Science graduate students doing science outreach:

Participation effects and perceived barriers to participation

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Introduction

This research project investigated a science outreach program developed at a leading research university in the northeastern United States. The outreach program was part of a funded National Science Foundation center, designed to fulfill the NSF requirement that the Center demonstrate broader impacts including that "results be disseminated broadly to enhance scientific and technological understanding" and that there be benefits to society (Material Research Science and Engineering Centers, 2002). The stated objectives for the outreach program were to increase scientific literacy in the community, increase voter comfort and understanding of scientific issues, to encourage people who have not traditionally considered careers in science to consider them, and to build positive university and community relationships.

Outreach as Service Learning

The structure of the outreach program studied is such that participation in this program can be considered a form of service learning. Service-learning programs in

universities typically use volunteers (or students who participate for extra credit or some other fairly minimal form of reward) to perform helping tasks in the community, in the local schools, or abroad. There have been some studies that have investigated the effects of service-learning. Much of the research currently available focuses on the work of high school youth and on undergraduates who perform many community service functions. For example, Steinke and Buresh (2002) recommended using service-learning as one component in an education curriculum. The literature shows general agreement among participants, parents, and community members that service-learning is worthwhile, useful, enjoyable, and a powerful leaning experience for those involved (Conrad & Heldin, 1991). However, researchers have raised valid methodological questions about many of the studies that have shown improvements for students doing service-learning. In particular, critics have questioned relying on self report data as the only evidence of benefits. These critics suggest using a wider variety of measurement tools such as improvements to grades, critical thinking, and creativity (Steinke & Buresh, 2002).

In an effort to improve research, Astin and Sax used the Cooperative Institutional Research Program Survey. Astin and Sax (1998) collected pretest data from 3450 freshmen at 42 different colleges. They then gathered post-test data from the same youth using another survey (College Student Survey) several years later. Out of the 3,450 respondents, 2,309 had participated in service learning activities and 1,141 had not. The group of respondents not involved in service served as a comparison group, allowing researchers to compare students' sense of civic responsibility, academic development, and life skills for the two groups. Astin and Sax (1998) incorporated two statistical

controls. The first sought to control for the possible effects of more or less effective service-learning curricula at different colleges. The second sought to ensure that the outcomes associated with service participation were not merely due to differences between students in the two groups. The study found that students who participated in volunteer service-learning activities in college had a statistically significant increase in their abilities to maintain good grade point averages in college and an ability to improve their grades point averages from what they were during their high school years. Youth involved in service in college were more likely to report feelings of increased life skills (e.g. increased social confidence, better conflict resolution skills, and enhanced problem solving skills) than the others (Astin & Sax, 1998). The study found that the top reasons why students initially get involved in service-learning programs were to help others, to feel personal satisfaction, to improve the community, and to improve society as a whole. Freeman and King (2001) noted that not all service-learning programs are successful at accomplishing the desired goals of improved grades, civic engagement, and life skills. Only carefully developed and executed programs have the potential to meet these expectations (Freeman & King, 2001).

Good service learning programs aim to benefit all involved. For example a college program might put fraternity men to work building playgrounds for youth in a local park. The project benefits the community by creating a park without labor costs, benefits youth and families who use the playground, contributes to positive public relations for the fraternity, gives the individual men the satisfaction of having helped in the project, and helps the university contribute to the community. We argue that the

scientific education outreach program described in this paper can be considered as a form of service-learning. Although the stated goals of the science outreach focus on increasing the public's understanding of and support for advanced science research, many features of the program we studied match features of service learning programs.   Its educators volunteer to participate, the outcomes of these endeavors help the community by providing quality educational experiences for a range of audiences, and the work is different from the participants' required programs of study.

This current study documents how participation in a service learning program effects science graduate students at a research oriented university. Many of the effects of participation identified in Astin and Sax's paper (1998) are generally consistent with the findings in this study. However, the specific effects on graduate student volunteers are strongly shaped by the demands of student's academic lives and experiences.

The Outreach Program Studied

The Research Center studied established an outreach division headed by a Director of Educational Programs. The Director recruits graduate student volunteers, establishes forums for outreach (including schoolrooms, community centers and prisons), facilitates the planning and execution of activities, and develops a library of curricular materials. The Outreach program aims to serve school-aged children (including incarcerated youth), teachers, and parents.

Graduate student volunteers can plan and present a new activity or use an activity designed and validated by others (e.g. activities developed by other NSF projects). The

activities address scientific concepts such as magnetism, states of matter, or properties of waves and generally involve opportunities for hands-on experiences. The volunteers are helped to present their activities to engage and be comprehensible to a non-scientific audience.

Most workshops are single day events; a few last for several days. The outreach program also seeks to help area teachers gain new teaching techniques for working with science in their own classrooms. To do this, volunteers conduct special sessions with science teachers and then assist these teachers as they present these activities to their students. The Director of Educational Programs maintains a list of approximately one hundred graduate students who have expressed an interest in participating in Outreach. Volunteers are recruited at informational meetings, through e-mails or by direct contact with the Director. Not all who volunteer actually participate in outreach programs. In nearly all cases the volunteers are graduate students. The graduate students we interviewed in this study came from one of four disciplines: physics, chemistry, engineering, or microbiology. (To protect identity we do not indicate the post-doctoral student's disciplinary focus).

The interviews explored the perceived effects of doing Outreach on those who did outreach frequently and the perceived hurdles to participation for those who did outreach infrequently or not at all.

Methods

Participants

Over the two years of the study twenty-five graduate students and one recent post-doctoral student participated in interviews. We refer to all the persons interviewed as volunteers, even if they never actually participated in any activities. The Outreach staff had records indicating how many times volunteers participated in Outreach, enabling us to assign volunteers to one of three groups, based on their level of involvement. Group I volunteers had done at least three outreach activities, Group II volunteers had participated only one or two times. Group III volunteers never participated in outreach. Figure 1 illustrates the amount of outreach participation by group.

Volunteers who responded to an initial e-mail invitation were contacted to set up interview times. Volunteers who did not respond to the e-mail invitation were not contacted again. After the first round of interviews we developed a short survey to gather relevant background data and ensure we had consistent data from all interviewees. This survey was sent to interviewees prior to their interviews. Those who had already been interviewed were sent this survey after their interviews. Twenty of the twenty-six interviewees returned the surveys.

Differences across the three groups were immediately apparent. Fourteen Group I volunteers were contacted and twelve agreed to be interviewed (86%) after the initial contact. Nineteen Group II volunteers were contacted and only seven agreed to be interviewed (37%). Thirty-two Group III subjects were contacted and only seven agreed to be interviewed (22%). (Two Group III subjects had left the university.) Not only did

fewer Group II and III volunteers agree to be interviewed, they more frequently changed interview times, arrived late at interviews, or failed to appear. Group I subjects showed none of these behaviors.

Procedures

Volunteers were interviewed by an advanced graduate student with training in interpretive research methods. All interviews were tape-recorded and transcribed. The interviewer used a semi-structured interview (Seidman, 1991; Creswell, 1998) with an interview guide of general questions. These general questions allowed the interviewer flexibility to follow up on responses and to explore unexpected topics raised by the interviewees. In addition, the interviewer, with permission, also taped the conversations that developed after the formal interview ended, since these conversations often provided rich insight as interviewees continued to think aloud. Interviews lasted from sixty to ninety minutes. Taping the interviews freed the interviewer to focus on establishing comfort and rapport so interviewees would express themselves honestly. Techniques to build rapport included sequencing of questions from straightforward to complex, listening carefully enough to ask well-placed and thoughtful follow-up question, allowing the interviewer to reveal his own thoughts when asked, and making eye contact with subjects (Seidman, 1991). The interviewer took notes only to note key ideas for later questions or analysis.

We designed the interview guide with input from the Research Center staff. The interviewer conducted two pilot interviews to test the guide and technique. Over the two years of the study, interview transcripts were analyzed twice a semester, four

times a year. The preliminary analyses were used to refine the guide. As a result of these preliminary analyses, the guide was modified for the second year of the study. Also, the guide was adjusted to reflect the differences across the three groups of volunteers.

The survey gathered data that could be converted into numerical scales for quick and easy comparisons between subjects.

Data Analysis:

All interview transcripts were entered into Folio Views (Nextpage, 1999). Because we had only general notions about what the interviews might reveal, we used a constant comparative analysis approach (Glaser & Strauss, 1967; Goetz, 1984). As the analysis progressed categories that described interviewees' perceptions of the significance of doing outreach and the hurdles to participating were created, tested, and revised. The interviewer did initial categorizations that were then reviewed by the second author and compared to the transcript data, a process repeated throughout the study. The on-going analysis provided a means to monitor the quality of the interviews and to adjust the interviewing when needed. The disadvantage is that earlier interviews provided less detail than later interviews, but overall the process ensured that we probed, in depth, areas relevant to the volunteers.

Folio Views allowed us to highlight coded data by color and to compare quotes coded the same across all interviews. Also, all quotes could be viewed in the context of the original interview. The ability to examine volunteers' quotes in these two contexts, combined with examining notes taken during the interviews, aided in our

interpretations. The categories we developed in our analyses provided a way to group responses. As with interpretive research generally, others might develop different justifiable categories. In our presentation of findings we describe the categories then include quotes to illustrate each category, thus allowing the reader to judge our interpretations.

Findings

In this section we first describe the general categories of benefits that volunteers identified. We present an overview of the results from the three groups, then discuss the subcategories in each general category. We then present the barriers to participating in outreach that were identified by members of Groups II and III.

Perceived benefits of participating in outreach

Volunteers perceived benefits of participation in outreach that we put into four major categories. Volunteers mentioned gaining a sense of accomplishment, having a legitimate break from their research programs, learning to communicate better, and fulfilling an obligation. Different groups perceived different benefits or perceived benefits differently. Figure 2 allows for an overall comparison.

Analysis of interviews showed that members of Groups II and III were describing the <u>potential</u> benefits of participating in outreach activities. For example, an interviewee from group III described how outreach offered a sense of accomplishment and pride although she had never participated. In contrast, the group I responses described actual

benefits based on volunteers' experiences in outreach. Members of Groups II and III did not experience outreach as a meaningful break from graduate study, and members of Group I did not perceive doing outreach as fulfilling an obligation.

Aspects of Sense of Accomplishment and Illustrative Quotes. The volunteers in Group I spoke of four kinds of accomplishments and some mentioned more than one kind. Five volunteers felt they were able to show youngsters that they, too, could participate in science. Five volunteers felt that they could "give back" by providing opportunities for youngsters similar to the opportunities they had had in earlier years. Four felt that they made science more accessible to average youngsters not usually interested in science. Two thought they had been able to change negative stereotypes about scientists.

One person described showing youngsters this way:

The principal came in, at the end of the day, thanked me for coming. "Anytime you want to come just let us know. This is great. We don't have anything like this around here. You're a woman and it's great to show them [the students] that there are women who can be scientists."

Another person described showing youngsters thus:

I guess that deaf kids don't get opportunities; they perceive themselves as not being able to go to college and not being able to do things that a [hearing] person would do and I would hope that maybe with us spending time with them, would see that they can do that!

One volunteer concerned to provide opportunities to youngsters described their own prior opportunities.

And then in the summer, they had a two-week summer science, elementary summer science program, where eighth graders and high schoolers would act as instructors and do a lot of fun science activities for elementary school kids. It was

just for two weeks. Sometimes there were trips …. They had lots of activities, which I actually did from 8th grade to 12th grade, and I did it the summer after high school and the summer before I came here as a little break.

Another volunteer interested in creating opportunities said:

I think it is good to give something back because obviously there were people who were helpful in getting me here to where I am in science and keeping me interested, and I think it important to hopefully be one of those people [to others like me].

One volunteer illustrated making science accessible by describing an activity s/he had

led.

A lot of kids say, "Oh yeah I'm just mixing colors." But you can relate to them and say, "Yeah, but that is how you can get a whole bunch of different colors and you can put a piece a fabric there!" You have to find a way to relate it to them. For example, "This is how your blue jeans are made."

One of the two volunteers interested in changing stereotypes about scientists described

the accomplishment in this way:

I really wish I could promote that it is OK and cool to be a nerd, in a good sense. I enjoy science and I like computers. In my spare time, I like playing with computers but I also play volleyball, go out on dates, I have a girl friend. I think I'm a decent looking guy, I can talk….You want to show people that scientists are normal, that they can have a normal life and that they can be cool and still be a scientist.

Aspects of Breaks from Studies and Illustrations. The Outreach educators in

Group I described themselves as having a wide variety of interests that they felt they

needed to maintain in graduate school. Eight of the Group I volunteers expressly stated

that participating in Outreach gave them a chance to do something other than their studies

that still related to science. Three volunteers described the importance of having

meaningful activities outside their studies, though did not specifically identify

participating in outreach as one of these activities. (The interviewer did not ask one

member of Group I about alternatives to study.)

One of the eight who described outreach as an alternative to their studies said:

I was looking for lots of valid breaks! I was looking for things to do that didn't make it look like I was slacking off too much. But I am not the kind of person who can sit in a room with an instrument for eight hours straight. And even my co-workers cannot be classified as the best conversationalists. So often when you are working on something you might not talk to people much other than, "Have you seen the Erlenmeyer flask? I don't know where I left it." And so I can't go the whole day without having some kind of human contact. You have to work as a team and collaborate with your other co-workers but it still doesn't hit the spot, Outreach is better.

One of the volunteers who spoke of the need for alternatives to studying science

described his interests in the following way.

It was actually pretty strange because I wasn't particularly focused on chemistry as an undergrad. I enjoyed it as a subject but it wasn't always my permanent focus. In grad school, it was the level of focus required that was kind of a shock to me. It was presented to me like this, "All of your courses are going to be chemistry and that is it!" That took a lot of adjusting to and also it took a while for me to realize that I could take other courses even though that wasn't explicitly stated. So I ended up taking a number of classes in [non-science areas].

Although only one person explicitly said so, it is possible that Outreach activities

contributed to the emotional well-being of Group I volunteers, creating opportunites for

interaction with others outside the intensities of the research lab. The volunteer who did

speak of this benefit said:

I was very lonely my first two years here and I tried many different things here to make friends and, you know, find something to do outside work. And really, I think being involved in Outreach has spared me a lot of despair because it has always been something that I can be working on and feeling good about. When my research isn't going well and I'm not happy in my department [Outreach makes me happy].

Aspects of Increased Communication and Illustrations. Eleven of the Group One

volunteers felt that participation has helped them to better communicate and consider

their research and careers. Three noted that participation helped them focus career

objectives. Two felt that their approach to science inquiry had been enlarged.

Participating in outreach forced people to think about highly complicated science content

in terms that an eighth grade student might grasp. One person described the benefit in

terms of professional needs.

> Yes, based on the things we just explained and I always try to keep it in the back
> of my mind how would I explain this to my mother or father or a teenager? It
> always helps me remember there is a whole world out there that doesn't speak the
> language that I speak in the lab. This is also true, even in the scientific world, so it
> helps my communication skills a lot.

> Another way in which participation shaped communication involved a review of

prior learning.

> Explaining those concepts to people who hadn't heard them before, really took a
> greater understanding than I had originally had. I mean, I am just taking the
> course myself. And I found that with Outreach as well. I could use my research
> and have a certain level of understanding, but then to relate it to concepts that the
> students already understand was really difficult. It took a whole other level of
> understanding to really make those connections to everyday worlds and also to
> presenting these fun science activities.

One volunteer used the Outreach experience to think more carefully about possible

future career paths.

> Well, it [Outreach] gave me a chance to try to work with kids because I have always
> thought that I'd be good at it. I tried it several times before, that I think I have the
> ability to talk to kids about science and teach them something and try to get them
> excited about science.

There were two Outreach educators who said that Outreach enabled them to gain

fresh perspectives on their work by creating opportunities for them to interact with other

graduate students.

> Yes, there are things that we do [in outreach] that I don't know anything about and in
> that respect it is informative. I also think it has given me a chance to speak with
> people who are not necessarily from chemistry and sometimes stuff comes up there
> … that they know about and that I don't, and I think that is good.

Fulfilling Obligations. One Group II volunteer described the obligation in this way:

> The specific funding that I have to be here is through a private foundation, but certainly an enormous amount of money and an enormous amount of the facilities that I use are supported by the public. So I feel I have some obligation to the public as well. I am here ostensibly doing work for the betterment of humankind, and so to some degree I can think that I am doing that sitting in my lab, but education is certainly a part of that as well. So I think that there are a lot of worthy reasons to do it.

Barriers to participation in outreach

Analysis of interviews with volunteers in Groups II and III helped understand reasons they did not participate in outreach. Some barriers were described explicitly and others were presented indirectly. For example, the interviewer asked "Why could you not do outreach?" He also used less direct questions such as "What is the attitude in the department about graduate students who do outreach?" or "Tell me what your advisor thinks about outreach." These indirect questions revealed factors in graduate students' lives that limited their participation. We used indirect questions to learn more about reasons for not doing outreach because most members in Groups II and III were articulate about the possible benefits of doing outreach, likely making it harder for some of them to justify their lack of participation.

Explicit reasons for not doing outreach. Volunteers offered several reasons for their lack of involvement in outreach activities. Nine stated that they simply did not have time. Four volunteers who had actually done some outreach found that they did not enjoy working with youngsters. Two felt that they should have been personally contacted by

the Director of Educational Programs, that an e-mail notification was insufficient. One

volunteer felt that outreach was not relevant to career plans that did not involve Academe

and one, as a non-native English speaker, felt a language barrier.

The following quote illustrates both the time pressure felt by the graduate student

and the lack of personal contact.

> What prevented me from doing more? Research! I mean, I know it is a pathetic
> excuse but I didn't even have time to do my laundry for the past month. I think also,
> usually I hear about these programs that I think [the director] has. She sends out
> requests through a mass e-mail message. I think when that happens everybody
> becomes unaccountable; they think that someone else is going to do it. I think that
> maybe a more personal approach would be better received.

The time pressures felt by these graduate students is further clarified in the following

quote:

> With the stuff that I work on, it is really hard to gauge what my schedule will be like
> next week. I could be in the middle of something that has to be done now or else
> everything that I have worked on for the past four days is just gone. So there are a
> few schedule problems with committing to Outreach and doing my research.

One person who felt uncomfortable working with youngsters reported:

> I just realized that I'm not very good at working with kids…[Outreach] is
> something that I should definitely support, but I don't think it is for me.

Implicit reasons for not doing Outreach. Four volunteers in groups II and III

explained that graduate students who were involved in outreach were perceived to be less

serious about their research and their studies. Three volunteers did not feel that their

advisors would support their involvement in outreach.

Two quotes illustrate perceptions of active outreach volunteers. The second quote

explores some of the pressures the interviewee felt in a particular field of study.

I would say that the people I know who are actively engaged in Outreach --or my perception of the people who do Outreach-- is that they are less involved in their research than I am. Or they feel less engaged with their research than I do. I know at least two people who are really involved, and one just never seemed really excited about their research and the other just transferred to another program. I don't know if that is my perception or any kind of reality. But they did speak really highly of Outreach; I think they really enjoyed it.

I perceive there to be a lot more involvement in Outreach in other scientific disciplines outside of chemistry. Again this is a perception, but I think chemistry has the average shortest time to completion among the sciences. Certainly the average in physics is more like seven years and in chemistry it is like five years. Part of it is that the work goes faster but part of it is that there is much higher demand and expectations among professors in chemistry of actual hours in lab doing work. My professor says his expectation is that we are spending sixty hours in the lab as a minimum. So you take that and try to eat healthy, try to exercise, try to have a relationship, and it doesn't leave a lot of time for anything else, and to me these other things are pretty huge priorities.

Out of eleven Group II and III subjects who were asked directly, no one said that his or her advisor openly did not support Outreach. However, eight of the eleven subjects described their advisors as not holding outreach as a priority. The quote below also suggests a possible origin of the view that outreach fulfilled an obligation.

> There is this kind of attitude where the faculty aren't particularly interested in doing Outreach but they realize that someone has got to be doing it because they need it in order for their grants to be renewed. Because they don't want to be doing it, they hire someone to kind of get graduate students to do it. I'm making it sound more negative than it is but if that's the picture, that is in the background of everyone's mind. It makes the task by definition sound onerous. Like it is something the faculty realizes has to be done but they don't want to do it themselves so they try to get graduate students to do it instead.

The following quote sums up how one graduate student gauges the importance of their advisors' support of any program outside the regular scientific research program.

> The first year of school there was no way I was going to do Outreach. I was so far behind I had to play catch up all year. Now if my advisor said, "Do you want to do Outreach? If you do, I support it, not to overdo it, but once a month or

something like that I really encourage you to do it!" If he condoned it I'd do it. I think if you asked him what he thinks about Outreach, he would give you the politically correct answer, but I think in reality he wants results. He is paying your salary with his grants and he wants results. So unless Outreach is directly tied into the grants with graduate students being required to do a certain amount of Outreach I don't think it is going to happen.

Survey results

Twenty volunteers answered the survey and their responses parallel interview results. One telling finding was that five of the seven Group I respondents planned on careers in Academe. Only two Group II (of 6) and two Group III (of 7) members indicated they planned on careers in Academe.   These different career plans are reflected in other responses presented in Figure 3. Volunteers in Group I saw outreach as important to their future careers, while others were more mixed. No Group I member felt that outreach demanded too much time, although several members of the other two groups did feel that outreach required too much time. Volunteers were mixed about requiring outreach activities of graduate students.

Discussion

The intent of the National Science Foundation goal to ensure that research centers endeavor to have a wider impact is laudable. The center at this northeastern university organized an extensive outreach education program to fulfill the NSF goal. The outreach program is arranged by a Director and primarily implemented by graduate student volunteers. As with other service learning programs, volunteers who were significantly involved in outreach spoke of a range of benefits that participation had offered them. For these individuals the outreach program, organized as it was, clearly was valuable. The

active volunteers articulated benefits in several spheres, including being able to contribute to others and learning more about their content. Some volunteers described benefits that contributed to their emotional well-being as graduate students. Not all graduate students who volunteered to do outreach actually became involved.

Some of the volunteers who did not get significantly involved in outreach gave reasons that reflected their lack of comfort working with youngsters or the lack of perceived value of this work for their careers. Other reasons offered for lack of participation related to the demands of their research projects and their inability to meet an outside schedule. No interviewee ever criticized the stated goals of the outreach program and no one recounted any friends, colleagues, or advisors having anything overtly negative to say about the program.

However, quotes from members of Groups II and III reveal some systemic factors in science research culture that made participation in outreach less attractive. The image of the committed scientist implied by some of the interviewees did not include participation in outreach. Expectations for research productivity and for progress in graduate programs are real, and interfere with involvement in outreach.

If the perceptions of these students are accurate, aspects of the culture of research university science programs may not support involvement in outreach. Is it reasonable to expect graduate students in highly sophisticated research program to become involved in outreach? Our data suggest that it is reasonable to expect that some graduate students will benefit from participating in outreach activities, but that not all will. Further, our data suggest that there are some cultural assumptions in some research communities that

inhibit participation in outreach. More research is needed to determine, first, if these

assumptions exist. Second, are these assumptions supported? Is it the case that less

successful graduate students are the ones more committed to doing outreach? Does

involvement in outreach impede progress in a graduate research program or decrease

chances of finding the best positions after graduation? If the answers to these questions

are positive, we need to think more about what implicit cultural assumptions students

develop in graduate programs and what assumptions faculty have developed. Are these

assumptions related only to outreach, or could they contribute also to undervaluing

teaching in university classes? Finally, one more important and relevant question is

raised by this research. Many colleges and universities across the country are considering

the task of merging their tenure track position requirements with their overall desire to

fulfill points outlined in their mission statements with regard to supporting and

interfacing with the community. This question is placed front and center, does the

definition of "scholarship" include the work done by professors and students who

participate in service-learning programs and activities (Buchanan, Baldwin & Rudisill,

2002)?

> We end this paper with a long quote that suggests the need for further study:

> Within our group, the top students definitely don't do Outreach. Also, it seems
> like it has little bearing on whether or not you get a job. It seems like it is your
> advisor's recommendation that gets you that good job. There was another woman
> in our group who did it and she was trying to get me to do it….and it is hard to
> say, but I think she wasn't really respected in the group. She wasn't really focused
> on her research. People like to say that they have put in the long hours and there is
> definitely the game of face time with their advisors and it makes me laugh
> because it is definitely a game. I like to pretend that I don't do it but I do. I have
> never directly asked my advisor if he supported Outreach but it is more by
> inferring from him and others in my group that I shouldn't do it. When I came

here I was very excited about Outreach and a friend of mine from another university told me, "don't do Outreach," he said, "the people who did Outreach got sucked into it and it always took them a couple of extra months or longer to graduate."

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Figure 1. Amount of outreach participation by group

Group	n =	Mean outreach sessions	Range of outreach sessions	Area of study	Gender
I	12	12.5	3-25	chemistry physics engineering	9 women 3 men
II	7	1.7	1-2	chemistry physics	2 women 5 men
III	7	0	--	chemistry, physics microbiology engineering	4 women 3 men

Figure 2. Benefits from doing outreach

Group	Sense of accomplishment	Break from studies	Increased communication	Fulfill obligation
I (n=12)	12	11	11	0
II (n=7)	7	0	3	0
III (n=7)	1			3

Figure 3. Survey data responses

Group	Strongly Agree	Agree	Disagree	Strongly Disagree
"It is **not** important for me to list outreach activities on my resume."				
I n=7	0	1	3	3
II n=6	0	3	2	1
III n=7	0	3	3	1
"The places where I would like to work do **not** value outreach-type activities."				
I n=7	0	0	5	2
II n=5	0	2	1	2
III n=7	1	3	3	0
"Being an outreach educator demands too much time from graduate students in science programs."				
I n=7	0	0	4	3
II n=6	0	1	3	2
III n=7	1	2	4	0
"Graduate students at this school should be expected to do science outreach with pre-college students."				
I n=7	2	1	4	0
II n=6	0	3	3	0
III n=7	0	2	5	0