

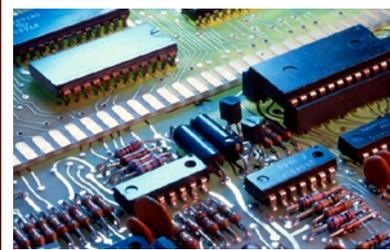


Center for High-rate Nanomanufacturing

Sharing Science Workshops, Fall 2009

Survey Results

July 2010



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Introduction

Funded by the National Science Foundation, the Center for High-rate Nanomanufacturing (CHN) brings together three universities with unique strengths in nanoscience and nanomanufacturing: University of Massachusetts, Lowell; Northeastern University, Boston; and the University of New Hampshire, Durham. The University of Massachusetts Donahue Institute (UMDI) is conducting the five-year evaluation of CHN's education and outreach activities, some of which are collaborations with the Museum of Science, Boston, which is a CHN subawardee. Evaluation will rely on multiple sources of evidence to provide the most complete picture of project impacts, as well as how and why they occurred, and challenges to implementation. Using quantitative and qualitative methods, UMDI will explore program impacts on students and faculty members at the three participating institutions and on targeted K-12 teachers and students. Specific research areas to be addressed include the extent of impact of CHN's education and outreach activities on the following:

- Increasing interaction among faculty and students from the three participating institutions
- Increasing public awareness of the importance of science and technology
- Motivating students, particularly women and under-represented minorities, to become interested in and better prepared for careers in science, technology, engineering, and mathematics (STEM)
- Preparing students for careers in research and in manufacturing related to nanotechnology
- Preparing students to meet broader science communication needs in interdisciplinary research, education, industry, and public discourse.

The evaluation will also document promising practices and innovative solutions from CHN's comprehensive education and outreach program. The evaluation plan is structured to ensure that the following objectives are met:

1. To measure the program's effectiveness in achieving its stated goals and objectives
2. To provide timely and meaningful formative feedback on program implementation and quality
3. To 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 exclusively on the Fall 2009 *Sharing Science* Communication Workshop and Practicum offered to CHN graduate students by the Museum of Science, Boston. The Sharing Science Workshop and Practicum were designed by the Strategic Projects group at the Museum of Science (MOS) to help CHN graduate students improve their abilities to present their research to scientific and nonscientific audiences, as well as to middle and high school students who are audiences for CHN-related outreach work.

The initial workshop consisted of a half-day training session. Several weeks later an optional practicum day was offered that included additional training as well as an opportunity for graduate students to engage with Museum visitors using hands-on demonstrations. To reduce group size, the MOS staff offered the half-day workshop on two different days, October 2 and October 16. The optional practicum was on Sunday, November 16. Finally, all CHN students were invited back to the Museum on Saturday, March 27 to join the MOS staff in engaging Museum visitors in NanoDays 2010 activities. This report focuses on the Workshop and Practicum days, with the NanoDays experience to be evaluated in a subsequent report.

The October workshops included activities designed to help students think about the broader context and meaning of their research, describe their research clearly to peers and non-scientists, practice good speaking skills, understand inquiry-based learning techniques, and learn how to use hands-on demonstrations to engage family

audiences in nanoscience. The workshop agenda is included in the appendix. The November practicum provided students with a brief review of what they had learned in October and coached them in engaging actual Museum visitors at special stations set up in the exhibit halls. At the NanoDays event, students again had the opportunity to interact with Museum visitors at demonstration stations, as well as to see talks and demonstrations offered by researchers and industry professionals.

The report is organized into the following sections:

- **Method** – Describes survey development, distribution, and data analyses.
- **Results** – Provides a summary of participant background information and impressions.
- **Conclusion** – Provides an overall summary of findings.
- **Appendices** – Includes the survey measures and appendix as well as a transcript of open-ended responses.

Method

To learn about participants' demographics, impressions, and suggestions, as well as impacts, the Museum of Science team worked with UMDI to develop surveys that were administered to all participants at the beginning and end of the half-day workshops. The surveys were coded to provide confidentiality to students. An additional measure was administered to the smaller group of graduate students who participated in the practicum day. The measures were adapted from measures created for the science communication workshops offered to participants in the CHN Research Experience for Undergraduates (REU) program.

Closed-ended items are reported using frequencies based on responses from students who completed the surveys. The reported number of responses per question may vary because individuals left some questions blank. Open-ended items were analyzed using a standard qualitative technique. The approach involved multiple readings of the data set and the assignment of themes around recurring ideas. Once themes were identified, each response was coded by its appropriate theme. The coded responses were then read and re-read in their thematic grouping to further identify patterns. Findings of the qualitative analysis are discussed in the body of the report, and a full transcript of responses is included in the appendix.

Results

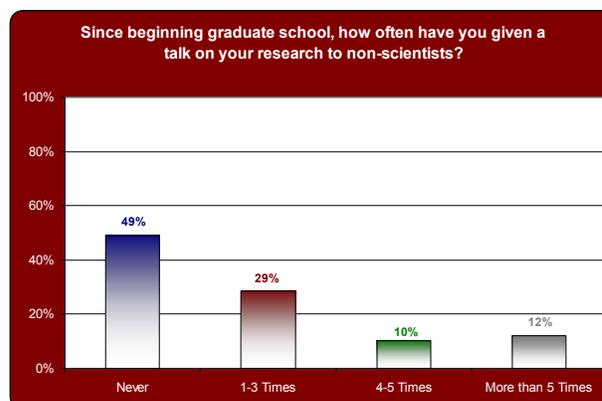
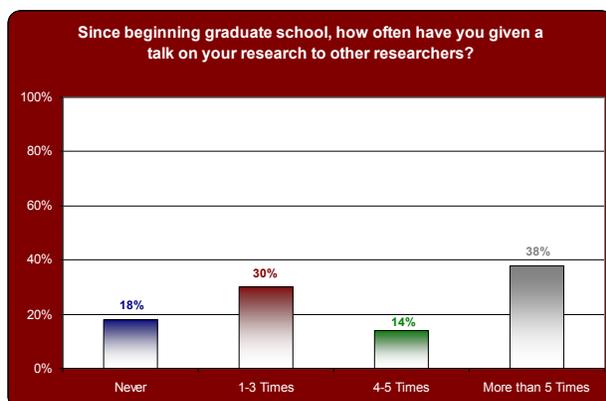
This section reports on participants' demographics and background information, impressions, and suggestions, as well as course impacts, based on both closed- and open-ended responses.

Half-Day Workshop

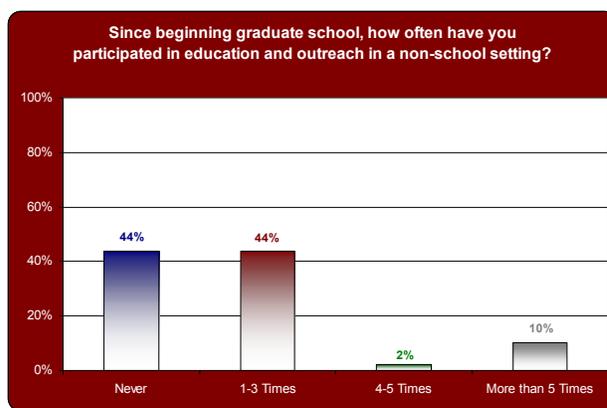
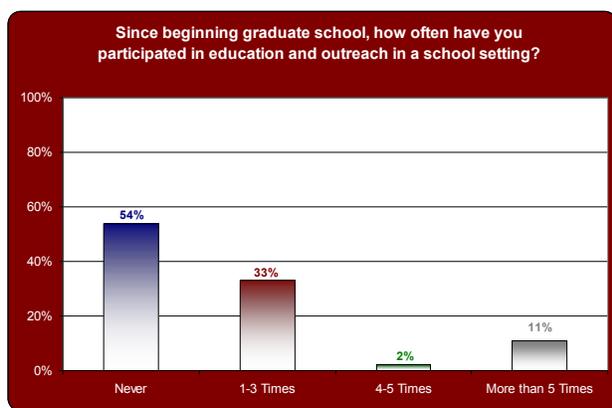
Demographics and Background Information

Participants in the half-day workshop included 52 graduate students from UMass Lowell (47%), Northeastern University (31%), and UNH (22%). This workshop was offered on two different days, with 34 attending the first day and 18 attending the second day. Sixty-five percent were male, and 35% were female. Participant ethnicities were 50% Asian or Asian-American, 40% White, 2% Latino, and 8% other. Fifty-three percent were in years 1-3 of graduate school, 35% were in years 4-6, 8% were postdoctoral fellows, and 4% were educators. Reported disabilities were visual (N=2), auditory (N=1), and learning (N=1). Reported disciplines and research fields were science and engineering (97%) and community outreach (3%).

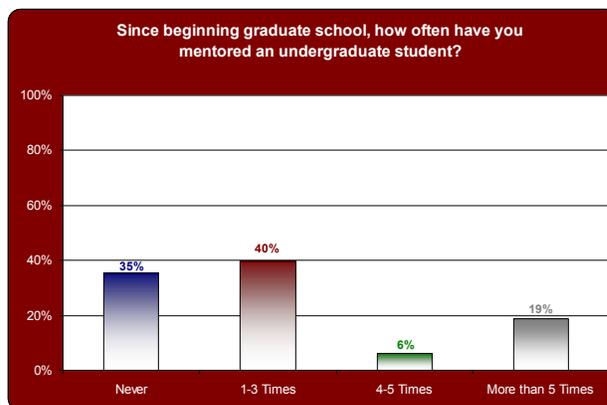
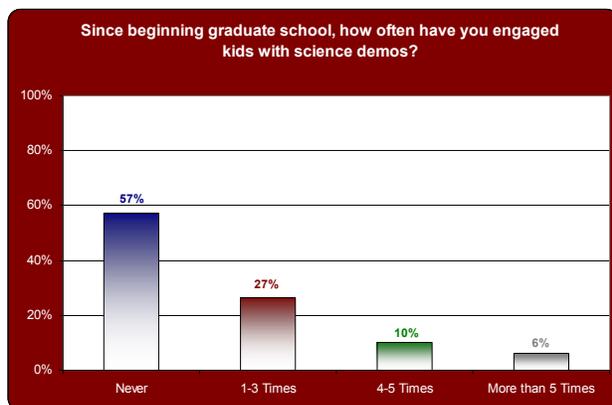
At the beginning of the half-day workshop, participants were asked about their experiences with making presentations and taking part in education and outreach activities. As reported in the following six tables, all responses refer to experiences since beginning graduate school. Many students had not made any presentations to scientific (18%) or nonscientific (49%) audiences, whereas others had done so four or more times with scientific (52%) or nonscientific (22%) audiences.



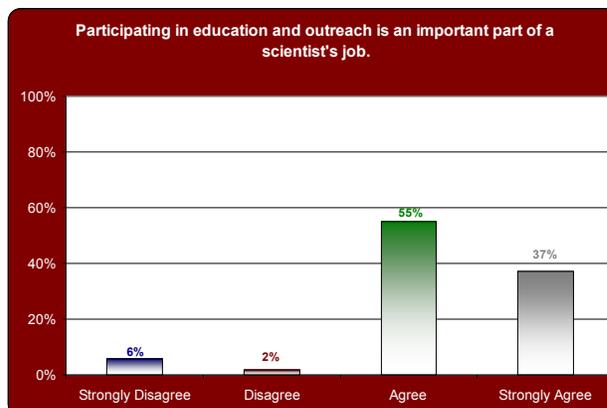
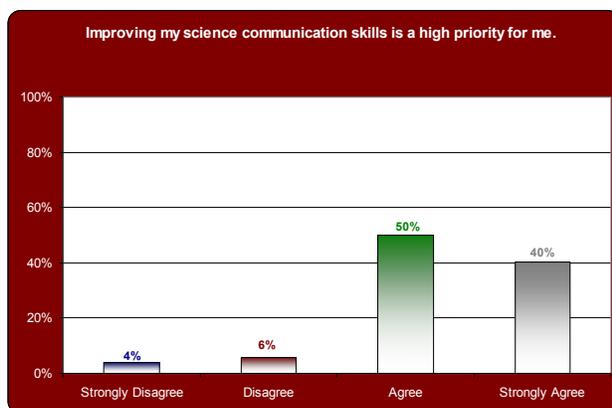
With regard to participating in education and outreach activities, only about 12% of respondents had done so more than four times in a school setting or a nonschool setting, and many had never engaged in such activities in school (68%) or nonschool (44%) settings.

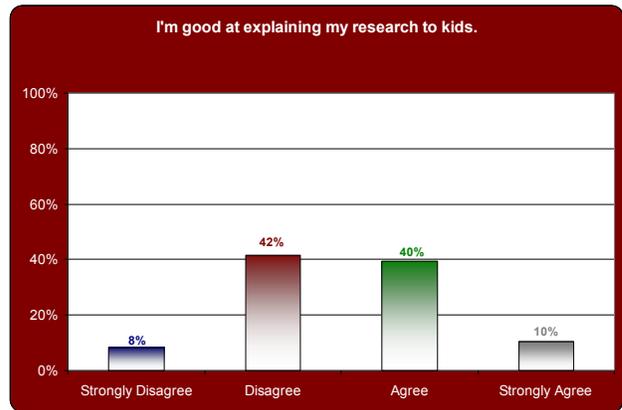
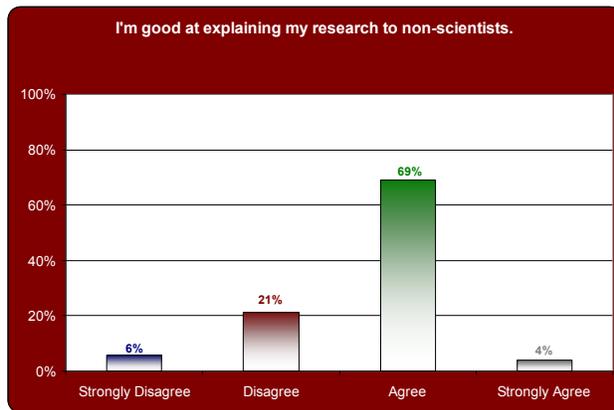
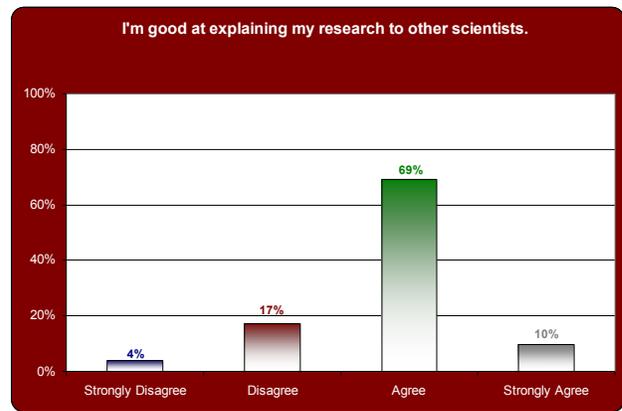
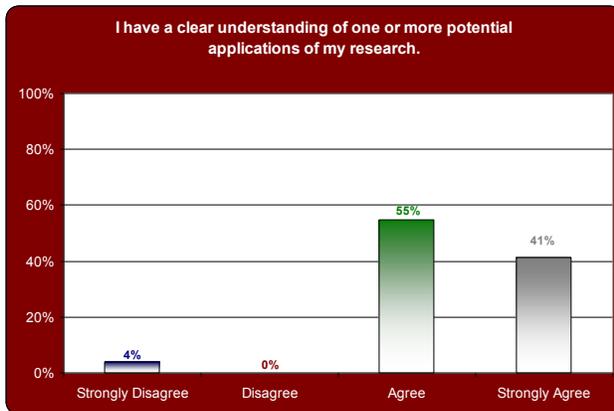


More than half of respondents (57%) had never engaged younger students with science demonstrations, and only one out of six (16%) had done so four or more times. Mentoring an undergraduate student was more common, with 40% having done so 1-3 times, 25% having done so 4 or more times, and only 35% not having done so at all.



Before the half-day workshop, graduate students rated their agreement with several statements related to their communication skills and attitudes. Ninety percent rated improving their science communication skills as a strong priority, and 90% agreed or strongly agreed that participating in education and outreach is an important part of a scientist's job. Ninety-six percent agreed or strongly agreed that they had a clear understanding of one or more applications of their research. More than 70% of respondents agreed or strongly agreed that they are good at explaining their research to scientists and nonscientists, but only half agreed or strongly agreed that they are good at explaining their research to kids.



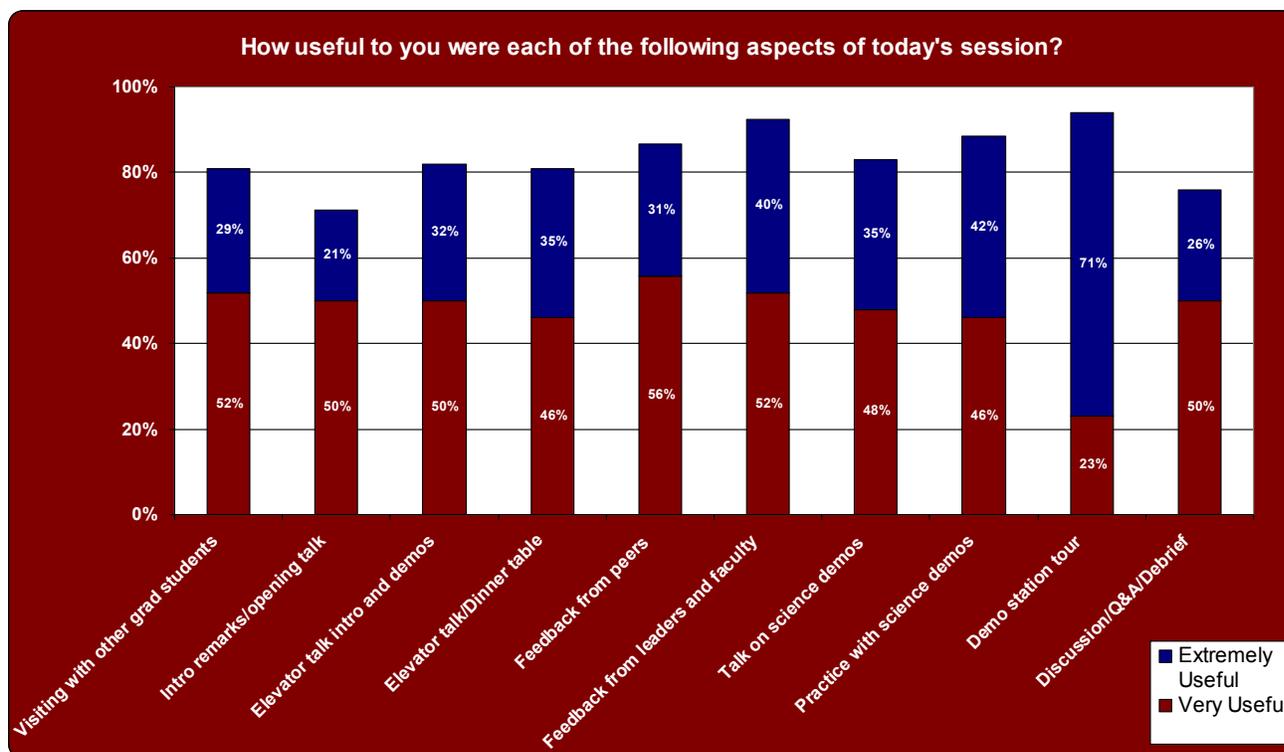


Participant Impressions of the Workshop

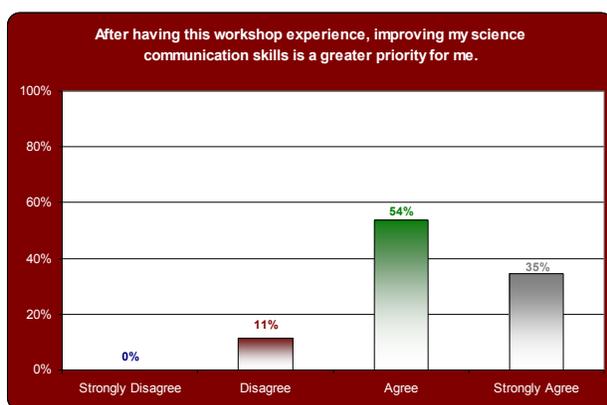
Graduate students were asked to rate the usefulness of the half-day workshop overall, and 89% rated it as very useful or extremely useful.

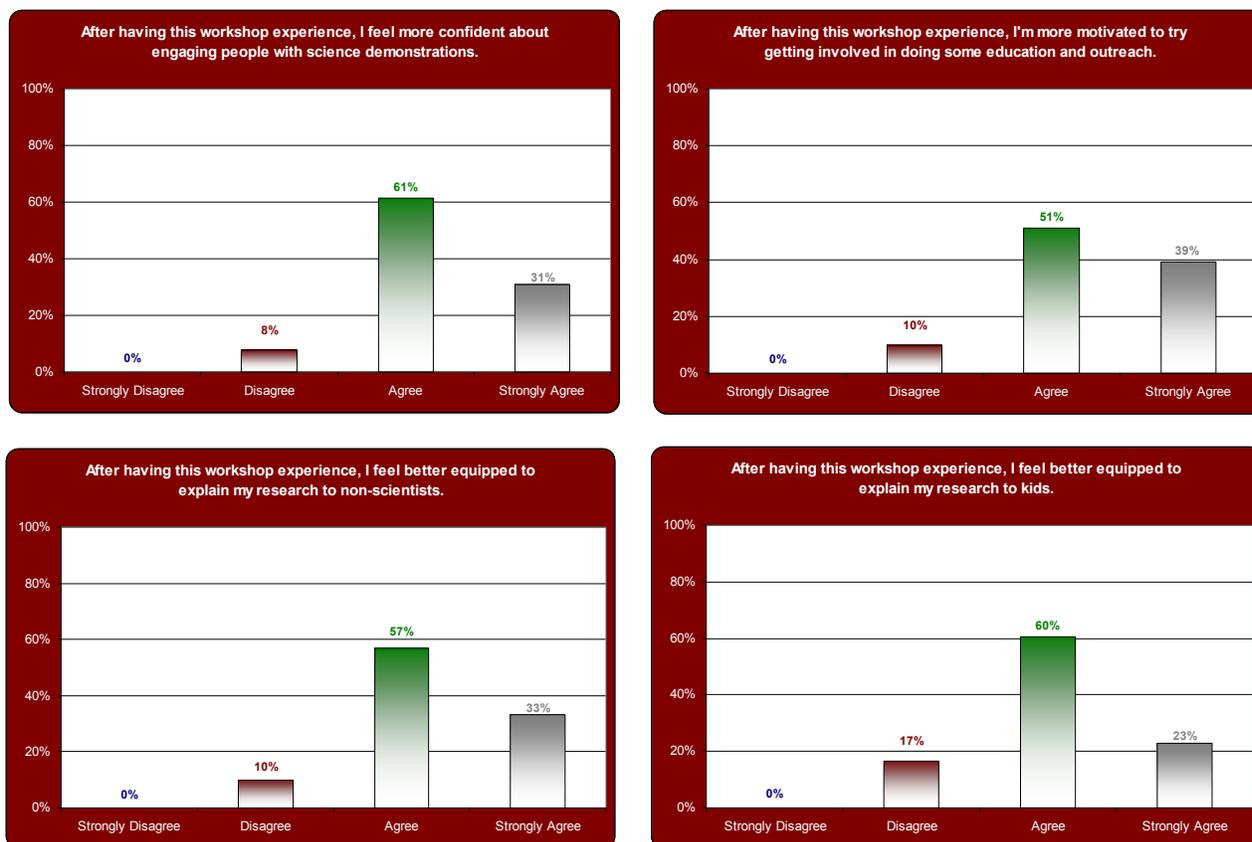


Respondents were also asked to rate the usefulness of each activity. The table below adds the two response categories "very useful" and "extremely useful" to show the rated usefulness of each program activity. While ratings vary, every component was rated "very useful" or higher by at least 71% of respondents, and the highest number of "not useful" ratings for any activity was three respondents.



After the half-day workshop, graduate students were also asked to comment on their perceptions of changes in their communication skills and attitudes as a result of participating in the workshop. Respondents agreed or strongly agreed that improving their science communication skills became a greater priority (89%), that they had a better understanding of the purposes of education and outreach (96%), that they felt more confident about engaging people with science demonstrations (93%), that they became more motivated to try getting involved in doing some education and outreach (90%), and that they felt better equipped to explain their research to nonscientists (90%) and to kids (83%).





Workshop participants were also asked to respond to the question "Why do you think your faculty supervisors asked you to participate in this workshop?" There were 50 responses to this question. About half (N=24) said that their supervisors wanted students to improve their communication skills and/or gain experience in communicating about their research. Some cited specific target audiences, such as nonscientists or students. Five noted that participation was an NSF requirement, and five said the purpose was to improve their presentation skills. Four respondents said they were asked to participate to become involved in outreach, and two cited each of the following: to increase opportunities and/or experience, it's good for the community, and to share research experiences with CHN and other researchers. The final answers, cited by one participant each, were: career development, to improve skills generally, get kids interested in science, meet nonscientists and share research, broaden knowledge, and understand CHN.

In response to the question "What did you like best about today and why?" 15 participants responded. (The response rate was low because the question was only asked on the second of the two workshop days.) Six mentioned the demo station tour, two cited the dinner table challenge, and two said encouraging kids to learn. The other responses, cited by one participant each, were: learning/practicing how to simplify language, thinking about research from a different perspective, involving graduate students in demos, gaining confidence, practice, interacting with CHN students, and learning how to explain the information adequately.

Participants were also asked "How could we have improved today's workshop? What would you have liked to spend more time on?" Despite this item's pull for critique, eleven respondents provided positive comments about the workshop, stating that they liked it, had a good experience, or not to change anything. Nine respondents would have changed some aspect of the demo presentation, such as adding more time, practice, variety, or the ability to do more than one demo or their own demo. Three participants wanted more discussion, and three would have liked more time on the dinner table challenge. Two participants each wanted

more interaction with children, a coffee break, smaller group activities, more time or longer sessions in general, and more instructor involvement and feedback. One participant each suggested real-time feedback for the elevator talk exercise, more public speaking exercises, more time for the elevator talk, less time for the elevator talk, more time in groups, more leaders to observe more individuals, more examples, more experiments, more practice in general, time to practice alone, bringing in people who care about outreach, excluding people with tight research deadlines, use of a laptop in the demo, a video of good and bad demos, introductions, and music.

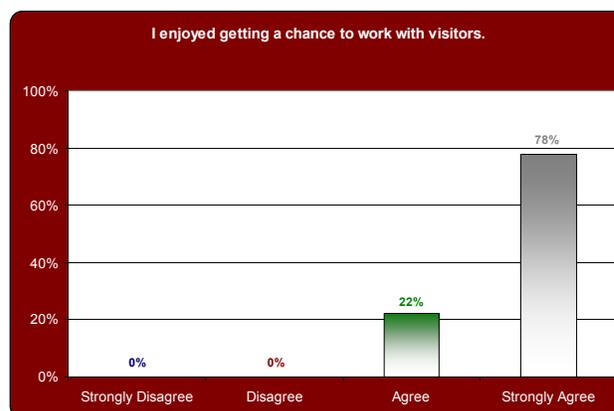
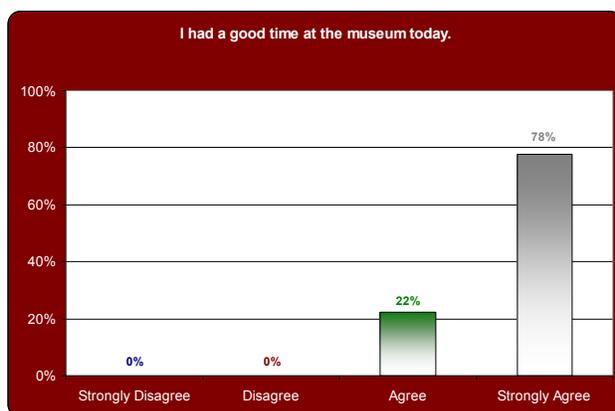
Practicum Day

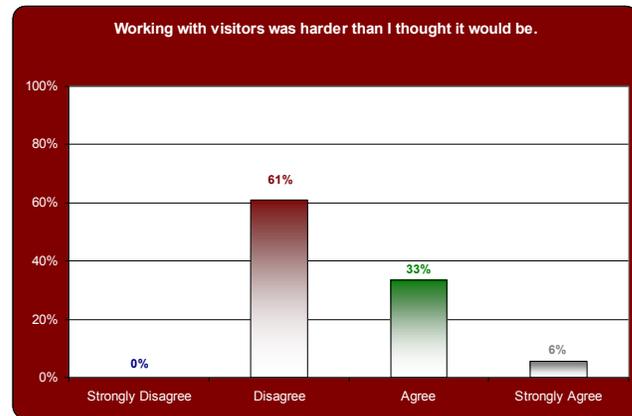
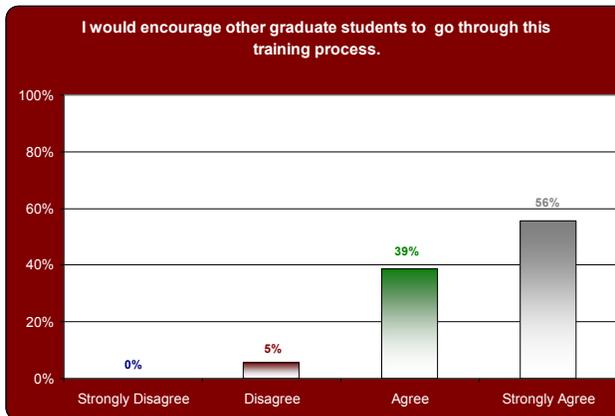
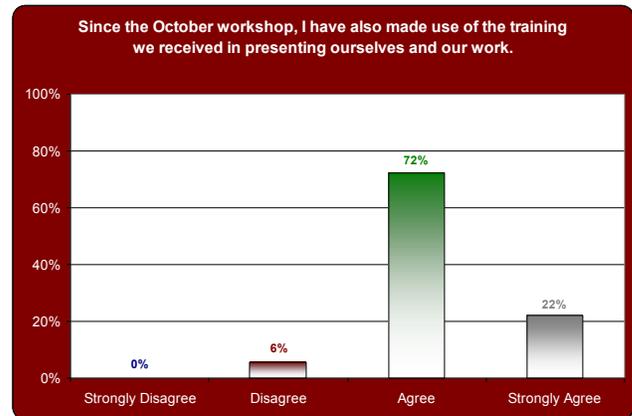
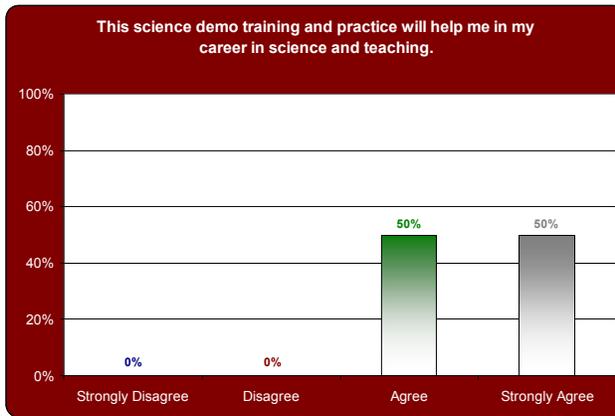
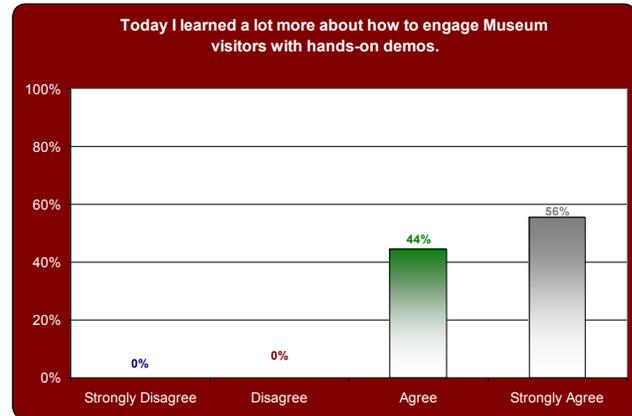
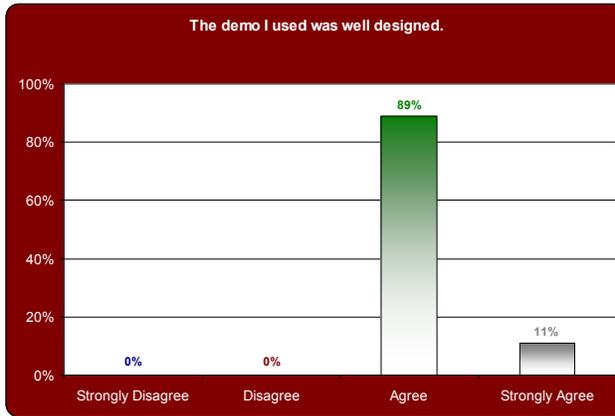
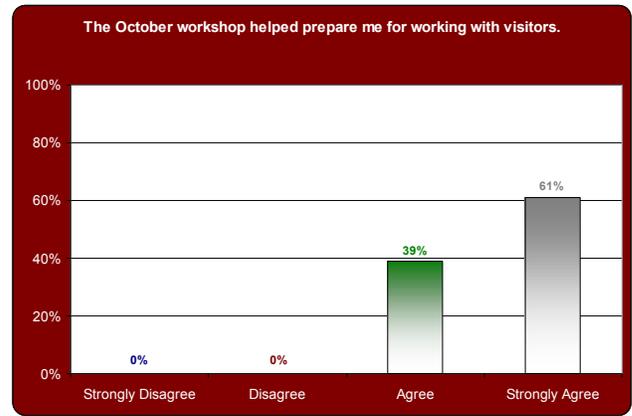
Demographics and Background Information

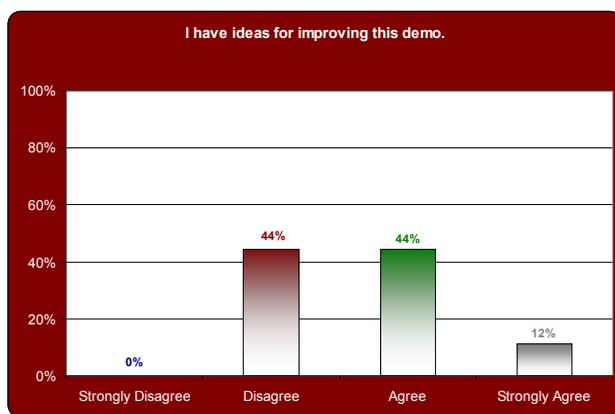
Eighteen CHN graduate students attended the optional practicum day, held on the Sunday before Thanksgiving, compared with 52 students who attended the half-day workshop. During the practicum, the students worked with real Museum visitors at demo stations in the exhibit halls, supervised by workshop staff. The following numbers of graduate students used each demonstration: Alka Seltzer (4), Magic Sand (2), Ferrofluid (2), Nasturtium Leaves / Nano Fabric (4), Memory Wire (2), Tiny Teacup (2), Atomic Trampoline (1), and Liquid Crystal (2). The students were also invited to observe two additional types of nanoscale informal science education activities. All 18 attended the Amazing Nano Brothers Juggling Show. Of the two Current Science & Technology presentations offered, 56% attended "Can Nanotechnology Help Cure Alzheimers?" and 44% attended "Tiny Solutions to Our Big Energy Problems".

Participant Impressions

After the practicum day, graduate students were asked to report on their impressions and attitudes about the day's activities. All respondents agreed or strongly agreed that they had a good time at the museum that day and enjoyed getting a chance to work with visitors, that working with visitors was personally rewarding, that the first workshop day had helped prepare them for their practicum work with museum visitors, that the demonstration project they used was well designed, that they learned a lot more about engaging visitors with hands-on demos, and that the science demonstration training and practice would help them in their careers in science and teaching. All but one respondent agreed or strongly agreed that they would encourage other graduate students to go through the Sharing Science Workshops and that, since the first workshop day, they had made use of the training they received in presenting themselves and their work. Thirty-nine percent of respondents agreed or strongly agreed that working with visitors was harder than they thought it would be, and 56% agreed or strongly agreed that they had ideas for improving the science demonstration that they conducted with museum visitors.







Responses to open-ended questions about the strengths, weaknesses, and impacts of the practicum day, as well as suggestions for improvements, are summarized below.

What did you learn about doing science demos with museum visitors today that hadn't been as clear before today? There were three responses to this question. One noted that parents can ask difficult questions, and another stated "even if you can explain things to small children, making them care is much harder." The third wrote "actual interaction with kids and parents."

What strategies did you find worked best for attracting and engaging visitors? Nine respondents answered this question, some listing more than one strategy for attracting and engaging visitors. Five noted the importance of letting the visitors experience the experiment on their own and making it hands-on. Suggestions offered by one participant each were to be positive and make it sound fun, have different explanations ready, look at the audience and greet them, talk to them first, and do the demo.

What suggestions do you have for improving your demo, or for creating a new demo? There were five responses to this question. One suggested adding more examples such as duck feathers and using a magnifying glass to show some small feature. Another suggested "applications," and another response was "a physical model of slipping atomic lattices vs. amorphous lattices." One respondent said "I think they are all great," and another stated that the question was not applicable.

If we'd had more time today, what would you have liked to use it for? Eight participants responded to this question, some citing more than one answer. Four stated that they would have like to see more of the museum, and two indicated that they would have appreciated a lunch break. The remaining responses, cited by one participant each, were "go to see other projects," "visit more interesting stuff," and "nothing."

Any comments on The Amazing Nano Brothers Show? Any insights on this approach to science education? There were eleven comments on The Amazing Nano Brothers Show, and all of them were positive, stating that it was great and entertaining. One person wrote: "It was awesome. I even learned about some facts that I've never learned before," and another wrote, "those guys could teach rocket science to 3-year-olds."

Any comments on the Current Science & Technology presentation you attended? Any insights on this approach to science education? There were nine responses to this question. Six respondents had positive comments about the presentation, one did not attend, one stated that the presentation was more appropriate for adults than children, and one respondent said that he/she had no comments.

Any other comments on today, or suggestions on improving this workshop? Three respondents indicated that they had no further comments or suggestions. Two said it was great. The remaining response was: “Need some snacks/refreshments for next time, we drove up all the way and haven't gotten to eat anything!”

Conclusion

The CHN Fall 2009 Sharing Science Workshops consisted of a half-day workshop (attended by 52 graduate students) and an optional practicum day (attended by 18 graduate students) that combined training and practicum components. Twenty of these students also participated in NanoDays 2010 activities, in March, at the Museum. A further UMDI study will examine the further impacts of student participation in that event. Participants had very favorable impressions of the workshops, with 98% rating the first half-day workshop as “very useful” or “extremely useful”, and all but one participant at the practicum day agreeing or strongly agreeing that they would encourage other graduate students to go through this training experience. Moreover, 80% or more agreed or strongly agreed that, as a result of the workshops, improving their science communication skills became a greater priority, they have a better understanding of the purposes of education and outreach, they feel more confident about engaging people with science demonstrations, they're more motivated to try getting involved in doing some education and outreach, and they feel better equipped to explain their research to nonscientists and to children.

Open-ended questions revealed specific program strengths as well as concrete suggestions for improving future versions of these workshops. In light of strong positive ratings from participants in the practicum day, it is important to note that far fewer students participated in it because it was optional and offered on a Sunday before the Thanksgiving holiday.

The Sharing Science Workshops were intended to help graduate students who work with the CHN program to improve their abilities to present their research to a variety of scientific and nonscientific audiences. Responses from participants indicate that they believed the workshops were successful in this regard. By strengthening graduate students' science communication skills, the workshops also supported broader goals of CHN's education and outreach activities, which include increasing interaction among faculty and students from the three participating institutions, increasing the public's awareness of the importance of science and technology, and preparing students for careers in nanotechnology research and manufacturing.

Appendix A - Sharing Science Workshop Surveys

Oct. 16, 2009

Sharing Science Workshop Pre Survey

Help the Museum of Science improve future workshops by providing us with feedback.

Sex: <input type="checkbox"/> Male <input type="checkbox"/> Female Graduate Education Level <input type="checkbox"/> Year One <input type="checkbox"/> Year Two <input type="checkbox"/> Year Three <input type="checkbox"/> Year Four <input type="checkbox"/> Year Five <input type="checkbox"/> Year Six <input type="checkbox"/> Post-Doc <input type="checkbox"/> Other:	Race/Ethnicity: (Check all that apply) <input type="checkbox"/> African American <input type="checkbox"/> American Indian/Alaskan Native <input type="checkbox"/> Asian-American <input type="checkbox"/> Hispanic/Latino <input type="checkbox"/> White, not of Hispanic origin <input type="checkbox"/> Other: _____	Temporary or Permanent Disabilities: (Check all that apply) <input type="checkbox"/> None <input type="checkbox"/> Mobility <input type="checkbox"/> Cognitive <input type="checkbox"/> Visual <input type="checkbox"/> Auditory <input type="checkbox"/> Learning <input type="checkbox"/> Other: _____
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Discipline / Field of Research:

School (circle one): UNH UML Northeastern

Since beginning graduate school, how often have you...

	Never	1-3 times	4-5 times	more than 5 times
Given a talk on your research to other researchers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Given a talk on your research to non-scientists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Participated in education and outreach activities in a non-school setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Participated in educational and outreach activities in a school setting. Circle (Grades): K-5 6-8 9-12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engaged kids with science demos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mentored an undergraduate student	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please rate your agreement with the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
Improving my science communication skills is a high priority for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm good at explaining my research to other scientists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm good at explaining my research to non-scientists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm good at explaining my research to kids.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Participating in education and outreach is an important part of a scientist's job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have a clear understanding of one or more potential applications of my research.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Why do you think your faculty supervisors asked you to participate in this workshop?

Describe your research, in a few sentences, to a sixteen-year old who has had little or no exposure to science or engineering:

Please create your own identification number so we can match this survey with one you will complete at the end of the workshop.

- _____ The first letter of your first name (Example: If your first name is Jane, write the letter J)
- _____ The second letter of your last name (Example: If your last name is Doe, write the letter O)
- _____ The date of your birthday (Example: If your birthday is May 3, write the number 3)

Oct. 16, 2009

Sharing Science Workshop Post Survey

Help the Museum of Science improve future workshops by providing us with feedback.

Circle which school you attend: UNH UML Northeastern

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

(Check one box for each.)

	Not very Useful	Somewhat Useful	Very Useful	Extremely Useful
Visiting with other graduate students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Introductory remarks: Sharing science with words	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
“Dinner Table Challenge” workshop activity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feedback and ideas from my peers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feedback from workshop leaders & faculty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Introductory talk: Using hands-on science demos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hands-on demo workshop activity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All-hands tour of demo stations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Debrief & discussion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Today's workshop session overall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

What did you like best about today and why?

Please rate your agreement with the following statements. (Check one box for each.)

After having this workshop experience...

	Strongly Disagree	Disagree	Agree	Strongly Agree
Improving my science communication skills is a greater priority for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have a better understanding of why we do education and outreach.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel better equipped to explain my research to non-scientists.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel better equipped to explain my research to kids.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel more confident about engaging people with science demonstrations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I'm more motivated to try getting involved in doing some education and outreach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How could we have improved today's workshop? What would you have liked to spend more time on?

Please take another try at describing your research, in a few sentences, to a sixteen-year old who has had little or no exposure to science or engineering:

Please create your own identification number so we can match this survey with one you will complete at the end of the workshop.

- _____ The first letter of your first name (Example: If your first name is Jane, write the letter J)
- _____ The second letter of your last name (Example: If your last name is Doe, write the letter O)
- _____ The date of your birthday (Example: If your birthday is May 3, write the number 3)

Nov. 15, 2009

CHN-MOS Sharing Science Practicum - Feedback

Help the Museum of Science improve future workshops by providing us with feedback.

Which university do you work at? (circle one) Northeastern UMass-Lowell UNH

Which group were you assigned to today? (circle one) Group One Group Two

Did you attend *The Amazing Nano Brothers Juggling Show*? (circle one) Yes No

Which CS&T Presentation did you attend? (check one)

Can Nanotechnology Help Cure Alzheimers?

Tiny Solutions to Our Big Energy Problems

Did you work with visitors on a science demo today? (circle one) Yes No

Which demo did you use? (check one)

Alka Seltzer/Surface Area Magic Sand Ferrofluid

Nasturtium Leaves/Nano Fabric Memory Wire Tiny Teacup

Atomic Trampoline Liquid Crystal Other: _____

Please rate your level of agreement with each of the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
I had a good time at the Museum today.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I enjoyed getting a chance to work with visitors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The October workshop helped prepare me for working with visitors today.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Today I learned a lot more about how to engage Museum visitors with hands-on demos.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Working with visitors was harder than I thought it would be.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The demo I used was well designed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have ideas for improving this demo.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Working with visitors was personally rewarding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
This science demo training and practice will help me in my career in science and teaching.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would encourage other graduate students to go through this training process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Since the October workshop, I have also made use of the training we received in presenting ourselves and our work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

What did you learn about doing science demos with museum visitors today that hadn't been as clear before today?

What strategies did you find worked best for attracting and engaging visitors?

What suggestions do you have for improving your demo, or for creating a new demo?

If we'd had more time today, what would you have liked to use it for?

Any comments on *The Amazing Nano Brothers Show*? Any insights on this approach to science education?

Any comments on the Current Science & Technology presentation you attended? Any insights on this approach to science education?

Any other comments on today, or suggestions on improving this workshop?

Please create your own identification number so we can match this survey with the one you completed in October.

- _____ The first letter of your first name (Example: If your first name is Jane, write the letter J)
- _____ The second letter of your last name (Example: If your last name is Doe, write the letter O)
- _____ The date of your birthday (Example: If your birthday is May 3, write the number 3)

Thank you!

Appendix B – Workshop Agenda



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A Museum of Science Workshop: Boston · Friday, October 16, 2009

Produced in partnership with the **NSF Center for High-rate Nanomanufacturing**
Northeastern University · University of Massachusetts-Lowell · University of New Hampshire

Workshop Agenda

1:00 Arrive, pick up nametags and café vouchers: reception table in main lobby.
Bring café lunches to Skyline Room: 6th floor, Green Wing.

1:15 Enjoy lunch; complete pre-workshop worksheets.
Take seats in front of screen by 1:45 pm.

1:45 Sharing Science with Words: An Introduction
Carol Lynn Alpert, Director, Strategic Projects, Museum of Science.

2:15 *The Dinner Table Challenge* workshop activity.

2:45 Coffee Break. Room set-up for next activity.

3:00 Sharing Science with Hands-On Demonstrations: An Introduction
Carol Lynn Alpert, Director, Strategic Projects, Museum of Science
Karine Thate and Alex Fiorentino, Museum of Science educators.

3:30 Hands-On Demonstrations – workshop activity

4:20 All-Hands Tour of Demo Stations

4:50 Debrief & Discussion.

5:15 Next Steps. Complete post-workshop worksheet.

5:30 Adjourn.

The Museum of Science will remain open until 9:00 pm this evening.
Workshop participants are welcome to enjoy the Museum's many offerings.
Workshop nametags will serve as exhibit hall entry passes.



Center for High-rate
Nanomanufacturing



UMass Donahue Institute
Research and Evaluation Group

Appendix C - Transcript of Open-Ended Questions

Pre-Survey Questions

Why do you think your faculty supervisors asked you to participate in this workshop?
Well, we kind of owe it to the NSF from all the funding, but aside from that I've been involved in outreach stuff since I have first been hired at it.
To improve communication skill of explaining scientific phenomena to public.
So that we can improve on our skills to talk to general public.
I think our school does most of the outreach activities at the CHN. Being part of the university our advisors have lots of outreach activities. We have tours, workshops (K-12). In order to engage all of us into outreach, they asked us to be a part of this seminar.
So that our group has the skills to effectively communicate about our findings.
It will help me to improve my skills.
Requirement of CHN grant.
It is good for presenting to others.
It's good for both myself & the community.
To enhance your communication skills, to help you become a good speaker for conferences. To explain your research in a better way to general public, to students, to nonscientists.
To improve communication skills w/ nonscientists.
To improve communication skill with nonscientists. Help future career developing.
To improve skills in communicating research both for scientific and nonscientific audiences. However, most presentations will be given and geared to scientific audiences.
To improve my presentation skills.
Because it is useful to teach younger kids about science. Since we are scientists/engineers we can tell them about our experiences. It is important for kids to think science is fun.
In order to give me more opportunity to see the other side of research or nanotechnology.
To improve communication skill.
To aid in the improvement of my general communication skills.
This is important even we have knowledge but we couldn't explain.
To improve my communication skills.
Because communication skills are basic for research.
This is a communication workshop. I was so happy when my faculty supervisors asked me about this. It is a good opportunity to improve and communicate with the people not related to science field.
Make us more understand the outreach of our research.
It is a good chance to explain the field in research to people & a good chance for scientists or students to give a talk in public.
Improve the science communication skill.
Improve the scientific communication with kids and nonscientists.
To get some experience in communication with different levels of people, also to improve my communication skills.
Because we have to. He would rather I be a bench top slave than do anything that will benefit me as a student. Part of NSF mandate for funded researchers to do outreach.
I was asked to participate because I'm interested in getting involved in outreach activities & Because I'm doing research in chem ed.
Broaden knowledge, more experience.

To explore myself and meet many nonscientist-people and be a part of outreach program and share my research to others.
To improve my scientific communication skills with others.
To contribute the knowledge to society. To improve my communicating skills.
To engage with science society and improve the communication skills. To improve the ways of making people aware of what I am doing for the science field.
He probably wanted me to improve my presentation skills to scientists as well as the public.
I think this workshop will be helpful to communicate with other scientists. Also expanding our knowledge in separate fields.
To broaden my knowledge by interacting with people having experience in different fields of research.
I think that my supervisor wanted me to improve communication skills especially to nonscientists.
I think that if we can explain easily our research to undergraduates or children, it's proven that you are able to be an expert. Also, it's helpful to students.
To understand how to communicate scientific concepts with others, and to understand the importance of outreach to people who have difficulty understanding the research being conducted in our field.
This workshop will help me in improving the communication skills amongst the scientists of my qualification or caliber and also give an understanding of how to pass on the information to kids about new developments in the field of science.
Share research experiences of every member of CHN and try to figure out work related to my research. Also, projects similar to my research having different methods of implementation.
I volunteered myself. My advisor didn't ask me.
To establish communication skills.
Good to practice presentation skills, especially for different audiences.
Communicate with other researchers. Explain my work to others and get to know and understand other people's work.
To understand different activities of CHN.
It's a requirement for NSF.
To improve our communication skills about our research.

Post-Survey Questions

What did you like best about today and why? (Oct. 16, only)
Demo Station tour. It's funny and helpful to understand other things by discussing with others.
Dinner Table Challenge and Demo Station Tour. Refreshed by idea of demo and do some practice.
Learning and practicing how to simplify scientific language.
It made me to think about my research from different perspective.
I really liked the idea of involving graduate students into science and technological demonstrations to the people with technical and nontechnical backgrounds. While explaining to kids, asking questions to them would encourage and excite them more to learn something and this I learned here today.
Demo workshop, because I could get different sight to look at people watching my explanation.
Interactions and hands on demos. They were really informative and got to talk to students from other schools.
The hands on demonstration. It makes you understand the concept of science more and in a better way.
It increased my confidence and made me more relaxed. Also, I had to go for an interview in the evening and the workshop experience gave me an idea of communicating better with professionals and nonprofessionals in my daily life.
I really enjoyed knowing the fact that general media doesn't usually get the information we (as scientists and engineers) give out unless we explain (demonstrate) it effectively. In one sentence "what we know is not very important, but how we present it - that's crucial".
Lots of practice.
Interacting with other CHN students outside the lab.

It makes me feel get involved with the education and outreach program. To intrigue kids interest in science has great significance.

The demos. Fun stuff.

I like the "dinner table challenge" the best because that activity made me think about research more and explain it very simply.

How could we have improved today's workshop? (Oct 2); How could we have improved today's workshop; what would you have liked to spend more time on? (Oct 16)

A bit more active or real time feedback (role playing) with the elevator discussion exercises. I felt like I was talking to a mirror or something.

More variety of workshop demonstration.

Have students do more than one demo.

Come up with our own demos. Come up with more public speaking exercises.

More direct coaching on demo presentation.

Practices should be with instructor as an audience. Graduate student feedback is not good enough.

Coffee break! Just need a pick-me-up after a few hours. Also a little more on interacting with children.

It's good. But I think maybe the elevator practice can be shorter.

It's pretty good. To enlighten a scientist to give feedback to the public.

By giving us more time on demos and elevator sections.

I really liked the workshop.

More interaction with group organizers, leaders for feedback opportunities.

More examples on each of the 10 points explained to emphasize the importance of each point and actually embed it into the mind.

More discussion, details on the topics.

Smaller group activity. Longer sessions.

More time for discussion.

Demo time too much.

Everything is good. Love it so much.

Have a small group of kids.

It was great, maybe at the end have more time to hear from the grad-students exp.

Learning how to present and communicate.

Introductory student com. Others will actually help.

Can we design and set up the demos ourselves? That would be much closer to what we are doing.

Very good. I like all schedules set for us.

It's pretty good, perfect. I learned a lot from this workshop, became more confident. I think it is better to get the feedback from visitors (students) too.

Bringing some kids in reality to practice on.

Bring people to it who care about outreach stuff or are involved, not everyone, namely people who have deadlines to meet in their research.

Coffee. Pretty good otherwise.

I think it was very well planned out all together and there is really not much to improve on.

More group working.

Keep more leaders so that we can observe more individuals.

By practicing by myself. I would like to spend more time on the demo.

I would spend more time on demo practice.

I feel that I improved my confidence on sharing scientific knowledge.

We could spend more time on the tricks that can be used for presenting to the public.

Demo station tour was great.

In many cases we may not have things to demonstrate the idea of uses in real practice. I would like to use a

laptop showing video/animation demonstration also which enables people to understand better and become more curious.

I would like to have more time on the dinner table challenge.

It's perfect.

All of the aspects - more practice.

Everything was great. Thank you.

I wish that it started in the morning so that I could have participated in every activity (left early) and benefit from my experience.

More experiments maybe, since it was loads of fun!

Video demonstrations of good/bad demos.

I think the demo activity was way too long - the entire activity was dragged out and made it more boring and less interesting. Half of the time allotted would have been sufficient.

I like the demo part. It's fun and it's helpful for us know how we can explain our research to nonscientists better.

Dinner table challenge was great fun - wish we had more time!

It was said there would be music - there was no music.

I would have liked to spend more time on the dinner table challenge and get more feedback from workshop leaders. I guess the time we spent on the 'demo station' tour was kind of long.

Practicum Day Questions

What did you learn about doing science demos with museum visitors today that hadn't been as clear before today?

Some parents ask really difficult questions that are hard to answer.

Actual interaction with kids and parents.

Even if you can explain things to small children, making them care is much harder.

What strategies did you find worked best for attracting and engaging visitors?

Make it sound like fun. Let visitors experience the experiment by themselves. Ask questions, compare to what they know in daily life.

Letting them do the demo hands on.

Encourage them to play with the demos.

I have to have different explanation for visitors' knowledge.

Looking at them and greeting them will attract visitors to your station.

Talk to them first. Playing the game first and showing the magic.

Free playing and the questions.

Actually doing the demo - bouncing bearing eye candy.

To get involved in demo help them to attract.

What suggestions do you have for improving your demo, or for creating a new demo?

Add more examples such As duck feathers. Use magnifying glass to show some small feature.

Applications.

A physical model of slipping atomic lattices vs. amorphous lattices.

I think they are all great.

NA.

If we'd had more time today, what would you have liked to use it for?

Seeing around the museum.
 Nothing.
 Visit more interesting stuff.
 Lunch break. Really hungry & thirsty.
 Go to see other projects.
 Seeing the museum...eating a quick lunch (I'm famished...)
 Seeing more of the museum.
 I want to tour the museum.

Any comments on *The Amazing Nano Brothers Show*? Any insights on this approach to science education?

The show was great.
 It was good, no suggestions.
 Good.
 Very good!
 It is good to see the comparison atom/electrons to juggling balls.
 It was awesome. I even learned about some facts that I've never learned before.
 It is great. They make the complex science problem easy to understand.
 It is a perfect learning experience.
 It was very cute and informative. I liked it.
 Those guys could teach rocket science to 3-year olds.
 It was great and so much fun.

Any comments on the Current Science & Technology presentation you attended? Any insights on this approach to science education?

The presentation is more for adult than kids.
 It was good.
 That was spot on.
 Very good presentation.
 Didn't attend.
 None.
 Alex does good work.
 I really enjoyed Alex's pres.
 It is .so clear and easy to understand the different concepts.

Any other comments on today, or suggestions on improving this workshop?

Great job.
 No.
 Nope.
 Need some snacks/refreshments for next time, we drove up all the way and haven't gotten to eat anything!
 A great day for me.
 Love working w/visitors.
 No, Thank You.