CHN Graduate Student Education and Outreach Summary of 2010 Focus Groups

One objective of the Center for High-rate Manufacturing is to increase knowledge of and interest in nanotechology among secondary and postsecondary students, educators, and the general public. One strategy that CHN uses to accomplish this objective is to have CHN graduate students engage in education and outreach activities with these groups.

To better understand graduate student education and outreach activities, focus groups were conducted in August 2010 by the UMass Donahue Institute with CHN graduate students at Northeastern University, UMass Lowell, and the University of New Hampshire. The focus group questions are listed in Appendix A, and student responses are summarized below.

Impact of Outreach Activities

What CHN outreach activities have you participated in?

Students at all three campuses participated in outreach activities at the Museum of Science. Most attended the workshop and the practicum, but Nano Days had limited attendance because it was on a Saturday when many students were not available. NEU students participated in a program called Show Me the Science at Wentworth Institute of Technology in which they shared their nanotechnology research with elementary school girls. The program was enthusiastically described by a participant as a "science club for girls". NEU students also gave tours of their facilities and demonstrations of their work to high school students. Several UNH students reached out to REU undergraduates and helped mentor them, and one UNH student spent a week working with 24 local high school teachers to educate them about nanotechnology and some lab activities that they could use with their students. UML students spent time sharing their nanotechnology work with local middle school students.

What did you enjoy about these outreach activities?

Participants from all three campuses enjoyed working with local school aged children and their teachers. The graduate student working with the Show Me the Science program said "I feel like I encouraged the girls, especially because they were like 'Wow you're a scientist, you're an engineer!', and I could see in their eyes that they were realizing that they could be scientists and engineers too." The graduate students enjoyed the activities because it was a welcome break from working in the labs and because it enabled them to connect with students at other universities.

What did you find most challenging or frustrating about your outreach activities?

Several students were challenged by learning to simplify complex nanotechnology concepts so that students and nonscientists could grasp them. UML participants were frustrated both by the lack of motivation of students in the after school programs they worked with, and also with disruptive students preventing more motivated students from learning. UNH and UML participants were frustrated that the outreach activities created many time conflicts that forced them to choose between attending class and attending CHN activities, both of which were required.

Did participating in outreach activities help you to better understand the broader impacts of your research project?

Participants found that teaching students and nonscientists about their nanotechnology research really helped them understand its broader impacts. One graduate student said "When you explain something, you realize how much you have learned, and it helps you to understand even more." One UNH student said that mentoring her

undergraduate REU student helped her see broader research impacts because she needed to be able to relate her work to the REU student's work.

In the future, would you like to participate in more or fewer outreach activities? If more, what types of activities would you like to do?
The majority of respondents enjoyed educational outreach with children and would like to do more because they felt it was important to increase youth interest in science and engineering. Several UNH students wanted to attend more conferences and also have some sort of forum for professional outreach with future potential employers.

In what ways were the MOS workshops helpful for your outreach activities?
A NEU student said "the key to me is learning how to simplify your work and explain it to others simply, and the Museum of Science workshops helped us learn how to do that." Across all three schools, responses to this question shared those key elements.

What suggestions do you have for improving CHN's outreach activities?
UML students suggested that some graduate students were not motivated enough to implement outreach activities effectively, and that they should perhaps be pre-screened for adequate motivation before being sent into the field. The NEU students were happy with their outreach activities as they were and wanted to continue doing them. The UNH students would like to see more internship and professional networking activities to be better prepared to enter the job market.

Impact of Graduate Student Training Activities

1. MOS Sharing Science Workshops

Do you feel that the Sharing Science activities improved your science communication skills? In what ways? What aspects of the workshops have turned out to be most useful?
The students across the three campuses unanimously cited learning how to communicate their work to nonscientists and to people working in other science fields. They were happy to be able to place their work in a broader context, which enabled them to explain their technical work in simpler and more general terms. One student at UNH said that the elevator speech was the most helpful for teaching these skills and likened it to "giving a sales pitch, and trying to do it effectively and quickly."

If you participated in the Practicum and/or Nanodays at the Museum, how important to you was having the opportunity to practice the skills you learned in the workshop? Explain.
All respondents felt that having the opportunity to apply what they had learned in the initial workshop was valuable. They described their growth in applying these skills, noting that they felt shaky at first and then more confident in communicating their work to nonscientists after actually applying their new skills a few times. The overall sentiment was that the Practicum and Nanodays activities prepared them well to utilize these skills in an authentic setting.

Did your participation in the Sharing Science Workshops increase your confidence about how to do education outreach more successfully? Do you think it will increase your interest in participating in education outreach activities in the future? Explain.
The students gained confidence about how to do education outreach because the practice sessions were hands-on activities that showed them they could be successful. A UML student gained confidence because of the joy he found, saying "it's nice to see the work from another point of view and it's also really fun to work with kids. I will definitely do it more."

Would you recommend the workshop/practicum/Nanodays experience to other graduate students? Why or why not?

All students at all three campuses said they would recommend it. One student at NEU said "every graduate student must experience this." Another student at UNH would recommend it because "it gives you a better idea of how to explain what you do and gives you an idea of the overall goals and big picture of what you are doing."

2. UMass Lowell -- Weekly Student Meetings

In what ways were these meetings beneficial to you? What did you get out of them? What did you like about them?

The UML weekly meetings gave students an opportunity to present their research to fellow students and get peer feedback before making the presentations to their advisors. They found this very helpful for gaining confidence, being better prepared, and being able to draw on the insights of second-year REU students about what advisors were looking for in presentations.

Were there any problems with these meetings? Aspects you disliked? Changes or improvements you would recommend for the future?

Students felt that presentations were sometimes too long, up to an hour and a half on occasion, and their schedules didn't allow for such long meetings. Also, feelings were hurt at times by the intensity and duration of negative feedback. The students said they were restructuring the meetings to better manage time and the feedback process.

Appendix A - CHN 2010 Graduate Student Focus Group Questions

Impact of Outreach Activities

1. What CHN outreach activities have you participated in?
2. What did you enjoy about these outreach activities?
3. What did you find most challenging or frustrating about your outreach activities?
4. Did participating in outreach activities help you to better understand the broader impacts of your research project?
5. In the future, would you like to participate in more or fewer outreach activities? If more, what types of activities would you like to do?
6. In what ways were the MOS workshops helpful for your outreach activities?
7. What suggestions do you have for improving CHN's outreach activities?

Impact of Graduate Student Training Activities

MOS Sharing Science Workshops

8. Determine who participated in each part -- Workshop, Practicum Day, Nanodays
9. Do you feel that the Sharing Science activities improved your science communication skills? In what ways? What aspects of the workshops have turned out to be most useful? (Probe for specific examples in the past 8-9 months -- for papers, presentations, networking, education outreach activities, general communication with non-scientists, etc.)
10. If you participated in the Practicum at the Museum, and/or Nanodays at the Museum, how important to you was having the opportunity to practice the skills you learned in the workshop? Explain.
11. Did your participation in the Sharing Science Workshops increase your confidence about how to do education outreach more successfully? Do you think it will increase your interest in participating in education outreach activities in the future? Explain.
12. Would you recommend the workshop/practicum/Nanodays experience to other graduate students? Why or why not?

Lowell Only -- Weekly Grad Student Meetings

13. In what ways were these meetings beneficial to you? What did you get out of them? What did you like about them?
14. Were there any problems with these meetings? Aspects you disliked? Changes or improvements you would recommend for the future?