as a result of the REU program. One student came to the program to see if he did want to work in the STEM fields and decided that it was not for him.

Student Impressions

Students were asked to rate several aspects of their summer research experience. All responses are shown in Table 5. Seventy-six percent rated their interactions with their advisors as excellent or good, and 44% rated their interactions with other professors as excellent or good. Ninety-three percent rated their interactions with other students as excellent or good.

Student perceptions of opportunities were positive: 73% reported that their opportunities to use research facilities and learn new techniques were excellent or good, 97% rated their opportunities to share and discuss their REU research with others as excellent or good, and 97% rated the Museum of Science Communication Workshops as excellent or good. When asked to rate the housing, many students (N=12) said it was not applicable to them. Most of the rest said it was excellent (N=10). One said it was poor.

Rating the overall summer research experience, 83% (N=21) rated it as excellent or good. Five students rated it as fair, and none said that it was a negative experience.

Table 5. Student Ratings of Summer Research Experience

	Excellent		Good		Fair		Poor	
	N	%	N	%	N	%	N	%
Interaction with your advisor	14	46%	9	30%	5	17%	2	7%
Interactions with other students	21	70%	7	23%	2	7%	0	0%
Interactions with other professors [NR=5(17%)]	5	17%	8	27%	11	36%	1	3%
Opportunities to use research and learn new techniques	15	50%	7	23%	6	20%	2	7%
Opportunities to share and discuss your research results with others	16	54%	13	43%	1	3%	0	0%
Housing [NR=12(40%)]	10	34%	3	10%	4	13%	1	3%
The two Museum of Science workshop sessions on science communication	22	74%	7	23%	1	3%	0	0%
Overall summer research experience	15	50%	10	33%	5	17%	0	0%

Students were asked several questions about human and material resources available to them as part of the REU program. The responses are shown in Table 6. Two-thirds of students (N=20) strongly or somewhat agreed that within the first week they and their advisor developed a clear set of goals related to their summer experience. Eighty-seven percent strongly or somewhat agreed that they were given access to appropriate information, equipment, and facilities so that they could achieve their research goals. Eighty percent strongly or somewhat agreed that their research advisors provided helpful guidance as their research projects advanced.

Table 6. Student Perception of Available Resources

	Strongly Agree		Somewhat Agree		Neither Agree nor Disagree		Somewhat Disagree		Strongly Disagree	
	N	%	N	%	N	%	N	%	N	%
Within the first week, my advisor and I developed a clear set of research goals related to my summer research experience.	10	33%	10	33%	1	3%	5	17%	4	13%
I was given access to appropriate information, equipment, and facilities so that I could achieve my research goals.	14	47%	12	40%	1	3%	2	7%	1	3%
My research advisor provided helpful guidance as my research project advanced.	19	63%	5	17%	3	10%	3	10%	0	0+%

When asked whom they would identify as the primary advisor of their research project, responses were 37% professors, 13% postdoctoral fellows, and 50% graduate students.

Feedback on Program Components

During focus groups students were asked to share their impressions of several program components. Those components are discussed next, except for the Science Communication Workshops, which were assessed in more depth and are presented in a separate section.

1. **Ethics in Nanotechnology Session** - Students across the three campuses discussed the session in two parts. The first part was related to ethics and discussed pros and cons about the projects. The students found that this part was generally good because it led them to think more broadly about how their projects fit into the larger picture. Several students felt that this was unnecessary for them because there are no ethical issues surrounding their projects and they suggested that a more appropriate title for the session would be 'practicality' or 'usefulness' as opposed to ethics. They felt that the professor forced the issue regardless of whether it was appropriate for their projects. However, students said that he was a good speaker in general. For the second part of the session, the one-on-one interviews, the students generally felt that ethics had left the discussion altogether. A general consensus was that they had to justify why their projects were good and why they should be done without addressing negatives. Several of the students really liked the individualized attention and said that it increased their motivation for their work, but not necessarily because of ethics. It was more because of the broadening of their perspectives on their work and seeing how it contributed to the science community in general.

2. **Writing an Introduction Session** - There were mixed feelings about this session. Students in general did not find the presentation helpful but did get a lot out of the one-on-one meeting with Dr. Smyser. Students who watched the presentation via video did not enjoy this format. Several students discussed that they were confused about the assigned length of the assignment and would have appreciated clearer instructions. A few students said they were assigned a literature review that was not

related to their project. Many students agreed that the session was a good way to organize their thoughts about their projects and that they really learned how their work fit with others in the field.

3. The "More-or-Less Weekly" Meetings – Students at two campuses (NEU and UNH) were asked this question, and they had very different experiences. The students at NEU were generally unhappy with how the weekly meetings occurred. Some students did not have any regularly scheduled weekly meetings, and they were unhappy about this. Some students had weekly meetings, but the meetings were usually focused on the graduate students' work rather than the REU students' work. A few students did have scheduled weekly meetings and found them very beneficial because they received focused attention about their projects, were kept on track, and learned about what others' projects. One student did not have meetings but his advisor sought him out regularly to see if he needed guidance. One student did not have meetings and was sought out by her advisor but felt that the advisor was mean and treated her poorly. In contrast to the NEU students, most UNH students had little to say about their weekly meetings, because most felt that the meetings had been very beneficial. Students were given good feedback about their work and enjoyed learning about the other REU students' work.

Program Strengths

Through the focus groups and web-based surveys, students were asked to comment on the strengths and challenges of the REU program, as well as their suggestions for change. Their responses with regard to program strengths are summarized first.

Of the 26 web-based survey respondents who commented on the strengths of the REU experience, thirteen noted content area gains, six noted the seminars and workshops, six cited the opportunities for interaction and collaboration with others, five noted the experience with public speaking and communication, and four cited the hands-on research experience provided. Other answers included insight into the ethics and societal impact as well as value-sensitive design (N=2) and the opportunity to work independently (N=1).

In focus groups, students were asked what they liked most about the program. Students who participated in the program at all three campuses had similar responses to this question. Many appreciated obtaining real research experience in the labs in a relaxed atmosphere and were excited to use the lab's machines and technology to which undergraduates typically lack access. For some others it was the exposure to the work in various disciplines that all of the other students were doing and working in new fields themselves. Several students liked the communication and presentation skills they learned through the program the most, and others felt that they had gained a sense of the importance of their chosen careers. Finally, a few students liked working with their graduate school mentors most, and that they were inspired to pursue graduate school themselves as a result of their interactions and mentoring.

Program Challenges

On the web-based survey, 25 students commented on challenges of the REU experience. Sixteen cited a lack of program organization, coordination, or communication. Ten cited lack of notice and/or planning in the beginning of the program, and six noted problems with preparation and supervision of their program advisors. Challenges cited by two students related to problems with equipment which either broke down or were not accessible. Finally, challenges noted by one student each were that lectures were not applicable, lack of their own content knowledge related to the project, and scheduling issues.

In focus groups, students participating at all three campuses had similar challenges/frustrations. The primary frustration was a lack of communication prior to arrival, and even into the first several weeks. Many students had no idea what projects they were working on, what the housing situation was, or who

their advisors were. Another common frustration was that equipment often wasn't working properly in the labs or students were not trained how to use the equipment. Several students found it challenging to be trained in one discipline and then come to the REU and have to learn in depth about a different discipline. A few people also expressed frustration with the rigid nine-to-five time schedule because their advisors and graduate students kept different schedules. They felt it wasted their time to be on different schedules. Some NEU students were frustrated by logistical related to their living on campus, including lack of access to email, software programs, and the gym. They also had to wait too long for their campus IDs, which made dorm access and parking difficult. Some UML students were frustrated by the amount of time they had to wait for materials to come in and the amount of time it took them to locate materials in storage due to a severe lack of organization. A positive challenge was that, to circumvent these problems, participants had to come up with their own procedures and methods and had to make the step from theory to execution, which helped them develop problem-solving skills.

Program Suggestions

On the web-based survey, 23 students made suggestions for improving the REU program. Twelve students suggested better planning and organization of the program, particularly before students arrive, but also during the program itself. Nine students suggested better communication about various aspects of the program before students arrive and for the duration of the program. Two students suggested better communication with graduate students and professors related to availability, responsibilities, and scheduling. Two others suggested better access to Northeastern facilities and labs. The remaining suggestions, each offered by one student, included having a different focus for the first and second session, having training for students to run NMRs (replacing the Regulatory lecture), and having weekly meetings with project groups.

Students were also asked what they would change about the REU program. Some NEU students would change what they perceived as too many time-consuming, hour-long meetings about repetitive topics such as PowerPoint usage. Other students felt that knowing what the NSF budget was at the beginning of the summer would be helpful for planning and knowing what was feasible, because the lab was not very willing to spend their budget on the REU students. The students would also change the equipment ordering procedures because it took too long for an order to be placed.

The UML students would change the poor communication between the REU students and their assigned graduate student and professor. Several students suggested more advanced planning and structuring of each student's responsibilities, and making sure that all advisors knew about program parameters. Several students were upset that the graduate students treated them rudely and with disrespect, and suggested that they have a training session about this. In addition, the students would change the graduate students' hours to match the REU students' hours. The REU students had to work longer hours and had to wait in the mornings for the graduate students to arrive. Some students also suggested having a required presentation halfway through the summer to make sure they were on the right track, having more interaction with the other campuses to see what they are working on, and better organization of storage.

In the focus groups, students were also asked what they wished they had known before starting the REU program, and what advice they would offer to next year's students. Students advised future participants to email their advisors and to advocate for themselves. This would help make sure everything is set up for them because otherwise they may not be notified about anything until they arrive. It was also suggested to ask a lot of questions and be very persistent when you ask for things so you are not ignored. They also said to be prepared for heavy reading and to do a lot of background reading, especially if you are given a project when you arrive. Interestingly there was an upside to starting a new project, which is that you are

involved in the design stage. Last, the students would advise future participants to prepare to be independent and do considerable thinking and work on their own.

Science Communication Workshops

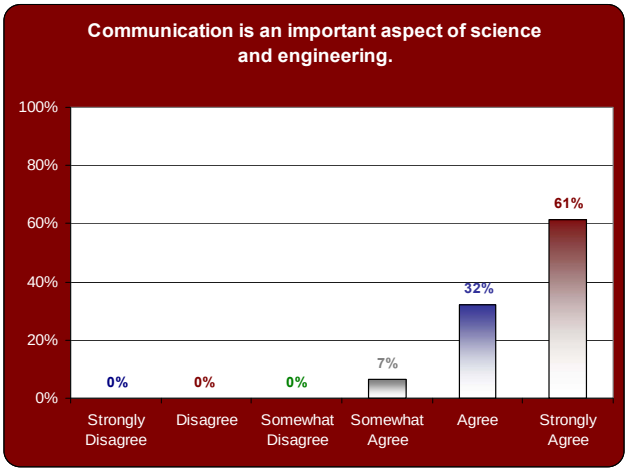
The Science Communication Workshops held at the Museum of Science were a central educational component of the REU program that was subject to more extensive evaluation than other program components. In addition to questions about the workshops in the web-based survey and focus groups that students completed at the end of the program, students completed surveys at the Museum of Science at the beginning and end of each of the two Science Communication Workshop days. Findings from this array of measures are reported below.

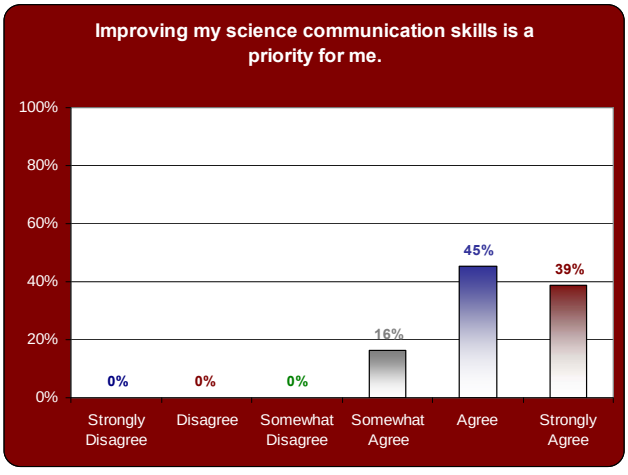
Session #1 Pre-Survey

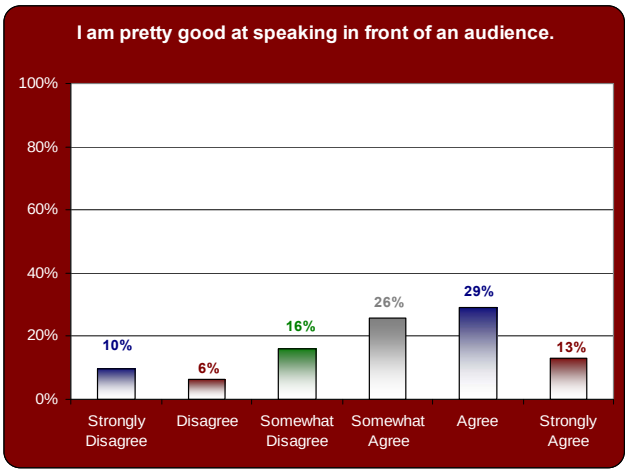
REU students completed surveys (Appendix C) before and after each of the two workshops. The Session #1 pre-survey asked about demographic information as well as students' skills, beliefs, and priorities related to making science presentations.

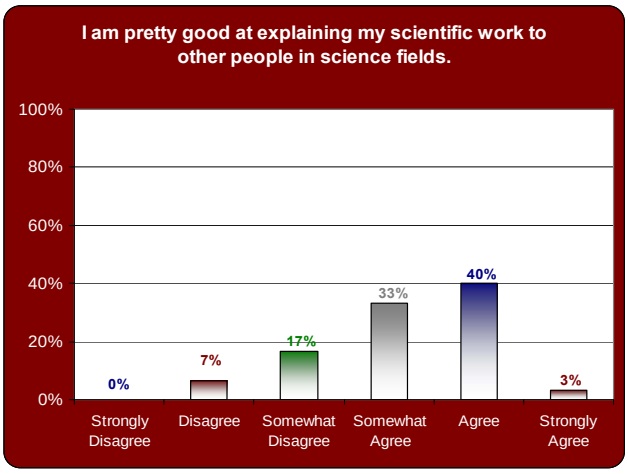
Demographic information is reported based on students' responses to the session #1 Pre-Survey (N=31). Sixty-five percent were male, and 35% were female. Sixty-five percent were Caucasian/White (N=20), 19% were Hispanic/Latino (N=6), 13% were Asian (N=4), and 3% were African American/Black (N=1). Fourteen students (45%) reported that they were completing their REU at UML, eleven (35%) at NEU, and six (19%) at UNH. Twenty-six percent had just completed their freshman year, 39% had completed their sophomore year, and 32% had finished their junior year. One student had completed the senior year.

All respondents agreed with the statement "communication is an important aspect of science and engineering," and 61% strongly agreed. All respondents also agreed with the statement “improving my science communication skills is a priority for me”, and 39% strongly agreed. The majority of respondents (68%) agreed that they were pretty good at speaking in front of an audience; however, a full 10% strongly disagreed with this statement. Seventy-six percent of the students agreed that they were pretty good at explaining their scientific research to others in science fields, although only 3% strongly agreed.

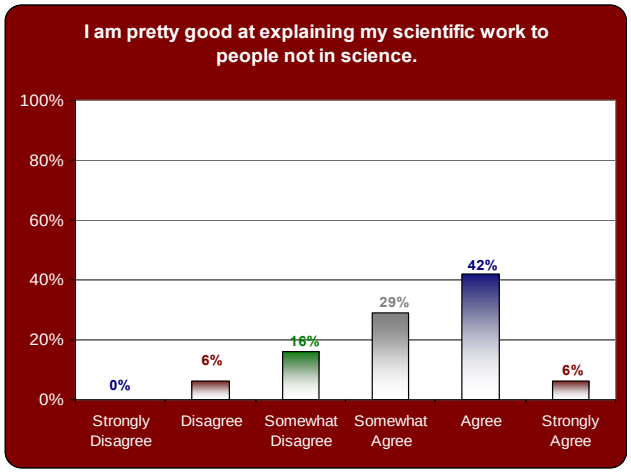


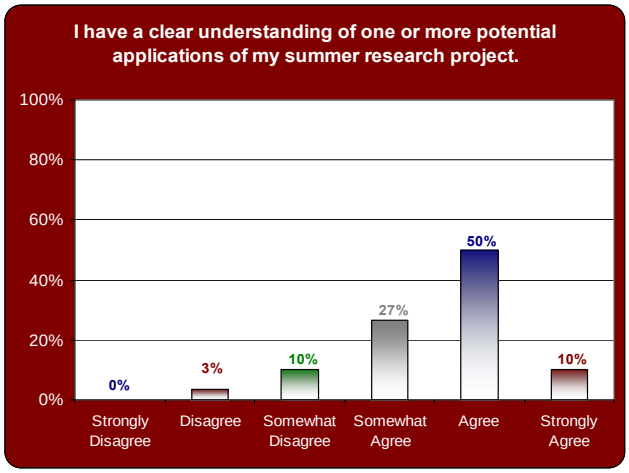






Students expressed similar agreement when asked about their abilities in discussing their scientific research to people who do not work in science fields. Seventy-seven percent agreed that they were pretty good at explaining their work to them, however, only 6% strongly agreed. Eighty-seven percent said they had a clear understanding of one or more potential applications of their REU research, but 13% disagreed or somewhat disagreed.





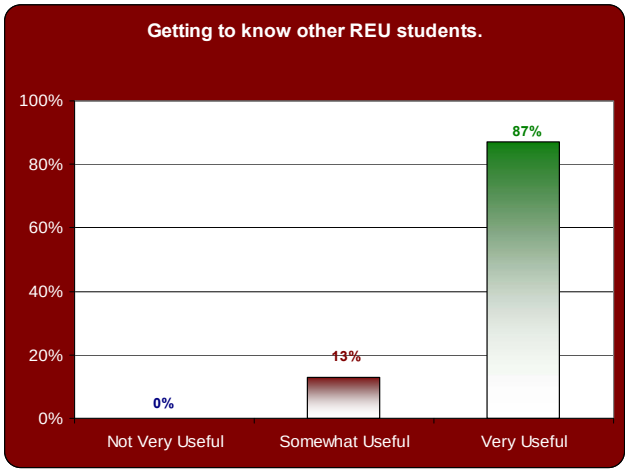
When asked what aspects of presenting science to an audience they liked the most, 11 respondents said they enjoyed educating the audience and sharing knowledge. Three respondents said they enjoyed explaining their research to others, and three more noted that presenting allowed them to get to know the topic more thoroughly. Two stated that their favorite aspect was answering questions at the end. The remaining answers, cited by one respondent each, were: discussion, getting technical advice, multimedia, informing people about the possibilities of technology, the attention and confidence gain, and critiques from other scientists. One stated that they had limited experience, and one said they did not enjoy anything about presenting to an audience.

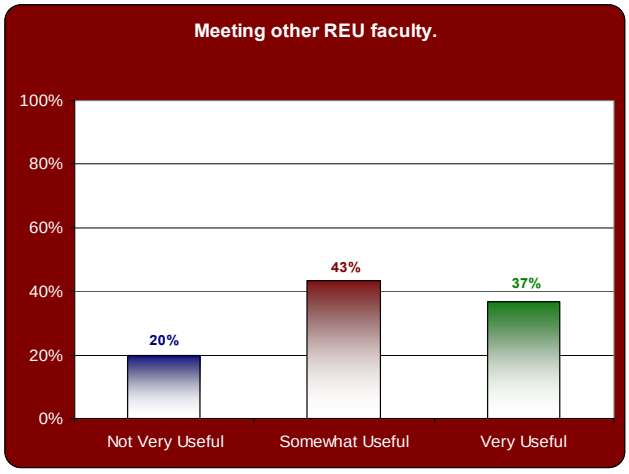
When asked what aspects of presenting science to an audience they liked the least, six said answering questions and four stated that finding ways to simplify their research was challenging. Four respondents disliked presenting in front of an audience and public speaking in general, and three disliked when the audience did not understand. Two disliked the nervousness that came with presentations. The remaining answers, cited by one respondent each, were: the audience knowing more about the topic, staying patient,

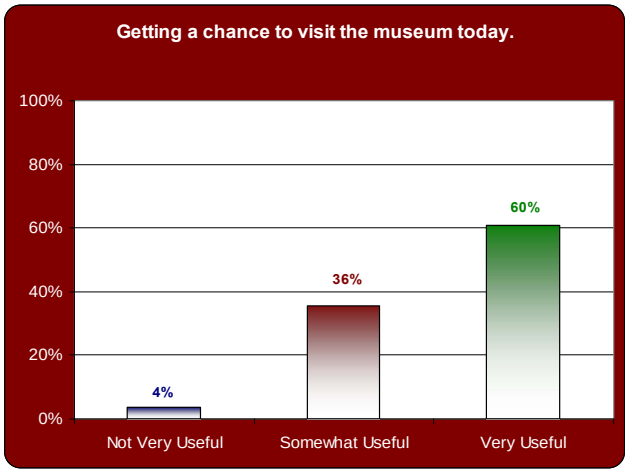
when people get defensive, budget meting, miscommunication, bad jokes, nothing, and not feeling that it was a strength.

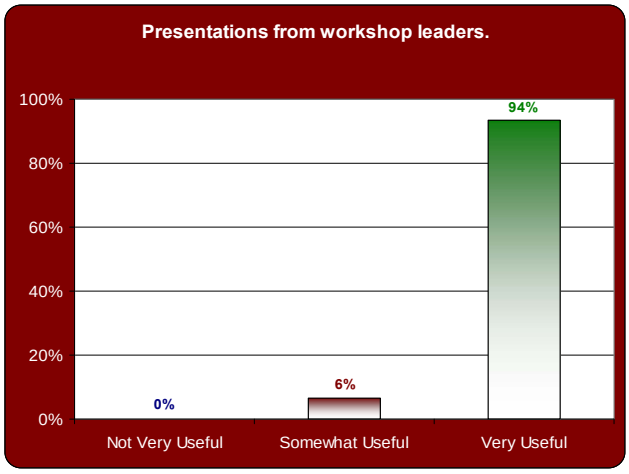
Session #1 Post-Survey

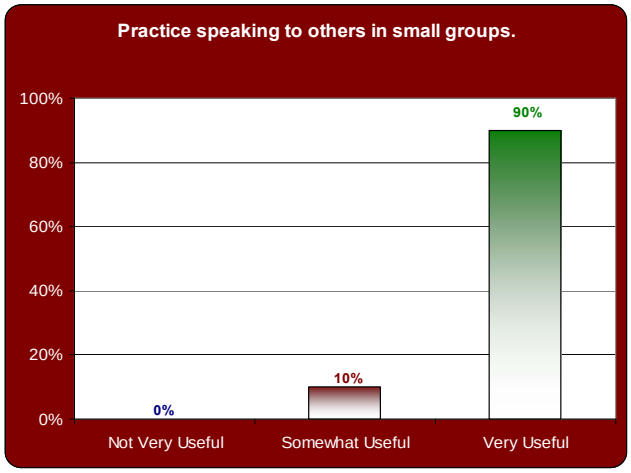
Respondents affirmed the usefulness of most Session #1 elements, with 100% rating the following either somewhat useful or very useful: Getting to know other REU students, presentations from workshop leaders, discussion on context and meaning, good/bad presentation demonstration, practice speaking to others in small groups, receiving feedback from workshop leaders, and receiving feedback from other students. The only two elements that were rated as not very useful by more than 4% of the students were meeting other REU faculty (20%) and the writing exercises (10%).

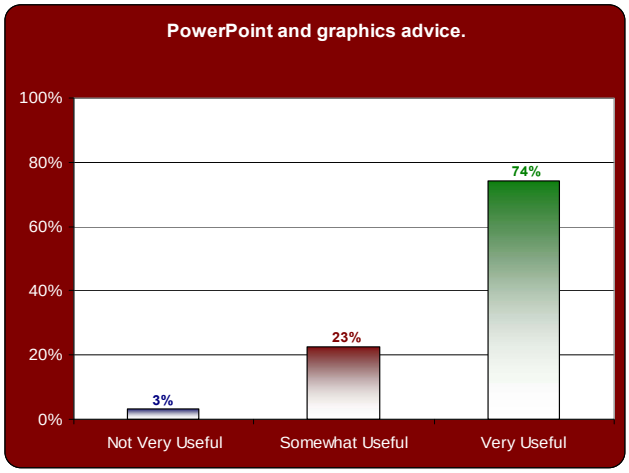


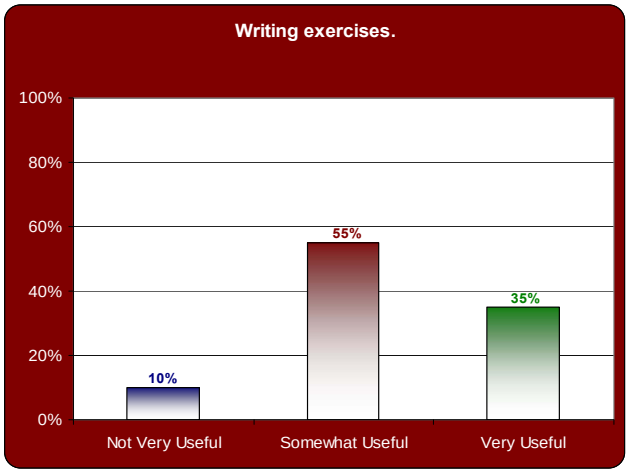


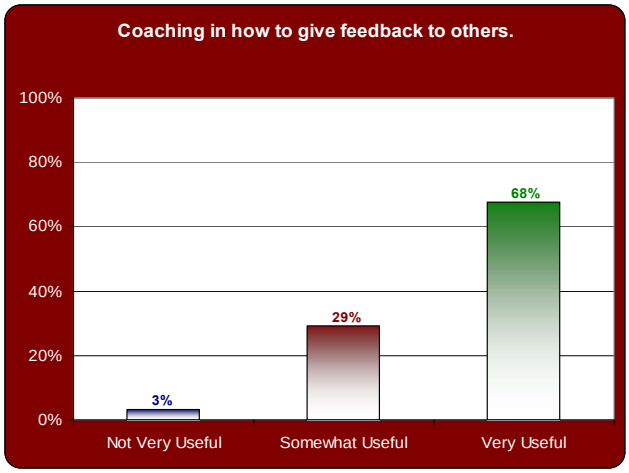




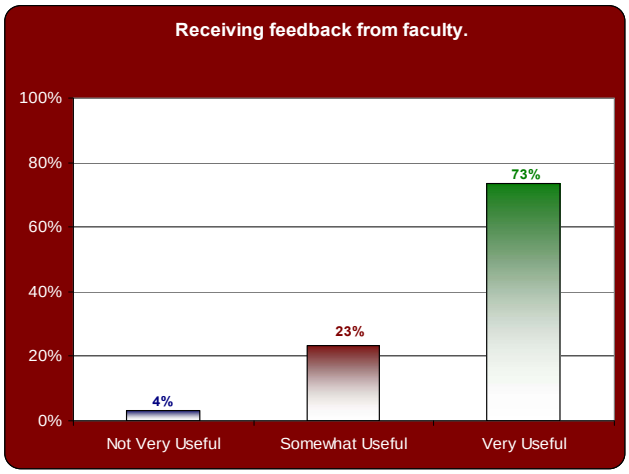

Practice speaking to others in small groups.
100%
80%
60%
40%
20%
0%
0%
10%
90%
Not Very Useful
Somewhat Useful
Very Useful

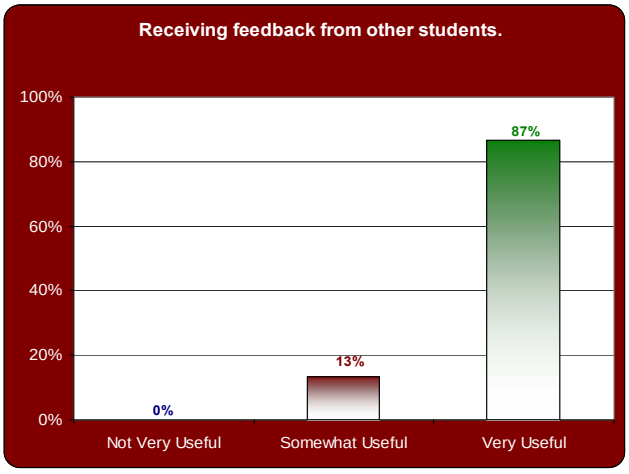

PowerPoint and graphics advice.
100%
80%
60%
40%
20%
0%
3%
23%
74%
Not Very Useful
Somewhat Useful
Very Useful


Writing exercises.
100%
80%
60%
40%
20%
0%
10%
55%
35%
Not Very Useful
Somewhat Useful
Very Useful


Coaching in how to give feedback to others.
100%
80%
60%
40%
20%
0%
3%
29%
68%
Not Very Useful
Somewhat Useful
Very Useful


Receiving feedback from workshop leaders.
100%
80%
60%
40%
20%
0%
0%
21%
79%
Not Very Useful
Somewhat Useful
Very Useful


Receiving feedback from faculty.
100%
80%
60%
40%
20%
0%
4%
23%
73%
Not Very Useful
Somewhat Useful
Very Useful



When asked what was most useful about Session #1, 8 respondents said they liked getting to practice their presentations; five of them specifically liked the small group presentations. Four of the students found receiving feedback as the most useful and it was learning tips for PowerPoint presentations for 3. Two students each cited: the mini-presentations, learning helpful tips for making effective presentations, learning about eye contact/mannerisms, and learning how to structure a talk. Additionally one student each answered: gaining confidence, learning that they lack confidence, group discussion, and talking to the group moderator.

The next question asked what information or topics that were not covered in the session they hoped would be covered in session #2. Four respondents noted they obtained the information they needed or they were pleased with the discussions. Three would like discussions on answering audience questions, particularly those that are difficult to understand. Three want to get tips on posters, and two want tips on when and how to use pictures and examples. The rest of the responses, cited by one participant each, were: "don't know," inspiring younger audiences, holding the interest of an audience, speaking to a larger audience, preparation, writing skills, talking to a group without a science background, specialized discussions on presenting science research, presenting to an audience with both scientists and non-scientists, how to remain calm, and posture techniques.

The participants were asked to rank a list of six science communication skills with regard to how much improvement they needed in each. A rating of '1' indicated the lowest level of improvement needed, and '6' indicated the highest. As shown in Table 7 below, the bottom five choices received nearly equal weightings, but substantially more students selected "making more effective graphics and PowerPoint slides."

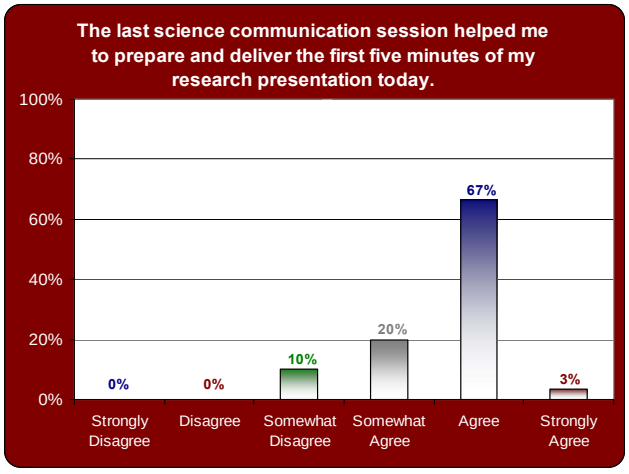
Table 7. Science Communication Skills	Mean Rank
Making more effective graphics and PowerPoint slides.	4.8
Explaining my research more clearly when face-to-face with non-scientists.	3.5
Better understanding the context and meaning of my adopted lab's research.	3.4
Explaining my research more clearly when face-to-face with other scientists.	3.3
Speaking more effectively in front of an audience.	3.1
Writing papers and reports about my research	3.0

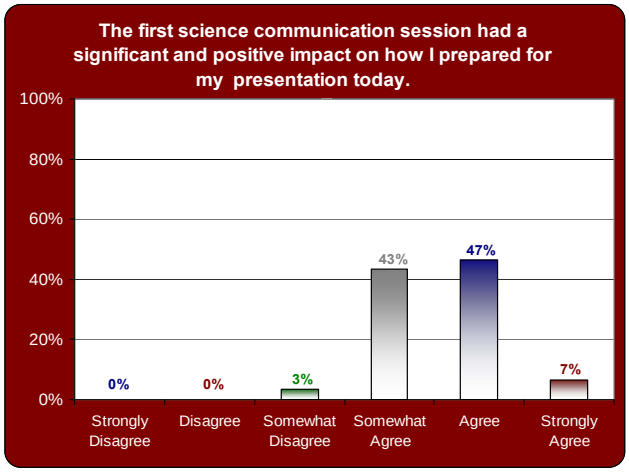
When asked what ways session one would influence their behavior over the next few weeks, five respondents said the session would help them to better communicate their research and give better presentations, five said the session gave them confidence, and an additional five said it would help them practice their brief research descriptions or short presentations. Four respondents said the session would help them convey the main ideas of their projects or think of the project in a broader scope. Three stated that the session enhanced their understanding of their research and/or were inspired to do more independent research and reading about their topics. Two noted that the session gave them more awareness about communication and how to talk about their research in general. The following influences on their behavior, cited by one participant each, were: they will spend free time preparing for the presentation, work on their speaking, learn to emphasize important topics, use their time more wisely, make direct contact with others, become more approachable and open, prepare the 2-slide presentation, understand the larger social implications of research, and help with future presentations and explain their work to others.

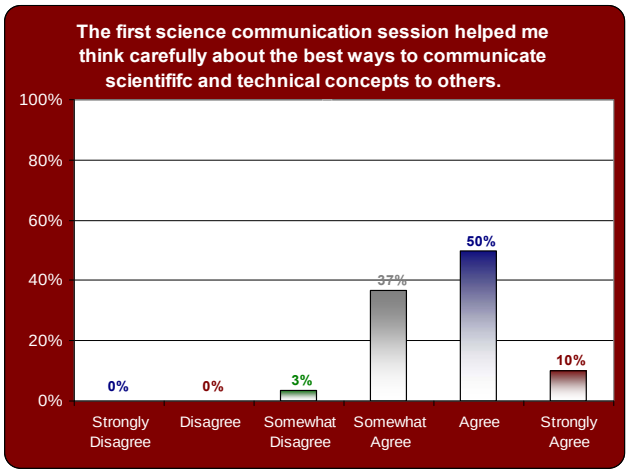
The final question invited students to make any other comments or recommendations. Seven respondents said that the session was excellent, good, or thanked the program. Six stated that the session was useful and informative, and two stated that it was fun. The remaining comments, cited by one student each, were: it should have been more general, the workshop lunch was awkward, the session held their attention, would have liked a writing skills session, would have liked more pointers on communicating with a non-scientific audience, would have liked to learn more about other presentation media (e.g. posters), in-group practice was the most helpful, the session was difficult to hear, and it would be helpful to have a series of sessions instead of just one.

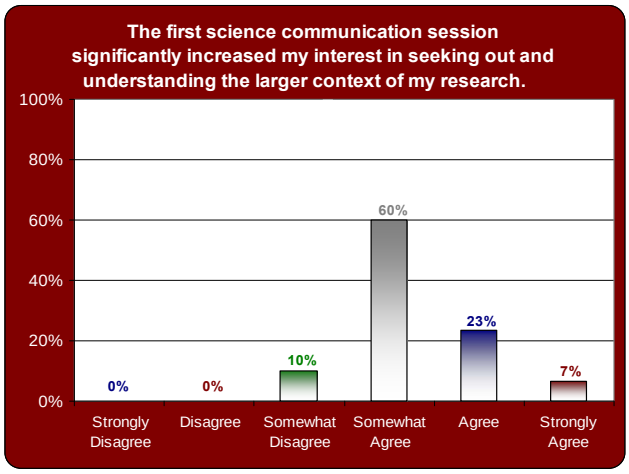
Session #2 Pre-Survey

The Session #2 pre-survey asked students to reflect on Session #1, their work between the two sessions, and their preparedness for the research presentation they needed to make during Session #2. Ninety percent of respondents agreed that the last session helped prepare them for their five minute presentation, although 10% somewhat disagreed. Further, 97% agreed that the first session "had a significant and positive impact" on how they prepared for their presentation and that Session #1 helped them think carefully about how to best communicate scientific and technical concepts to others. Ninety percent agreed that Session #1 significantly increased their interest in seeking out and understanding the broader impact of their own research.

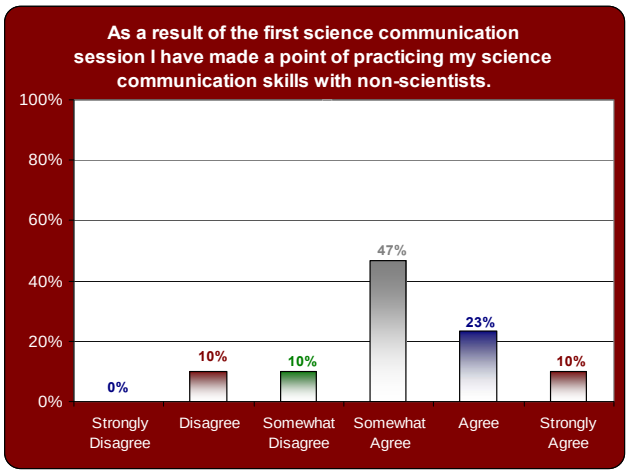


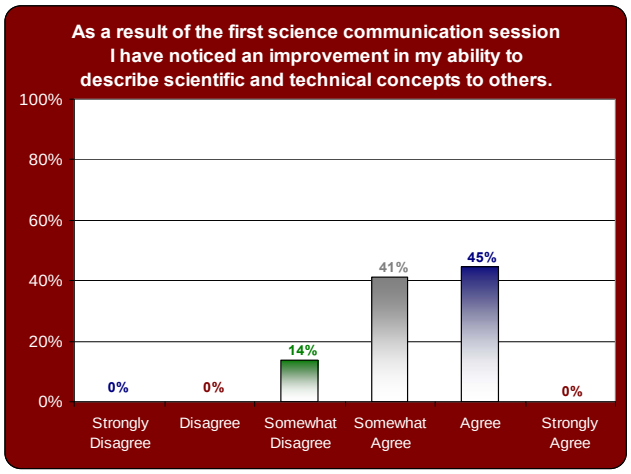


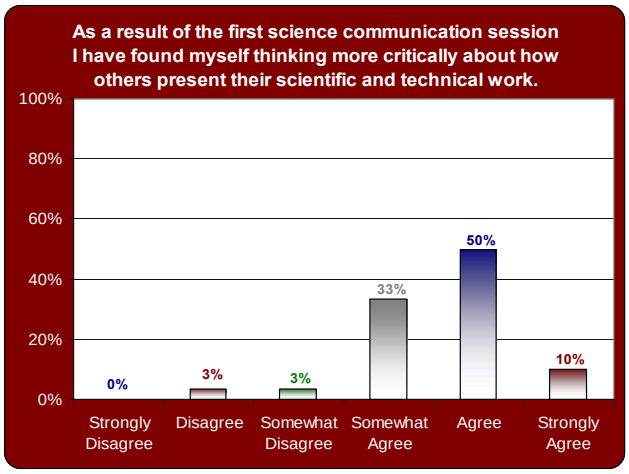




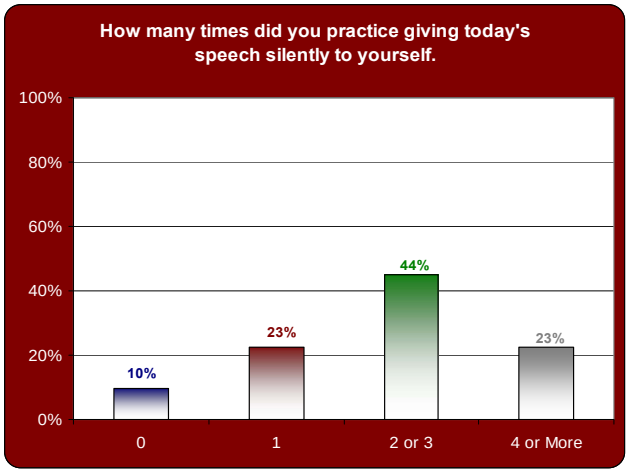
As a result of Session #1, eighty percent of respondents agreed that they have made a point of practicing their science communication skills with non-scientists, 86% agreed that they have noticed an improvement in their ability to describe scientific concepts to others, and 86% agreed that they have been thinking more critically about how others present their scientific research.

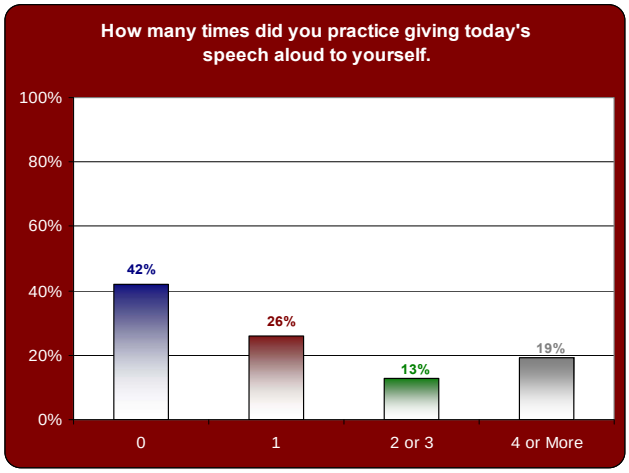


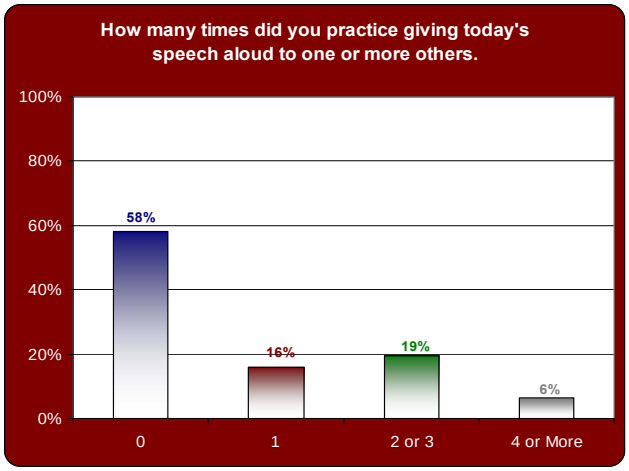




Students were asked how frequently they practiced giving their Session #2 presentation, and 90% had done so silently to themselves at least once. More than half (58%) practiced aloud to themselves and only 42% practiced aloud to others.





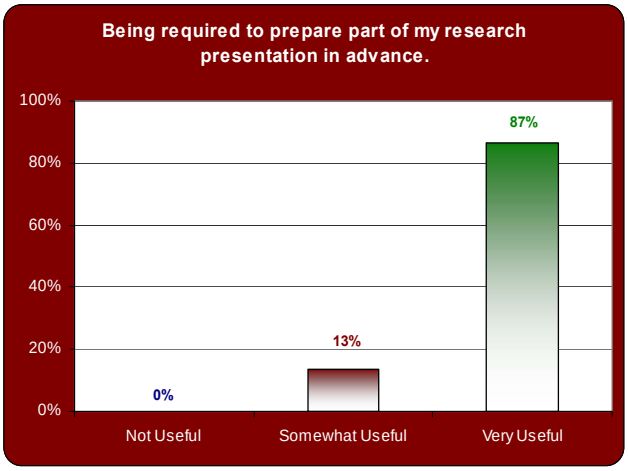


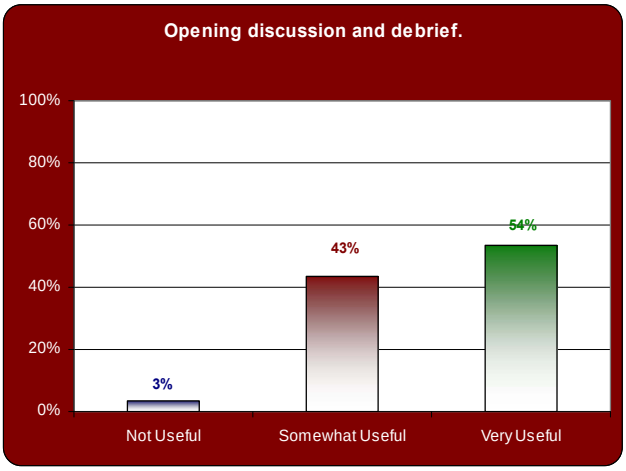
Students were then asked what, in retrospect, they found most helpful about Session #1. Nine said that the PowerPoint tips and "how-to's" were the most helpful, four cited learning how to organize and focus their presentations, three cited receiving feedback, and three cited the presentation practice. Two respondents found the examples of what to do and not to do most useful, and two cited learning to speak slowly and clearly. One student cited learning about posture and physical presence and one cited learning to engage the listeners.

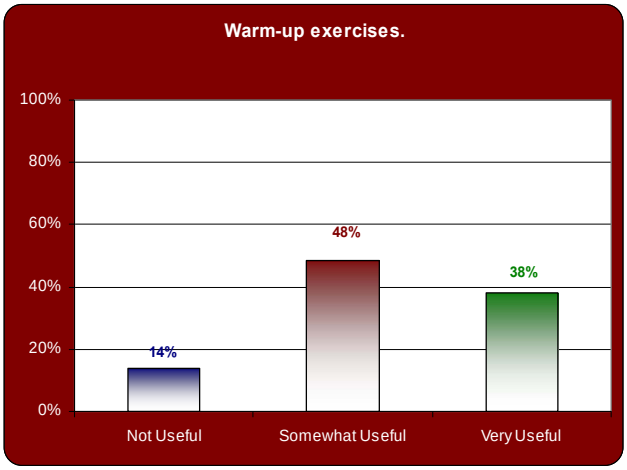
Finally, students were asked to report on their recent insights about the challenge of communicating science clearly to people outside their field. Six cited realizing the need to explain difficult concepts clearly, and six cited having to use simpler vocabulary and drawing analogies to concepts that are more familiar to their audience. Four cited realizing that the audience often lacks interest and/or relevant knowledge, three found avoiding jargon to be a challenge, and three cited having to understand the audience's background and how to explain their work's location in the "big picture". Two respondents were challenged by the amount of time it takes to explain challenging concepts, and one cited the challenge of using PowerPoint graphs. One respondent said "I have to be a teacher, not just a presenter."

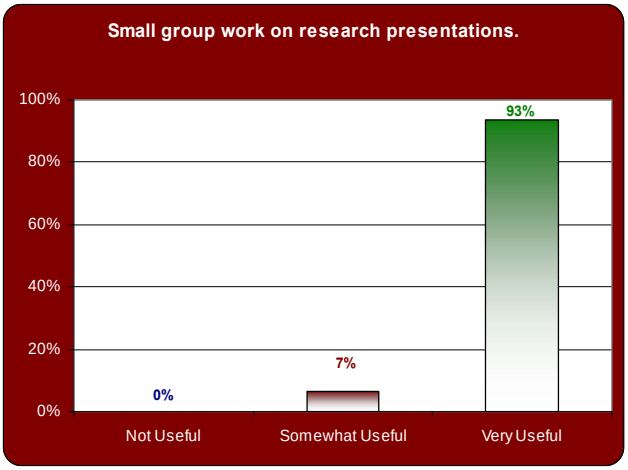
Session #2 Post-Survey

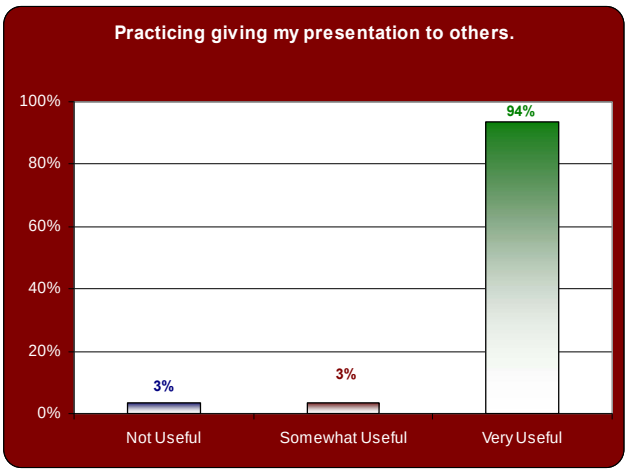
Respondents affirmed the usefulness of most Session #2 elements, with 100% rating the following either somewhat useful or very useful: being required to prepare part of the research presentation in advance, small group work on research presentations, feedback from peers, feedback from workshop leaders and faculty, practice giving productive feedback to their peers, and the workshop session overall. Ninety-seven percent of respondents found the opening discussion and debrief, presentation practice, and learning about other people's research to be useful. The warm-up exercises were rated as the least useful, with 14% rating them as "not useful".

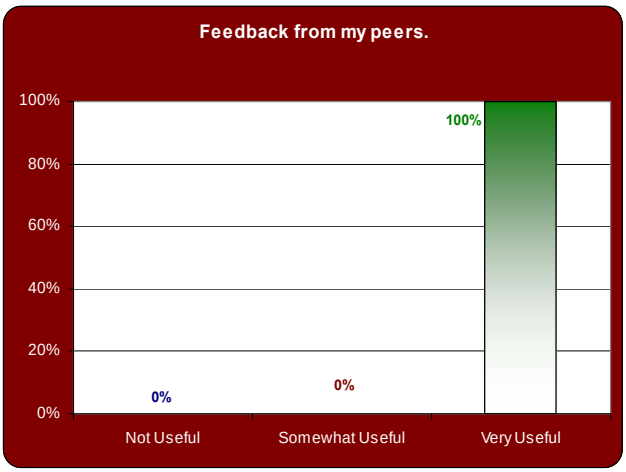


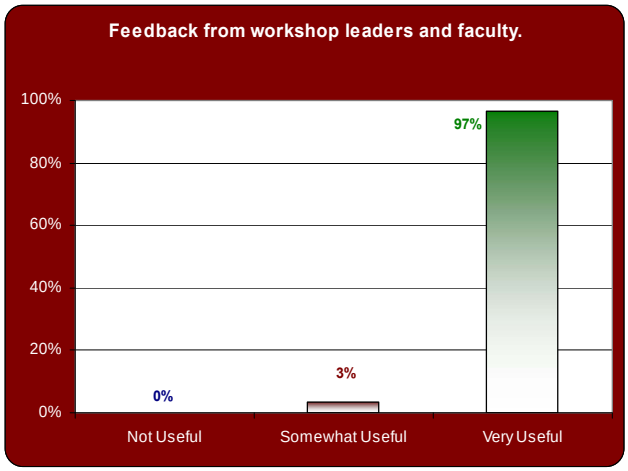


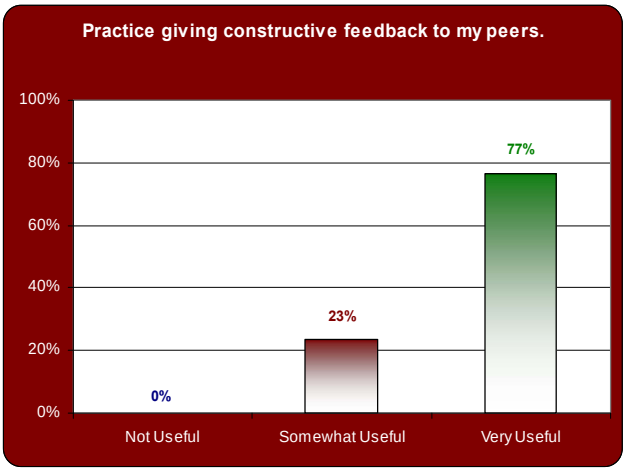


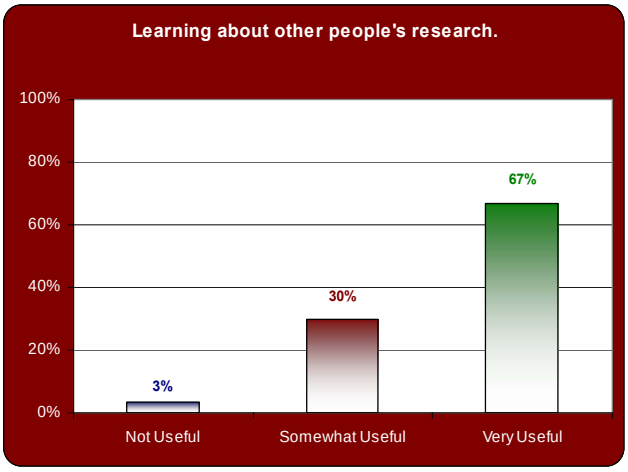


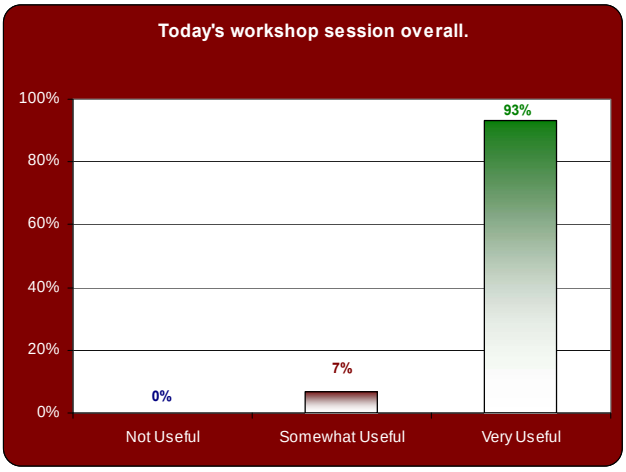








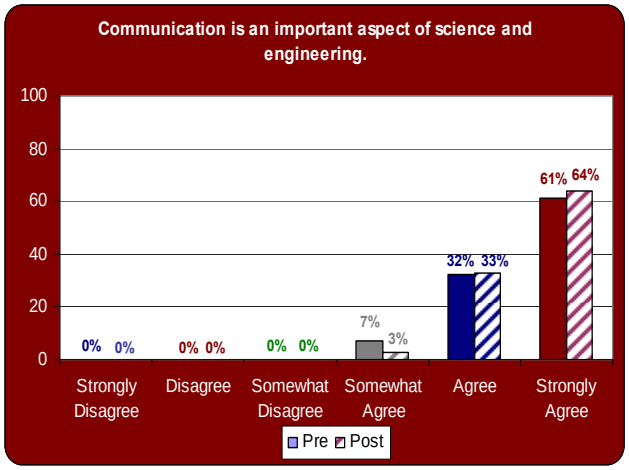


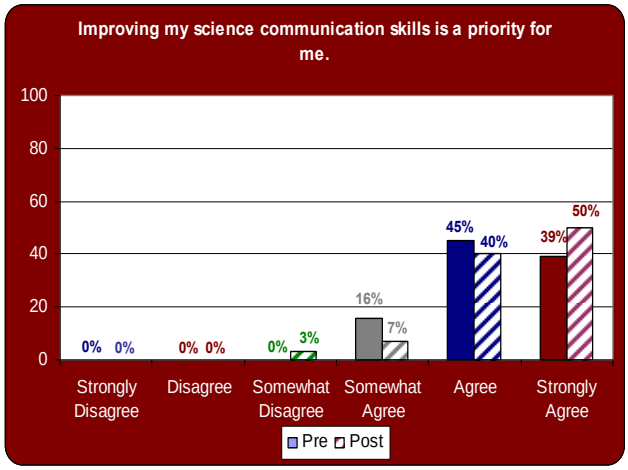


The students were then asked "If there had been more time today, what would you have liked to use it for?" Four respondents felt that everything was set up well and that time was well spent. Four would have liked more time to present so that they could share more information. Two would have liked a tour of the Museum of Science, two said time for more feedback, two would want to see more of the presentations, and two would have presented twice in order to improve the weaker parts and receive more

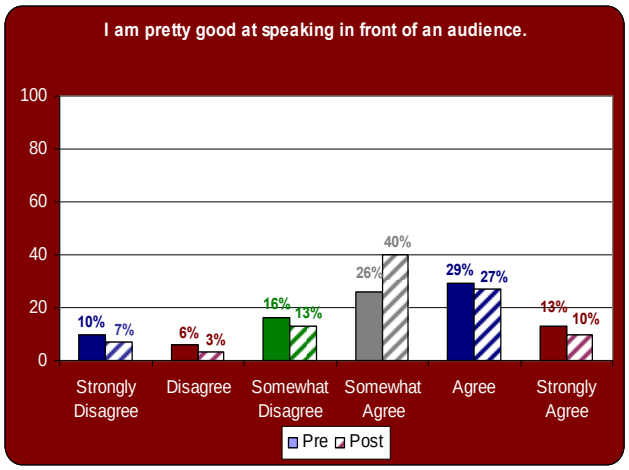
input. One respondent requested more communication tips, one would have liked to get to know his peers more, and one would have liked to see a couple of brave presenters present to the entire group.

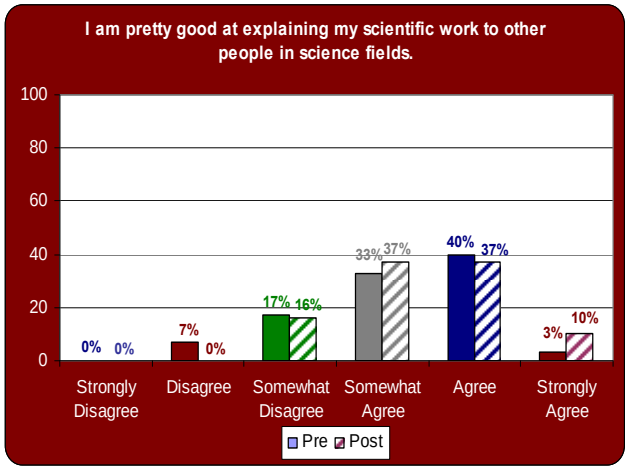
The Session #2 post-survey repeated the five questions asked in the Session #1 pre-survey about students' skills, beliefs, and priorities related to making science presentations, and the tables below compare their responses before and after completing the two sessions. The percentage of students who agreed or strongly agreed that communication is an important aspect of science and engineering increased from 93% before the workshops to 97% after the workshops. The percentage of students who agreed or strongly agreed that improving their science communication skills was a priority increased from 84% before the workshops to 90% after the workshops.

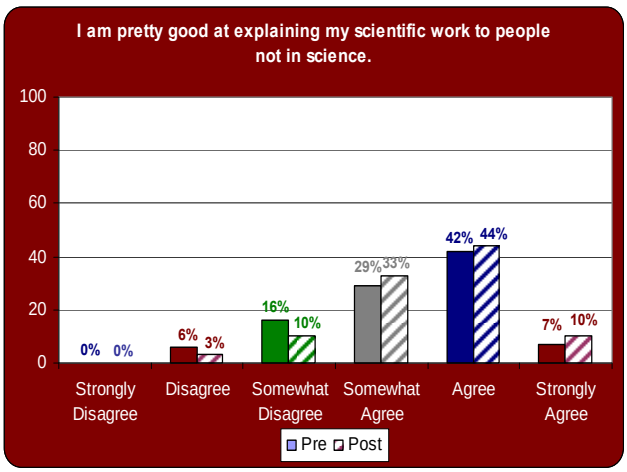


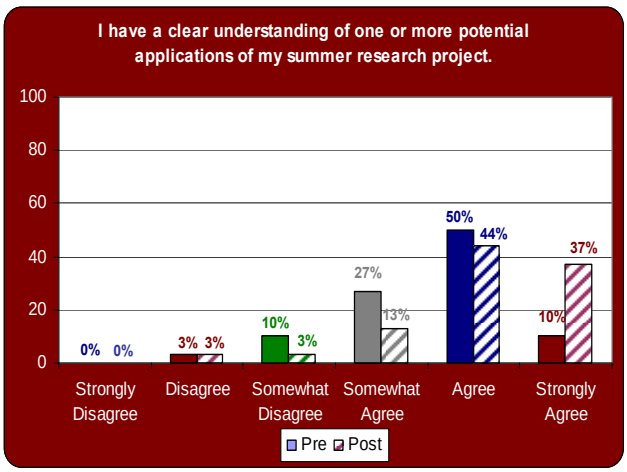


Students' assessment of their ability to speak in front of an audience increased slightly from pre-survey to post-survey, as shown in the chart below. The same is true of students' assessment of their ability to explain their scientific work to other people in both scientific and nonscientific fields. The percentage of students who agreed or strongly agreed that they had a clear understanding of one or more potential applications of their summer research increased from 60% before the workshops to 81% after the workshops.

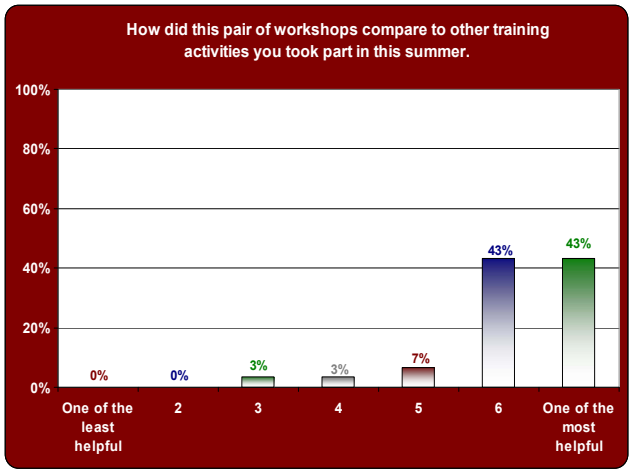


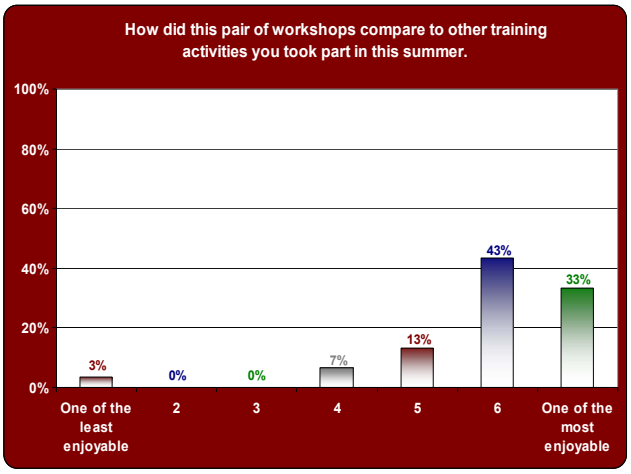






Students were also asked to compare the workshops to the summer's other REU training activities. On a scale from '1' as 'one of the least helpful' and '7' as 'one of the most helpful,' the average rating was 6.2 and no student gave a rating lower than 4. On the same scale, but for the item about how enjoyable the workshops were compared to other training activities, the average rating was 5.9 and only one student gave a rating lower than 4.





The final Session #2 Post-Survey question invited students to make any other comments or recommendations they wished. Twelve offered positive comments about their experiences at the workshops. One student recommended a short tour of the museum, one would have liked the session to be a bit earlier, and one recommended only having one presentation per room.

Web-Based Survey and Focus Groups

As noted earlier in the Student Impressions section of the report, on the web-based survey 97% of students rated the Science Communication Workshops as excellent or good. That survey also asked students what comments or suggestions they had about the Science Communication Workshops. Of the twenty who responded, twelve had positive remarks, stating that the workshops were great and three recommended adding more trips to the museum. The remaining comments and suggestions, offered by one student each, included giving tips for science posters, starting earlier in the day to avoid rush hour

traffic, doing both workshops on Fridays, offering a Museum of Science tour, and offering communications practice.

The focus groups also asked about the Science Communication Workshops. Students at all of the campuses had positive reactions to these workshops. They realized the value of being able to communicate their research to both scientific and nonscientific audiences and felt that the workshops were fun. They were pleased to have gained public speaking experience and to have received the PowerPoint tips. Several students enjoyed learning about the constructive feedback process and several mentioned that the workshops enabled them to think more broadly about the context of their research. One liked seeing what the students at the other REU universities were working on, and one suggested holding a third workshop at the museum because the museum workshop was more helpful than the one held on campus. The only recommendation for change was that one student wished that the workshops were a little slower.

Conclusion

This report provides an evaluation of the CHN Research Experience for Undergraduates (REU) program which occurred during the summer of 2010. Thirty students who participated in the program at Northeastern University, the University of Massachusetts Lowell, and the University of New Hampshire completed surveys and focus groups to provide feedback on the REU program and on the Science Communication Workshops offered to REU students by the Museum of Science.

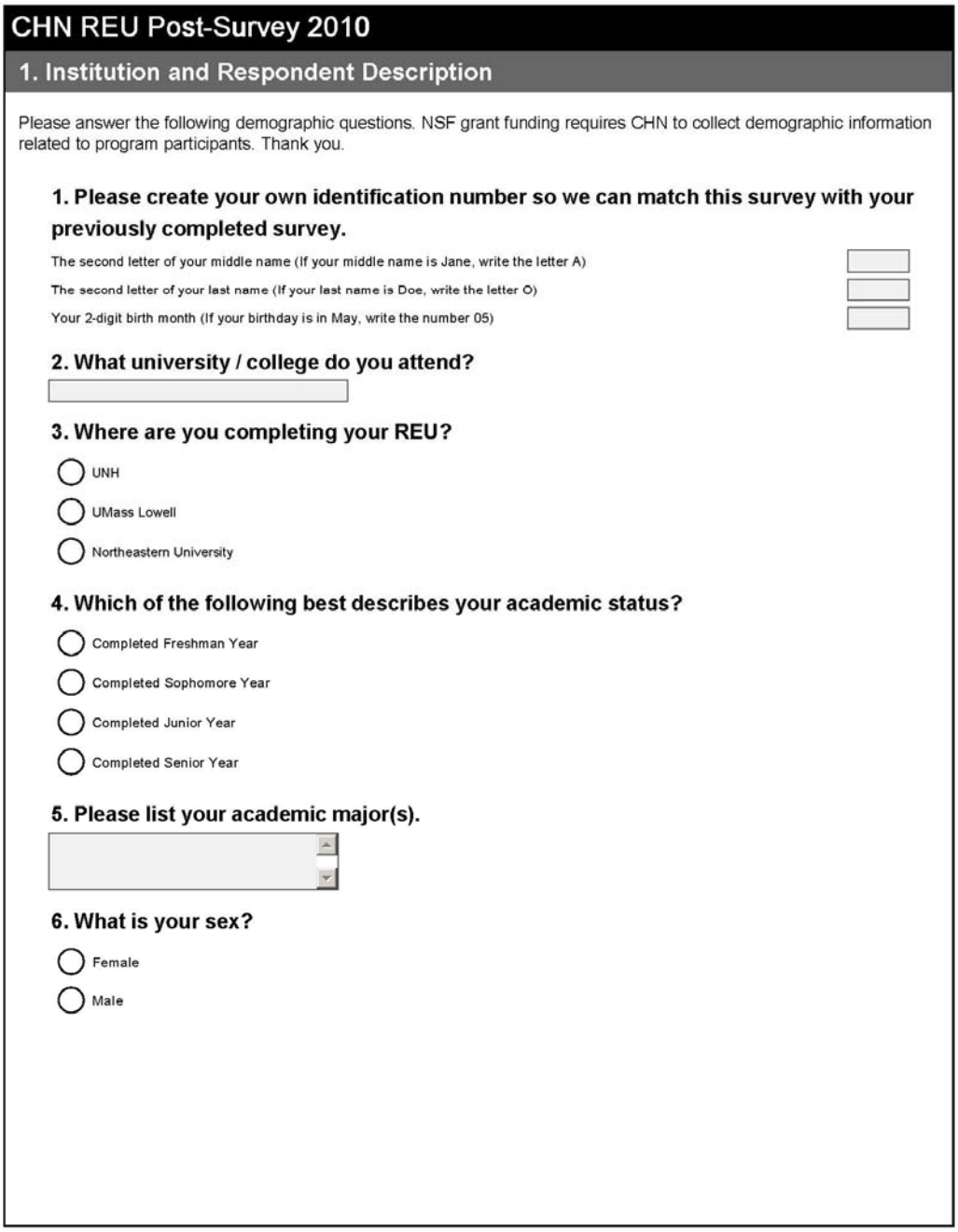
Approximately 40% of participants were female, and 37% were minority students. Substantial majorities of participants reported that their participation in the program increased their interest in pursuing graduate studies related to nanotechnology, their interest in finding a career in research and manufacturing related to nanotechnology, and their awareness of broader societal implications of new technologies related to nanotechnology. About half reported increased interest in finding a career in science education and/or engineering education. Most students also felt more prepared to pursue careers in research and manufacturing related to nanotechnology.

In-depth assessment of the Science Communication Workshops offered by the Museum of Science included student surveys and student focus group questions. The picture that emerged from these measures was very positive. Students rated the workshops as among the most helpful and enjoyable REU program activities, and their self-reported understanding of how to present their research to both scientific and non-scientific audiences increased.

When discussing strengths and challenges of the overall REU program, no single issue emerged as prominent across all students, but commonly noted strengths included the ability to do hands-on work, the gains in content knowledge, and the opportunities for interaction and collaboration with others. Commonly noted challenges included issues of preparation, organization, and communication, as well as accessibility of mentors and equipment. Notably, these are similar to the primary challenges that students have noted in the previous two years' REU evaluation reports. Students' interactions with advisors were rated highly for the most part, although some dissatisfactions were expressed, and students' interactions with each other were rated very highly.

The overall summer research experience was rated as good or excellent by 83% of participating students.

Appendix A: REU Web-Based Post-Survey



CHN REU Post-Survey 2010

1. Institution and Respondent Description

Please answer the following demographic questions. NSF grant funding requires CHN to collect demographic information related to program participants. Thank you.

1. Please create your own identification number so we can match this survey with your previously completed survey.

The second letter of your middle name (If your middle name is Jane, write the letter A)

The second letter of your last name (If your last name is Doe, write the letter O)

Your 2-digit birth month (If your birthday is in May, write the number 05)

2. What university / college do you attend?

3. Where are you completing your REU?

- UNH
- UMass Lowell
- Northeastern University

4. Which of the following best describes your academic status?

- Completed Freshman Year
- Completed Sophomore Year
- Completed Junior Year
- Completed Senior Year

5. Please list your academic major(s).

6. What is your sex?

- Female
- Male

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CHN REU Post-Survey 2010

7. What is your race / ethnicity? (Please select all that apply.)

- ☐ African American / Black
- ☐ Asian
- ☐ Caucasian / White
- ☐ Hispanic / Latino(a)
- ☐ Native American / Alaska Native
- ☐ Pacific Islander
- ☐ Other (please specify)

8. What is your citizenship status?

- ◯ U.S. citizen
- ◯ Permanent resident
- ◯ Other non-U.S. (e.g., temporary visa; student visa)

9. Do you have one or more disabilities? (A disability refers to having an impairment that substantially affects one or more activities of daily living and is not correctable with assistive devices.)

- ◯ Yes
- ◯ No

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2. Participant Impressions

Please select the responses that most accurately reflect your opinion and answer open-ended questions as completely as possible. Thank you.

10. How has your ability level in each of the following areas changed as a result of your participation in the CHN summer research experience?

	Increased a Lot	Increased a Little	No Change	Decreased a Little	Decreased a Lot	N/A
(1) Find information using library database resources	◯	◯	◯	◯	◯	◯
(2) Condense literature search into a coherent written introduction	◯	◯	◯	◯	◯	◯
(3) Understand how a particular science or engineering challenge relates to a larger goal or application	◯	◯	◯	◯	◯	◯
(4) Construct a professional PowerPoint presentation	◯	◯	◯	◯	◯	◯
(5) Communicate a research project and results verbally as a 15-minute professional presentation	◯	◯	◯	◯	◯	◯
(6) Summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to other researchers in the same field	◯	◯	◯	◯	◯	◯
(7) Summarize the purpose and results of a research project in a brief 1-3 minute "elevator speech" to people who don't have much scientific or technical training in your field	◯	◯	◯	◯	◯	◯
(8) Demonstrate new technical skills	◯	◯	◯	◯	◯	◯

11. How has your level of awareness, interest or preparation in each of the following changed due to your participation in the CHN summer research experience?

	Increased a Lot	Increased a Little	No Change	Decreased a Little	Decreased a Lot
(1) Awareness of the broader societal implications of new technologies related to nanotechnology	◯	◯	◯	◯	◯
(2) Interest in pursuing a graduate level degree related to nanotechnology	◯	◯	◯	◯	◯
(3) Interest in careers in research and manufacturing related to nanotechnology	◯	◯	◯	◯	◯
(4) Interest in careers in science education and/or engineering education	◯	◯	◯	◯	◯
(5) Preparation for careers in research and manufacturing related to nanotechnology	◯	◯	◯	◯	◯

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12. How did you learn about CHN's Research Experience for Undergraduates program? (Please select all that apply.)

- ☐ Advisor recommended
- ☐ Faculty member (not advisor)
- ☐ Friend
- ☐ CHN Web site
- ☐ Received information via email
- ☐ Attended a workshop
- ☐ Was invited to attend (please specify by whom in the 'other' space below)
- ☐ Other (please specify)

13. Within the first week, my advisor and I developed a clear set of research goals related to my summer research experience.

- ○ Strongly Agree
- ○ Somewhat Agree
- ○ Neither Agree nor Disagree
- ○ Somewhat Disagree
- ○ Strongly Disagree

14. I was given access to appropriate information, equipment, and facilities so that I could achieve my research goals.

- ○ Strongly Agree
- ○ Somewhat Agree
- ○ Neither Agree nor Disagree
- ○ Somewhat Disagree
- ○ Strongly Disagree

15. Whom would you identify as the primary advisor for your research project?

- ○ The professor with whom you worked
- ○ The post-doctoral fellow with whom you worked
- ○ The graduate student with whom you worked

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16. My research advisor provided helpful guidance as my research project advanced.

- ◯ Strongly Agree
- ◯ Somewhat Agree
- ◯ Neither Agree nor Disagree
- ◯ Somewhat Disagree
- ◯ Strongly Disagree

17. What were the most significant strengths of this summer's REU program?

18. What were the most significant weaknesses of this summer's REU program?

19. What recommendations (if any) do you have for program improvement?

20. How would you rate each of the following aspects of your summer research experience?

	Excellent	Good	Fair	Poor	N/A
(1) Interaction with your advisor	◯	◯	◯	◯	◯
(2) Interactions with other students	◯	◯	◯	◯	◯
(3) Interactions with other professors	◯	◯	◯	◯	◯
(4) Opportunities to use research facilities and learn new techniques	◯	◯	◯	◯	◯
(5) Opportunities to share and discuss your research results with others	◯	◯	◯	◯	◯
(6) Housing	◯	◯	◯	◯	◯
(7) The two Museum of Science workshop sessions on science communication.	◯	◯	◯	◯	◯
(7) Overall summer research experience	◯	◯	◯	◯	◯

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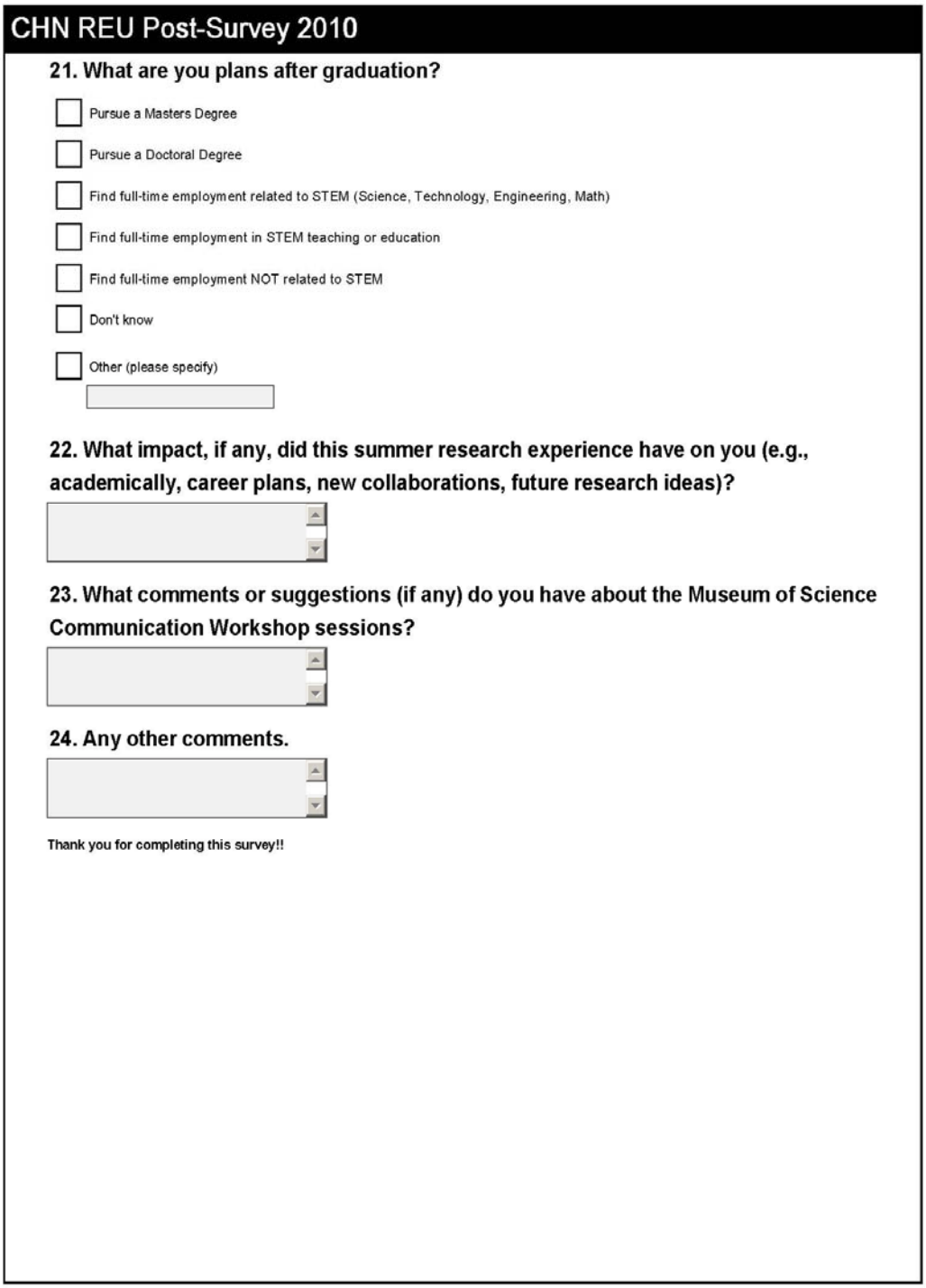

CHN REU Post-Survey 2010

21. What are you plans after graduation?

- ☐ Pursue a Masters Degree
- ☐ Pursue a Doctoral Degree
- ☐ Find full-time employment related to STEM (Science, Technology, Engineering, Math)
- ☐ Find full-time employment in STEM teaching or education
- ☐ Find full-time employment NOT related to STEM
- ☐ Don't know
- ☐ Other (please specify)

22. What impact, if any, did this summer research experience have on you (e.g., academically, career plans, new collaborations, future research ideas)?

23. What comments or suggestions (if any) do you have about the Museum of Science Communication Workshop sessions?

24. Any other comments.

Thank you for completing this survey!!

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Appendix B: REU Focus Group Questions

REU Focus Group Questions - Fall 2010

1. What did you like most about the REU program?
2. What did you find most challenging or frustrating about the REUs?
3. If you were in charge of this program, what would you change?
4. Has the REU program influenced your desire to work in a science, technology, engineering, or mathematics career? Explain.
5. What advice do you have for students coming into the REU program next year? What do you wish you had known?
6. Now I would like to ask you about some of the specific program activities -- how they contributed to your experience this summer, how they were beneficial as well as any suggestions for change or improvement in the future:
    a. The two Museum of Science communication workshops.
    b. The Ethics in Nanotechnology session with Dr. Sandler.
    c. The Writing an Introduction session with Dr. Smyser.
    d. The (more-or-less) weekly meetings.
7. Any other thoughts, comments you would like to share about the program?

[Only for students who are doing the REU program for a second time]

8. Between the two times you completed the REU program, did you complete co-ops or summer jobs in industry?
    a. How did your experience in the REU program influence your experience in an industry setting?
    b. Were there ways that it was beneficial? What aspects? Having done research before? The communication workshops? Explain.
    c. Do you have any recommendations for the REU program specifically related to having complete the program twice?

Appendix C: Science Communication Workshop Surveys

Science Communication Workshop - Session 1 Pre-Survey

Please help improve future workshops by providing feedback. Your responses are confidential and will be analyzed by an independent evaluator. Please use a black or blue ball point pen. No felt tip pens please. If you fill in the wrong answer choice, simply cross it out and fill in the correct one.

Date:

☐☐ / ☐☐ / ☐☐☐☐

Sex:

O Male O Female

Race/Ethnicity (Check all that apply):

O African American O American Indian/Alaskan Native O Asian-American
O Hispanic/Latino O White, not of Hispanic origin O Other:_____

Education (Choose the year of college you will enter in the Fall):

O Freshman O Sophomore O Junior O Senior O Graduate School O N/A

Please write the name of the university you are working at this summer:

_____

Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Communication is an important aspect of science and engineering.	O	O	O	O	O	O
Improving my science communication skills is a priority for me.	O	O	O	O	O	O
I am pretty good at speaking in front of an audience.	O	O	O	O	O	O
I am pretty good at explaining my scientific work to other people in science fields.	O	O	O	O	O	O
I am pretty good at explaining my scientific work to people not in science.	O	O	O	O	O	O
I have a clear understanding of one or more potential applications of my summer research project.	O	O	O	O	O	O

47014

Please continue onto the back.

What aspects of presenting science to an audience do you like the most?

What aspects of presenting science to an audience do you like the least?

Please create your own identification code so that the independent evaluator can match this survey with one you will complete at the end of the workshop. If something doesn't apply to you, fill in an X.

	Example: Jane (mother), Doe (your last name), 1983 (birth year)
☐ The first letter of your mother's first name.	☒ J The first letter of your mother's first name.
☐ The second letter of your last name.	☒ O The second letter of your last name.
☐ The last digit of your birth year.	☒ 3 The last digit of your birth year.

47014

Science Communication Workshop - Session 1 Post-Survey

Please help improve future workshops by providing feedback. Your responses are confidential and will be analyzed by an independent evaluator. Please use a black or blue ball point pen. No felt tip pens please. If you fill in the wrong answer choice, simply cross it out and fill in the correct one.

Date:

☐☐ / ☐☐ / ☐☐☐☐

How useful to you were each of the following elements of today's session?

	Not Very Useful	Somewhat Useful	Very Useful	N/A
Getting to know other REU students	O	O	O	O
Meeting other REU faculty	O	O	O	O
Getting a chance to visit the museum today	O	O	O	O
Presentations from workshop leaders	O	O	O	O
Discussion on context and meaning	O	O	O	O
Good/bad presentation demonstration	O	O	O	O
Practice speaking to others in small groups	O	O	O	O
Powerpoint and graphics advice	O	O	O	O
Writing exercises	O	O	O	O
Coaching in how to give feedback to others	O	O	O	O
Receiving feedback from workshop leaders	O	O	O	O
Receiving feedback from faculty	O	O	O	O
Receiving feedback from other students	O	O	O	O

What was most useful about today's session and why?

What information or topics were not covered today that you hope will be discussed during another upcoming science communication workshop session?

11003

Please continue onto the back.

Which of the science communication skills listed below do you feel that you most need to concentrate on improving? Please read all six choices first, and then rank them in order of personal priority to you. Select each number only once.

Science Communication Skills	(Be sure to select each number only once.) Most Improvement Needed					Least Improvement Needed
Speaking more effectively in front of an audience.	O 1	O 2	O 3	O 4	O 5	O 6
Making more effective graphics and powerpoint slides	O 1	O 2	O 3	O 4	O 5	O 6
Explaining my research more clearly when face-to-face with other scientists	O 1	O 2	O 3	O 4	O 5	O 6
Explaining my research more clearly when face-to-face with non-scientists	O 1	O 2	O 3	O 4	O 5	O 6
Writing papers and reports about my research	O 1	O 2	O 3	O 4	O 5	O 6
Better understanding the context and meaning of my adopted lab's research	O 1	O 2	O 3	O 4	O 5	O 6

In what ways, if any, do you think that today's session will influence your behavior over the next few weeks?

What other comments or recommendations do you have about today's experience?

Please again provide your identification code so that the independent evaluator can match this survey with one you completed at the beginning of the workshop. If something doesn't apply to you, fill in an X.

	Example: Jane (mother), Doe (your last name), 1983 (birth year)
☐ The first letter of your mother's first name.	J The first letter of your mother's first name.
☐ The second letter of your last name.	O The second letter of your last name.
☐ The last digit of your birth year.	3 The last digit of your birth year.

Thank you!

11003

Science Communication Workshop - Session 2 Pre-Survey

Please help improve future workshops by providing feedback. Your responses are confidential and will be analyzed by an independent evaluator. Please use a black or blue ball point pen. No felt tip pens please. If you fill in the wrong answer choice, simply cross it out and fill in the correct one.

Date:

☐☐ / ☐☐ / ☐☐☐☐

Please write the name of the university you are working at this summer:

_____

Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
The last science communication session helped me to prepare and deliver the first five minutes of my research presentation today.	O	O	O	O	O	O
The first science communication session had a significant and positive impact on how I prepared for my presentation today.	O	O	O	O	O	O
The first science communication session helped me think carefully about the best ways to communicate scientific and technical concepts to others.	O	O	O	O	O	O
The first science communication session significantly increased my interest in seeking out and understanding the larger context of my research.	O	O	O	O	O	O
As a result of the first science communication session, I have made a point of practicing my science communication skills with non-scientists.	O	O	O	O	O	O
As a result of the first science communication session, I have noticed an improvement in my ability to describe scientific and technical concepts to others.	O	O	O	O	O	O
As a result of the first science communication session, I have found myself thinking more critically about how other people present their scientific and technical work.	O	O	O	O	O	O

16169

Please continue onto the back.

How many times did you practice giving today's presentation in the following ways?

SILENTLY to yourself:
O 0 O 1 O 2-3 O 4 or more

ALOUD to yourself:
O 0 O 1 O 2-3 O 4 or more

ALOUD to one or more others:
O 0 O 1 O 2-3 O 4 or more

In retrospect, what from the <u>first</u> science communication session have you found most helpful?

Please describe two or three insights you've had since the first science communication workshop about the challenge of communicating science clearly to people outside your field:

Please create your own identification code so that the independent evaluator can match this survey with one you will complete at the end of the workshop. If something doesn't apply to you, fill in an X.

	Example: Jane (mother), Doe (your last name), 1983 (birth year)
☐ The first letter of your mother's first name.	☒ J The first letter of your mother's first name.
☐ The second letter of your last name.	☒ O The second letter of your last name.
☐ The last digit of your birth year.	☒ 3 The last digit of your birth year.

16169

Science Communication Workshop - Session 2 Post-Survey

Please help improve future workshops by providing feedback. Your responses are confidential and will be analyzed by an independent evaluator. Please use a black or blue ball point pen. No felt tip pens please. If you fill in the wrong answer choice, simply cross it out and fill in the correct one.

Date:

☐☐ / ☐☐ / ☐☐☐☐

Which presentation group were you in?

O 1 O 2 O 3 O 4 O 5 O 6 O 7 O 8

How useful to you were the following aspects of today's session?

	Not Useful	Somewhat Useful	Very Useful
Being required to prepare part of my research presentation in advance	O	O	O
Opening discussion and debrief	O	O	O
Warm up exercises	O	O	O
Small group work on research presentations	O	O	O
Practicing giving my presentation to others	O	O	O
Feedback from my peers	O	O	O
Feedback from workshop leaders and faculty	O	O	O
Practice giving constructive feedback to my peers	O	O	O
Learning about other people's research	O	O	O
Today's workshop session overall	O	O	O

If there had been more time today, what would you have liked to use it for?

48820

Please continue onto the back.

Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
Communication is an important aspect of science and engineering.	O	O	O	O	O	O
Improving my science communication skills is a priority for me.	O	O	O	O	O	O
I am pretty good at speaking in front of an audience.	O	O	O	O	O	O
I am pretty good at explaining my scientific work to other people in science fields.	O	O	O	O	O	O
I am pretty good at explaining my scientific work to people not in science.	O	O	O	O	O	O
I have a clear understanding of one or more potential applications of my summer research project.	O	O	O	O	O	O

How did this pair of workshops compare to other training activities you took part in this summer?

One of the least helpful						One of the most helpful
O 1	O 2	O 3	O 4	O 5	O 6	O 7

One of the least enjoyable						One of the most enjoyable
O 1	O 2	O 3	O 4	O 5	O 6	O 7

What comments or recommendations do you have about the science communication workshops?

Please create your own identification code so that the independent evaluator can match this survey with one you will complete at the end of the workshop. If something doesn't apply to you, fill in an X.

	Example: Jane (mother), Doe (your last name), 1983 (birth year)
☐ The first letter of your mother's first name.	J The first letter of your mother's first name.
☐ The second letter of your last name.	O The second letter of your last name.
☐ The last digit of your birth year.	3 The last digit of your birth year.

48820