

## **Barriers, Lessons Learned, and Best Practices in Engaging Scientists in Education and Public Outreach**

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**Abstract.** This Astronomical Society of the Pacific conference brought together a group of specialists interested in education and public outreach (EPO) from a wide variety of contexts including NASA centers, non-profits, museums, and universities. Active engagement of scientists in EPO activities results in benefits for both the audience and the scientists. Despite this, education research has shown that many barriers exist that keep scientists from engaging in EPO activities. To counter these barriers, many stakeholders in this community are working to bridge the gap and help scientists make a meaningful contribution to these efforts. There are many documented roles for scientists including giving public talks, classroom visits, large outreach events, radio broadcasts, engaging in curriculum development and teacher workshops. Over the past year, members of the NASA science mission directorate forums have been actively working with their community members to understand the reasons that scientists in our community do and do not participate in EPO activities. This session expanded the discussion to the larger community of stakeholders across science, education, and outreach contexts. It was an open forum for discussion of ideas about barriers and lessons learned regarding engaging scientists in education and public outreach.

### **1. Introduction**

This special interest group session brought together scientists, EPO professionals, and program officers to discuss barriers, successes, and opportunities to engage scientists in education and public outreach. The session was structured so that participants could respond to previously documented barriers and resources, leading to a larger discussion

so that everyone could express their opinions. Participant feedback was collected in both written and spoken words. This document synthesizes feedback from the thirty-five people who participated in the one-hour discussion.

A list of documented barriers that prevent scientists from participating, or participating more fully, in EPO activities was compiled from education research, evaluation, and surveys conducted by members of NASA's Science Mission Directorate over the last ten years (Andrews et al. 2005; Crettaz von Roten 2010; Poliakoff & Webb 2007; Thiry, Laursen, & Hunter 2008; Word Craft 2008). The working list of documented barriers presented during the workshop can be found in Appendix A.

In the next section we present the challenges and successes of doing EPO discussed by participants in the session. We have sorted comments by topic and included representative feedback (written and verbal) collected during the discussion. We have organized the feedback we collected into four themes: i) support for EPO involvement, ii) considerations of cost versus benefit, iii) connecting with the EPO community, and iv) skills to engage in EPO.

## **2. Support for Scientist Engagement in EPO**

### **2.1. Challenges**

Participants discussed how a lack of support from their supervisors coupled with the pressure to publish and a lack of release time posed barriers to doing EPO for scientists. Specific comments included:

“[I] do not feel there is enough incentive or recognition [for doing EPO].”

“[There is] no support from management for spending ‘work’ time on EPO.”

“The lack of support is real and affects many researchers that try EPO.”

“[Support] needs to come from the top down on the org chart.”

### **2.2. Successes**

In contrast to those who expressed a lack of support to do EPO, several participants were able to share success stories. Each of the successful stories documented support from managers and/or supervisors to do EPO so that it was not done during “off” time but rather was part of normal activities. Specific comments included:

“At [our lab], the lab director has dictated that scientists and engineers should be spending 1% of their overall effort on EPO; this makes management much more supportive and scientists and engineers more involved.”

“We have been successful in getting a ROSES supplement grant that provides a week of funding for a group of scientists to do EPO work each year. Being able to pay them makes it more likely that they would be engaged and lets them know that we value their time.”

## **3. Cost versus Benefit for Scientist Engagement in EPO**

### **3.1. Challenges**

Participants expressed that doing EPO activities took away too much time from doing science and that overall it was too time consuming to do if there was no funding for the activities, which was the experience of at least some of the people in the room. Specific

issues related to NASA education proposals raised concerns, reflected in the literature and previous surveys of NASA scientists, which included the difficulty of obtaining EPO grant funding, too little money for the effort spent, and damaging one's career. Specific comments included:

"[Writing a] SMD supplement grant is too much effort for too little money (too many hoops to jump through)."

"The biggest problem — [EPO] conflict with personal time; EPO takes away from this and scientists aren't willing to give that up."

"For post docs and grad students, danger of doing EPO is that it could derail their science career."

"Women scientists sometimes are particularly sensitive to being "assigned" to EPO; feel it damages their credibility."

This last point raises a concern well-known to the community and is worth further investigation. Several issues are worth further discussion including possible gender bias in the community with regards to who does EPO as well as promoting a balanced number of role models engaged in this work.

### **3.2. Successes**

In contrast to those who expressed barriers, some scientists in the room shared that they had had been successful in crafting winning EPO proposals funded by NASA. Thus the sentiment that the "effort was not worth the time to do it" was not shared by all scientists in the room. Specific comments included:

"I disagree with 'too hard to get funding' [for EPO work]."

"For post docs and grad students [doing EPO] can benefit their career toward teaching."

## **4. Connection to Education and Public Outreach Community**

### **4.1. Challenges**

Scientists in the session expressed that they were in need of better ways to connect to teachers and classrooms. Additionally, that they needed more ways to find opportunities to do EPO. Specific comments included:

"I need better EPO contacts."

"I need better ways to get my name out to EPO community."

"[We have] pedagogical barriers—translating content to teaching practices."

"Don't know (or have time to figure out) how to get a relevant education professional partner."

"Many scientists feel that the public could/would not understand what they do."

### **4.2. Successes**

In contrast, other participants were able to point to successful practices that they had used to make connections to classrooms and EPO opportunities. Specific comments included:

"We have had success using master teachers to make connections to skills and develop pedagogically appropriate materials."

“At our institution, we have hired a retired teacher who not only helps us make connections back to the school district, but helps scientists understand the standards.”

## **5. Skills to Engage in EPO**

### **5.1. Challenges**

Some participants shared that they felt that they and some of their peers lacked the opportunities, either due to skills or complexity of their science content area, to engage in education and public outreach. Specific comments included:

“My science is too esoteric to explain.”

“Many scientists feel intimidated by children; they feel they don’t know what is age-appropriate (terminology, concepts, developmental understanding).”

“Lack of communication skills in scientists.”

### **5.2. Successes**

In contrast, some participants expressed positive contributions that scientists bring to EPO. Specific comments included:

“Scientists may not be aware/convinced that they bring a unique and valuable experience to EPO that others (ed specialists/former researchers) cannot provide alone.”

“[Our program] has an “Ask an Astronomer” service in which they ask for volunteers; they have 12 scientists who participate and in one week it takes care of all the questions.”

## **6. Exemplar Programs to Look Toward for Best Practices**

**Project ASTRO:** The program provides a manual for both teachers and astronomer partners to work through together, thus sets parameters and gives strategies for meaningful partnerships.

**NSF GK-12:** Graduate students partnered with classroom teachers for content support, and teacher give grad students strategies to work with students.

### **6.1. Best Practices**

In addition to discussing systematic programs that help connect scientists to education and outreach opportunities, participants discussed best practices from programs that they had facilitated and participated in. Specific comments included:

“Encourage grad students to be involved. It helps if you have incentives, a recognition program for doing EPO work, so that they feel that it is valued and worth their time, and that there is support from program management.”

“At Princeton University Astrophysics department, a professor has organized some grad students to volunteer to teach math and science in a youth correctional facility. This program has helped both grad students and those who made a positive connection to the community.”

## **7. Resources to Support Scientists Engagement in EPO**

Throughout the discussion, participants asked for and provided resources to connect scientists with EPO opportunities. These resources are used both by scientists who wanted to find avenues to become more involved and from educational professionals who wanted to find a way to connect with scientists for various projects. Below is a list of resources discussed during the session.

**NASA Speakers Bureau:** A resource for both scientists and the public.

<http://www.nasa.gov/about/speakers/>

**The Higher Education Clearinghouse:** A One-Stop Shop for information and resources for undergraduate education in planetary science and solar and space physics. The site hosts the latest news, funding opportunities, and educational research for undergraduate faculty. Additionally, the clearinghouse is a place where faculty can submit and find materials for their classroom, including lectures, activities, homework, and other assets. <http://www.lpi.usra.edu/hecl/>

**NASA's Science Mission Directorate Forum Community Site:** The site provides resources to assist individuals funded by NASA's Science Mission Directorate (SMD) in carrying out their SMD education and public outreach programs. Information and documents that may be of interest to all, such as tips for getting involved in SMD education and public outreach and meeting notes. The site may be accessed by everyone. <http://smdepo.org/>

**National Lab Network:** The National Lab Network is a nationwide initiative to build local communities of support that will foster ongoing collaborations among volunteers, students and educators. <http://www.nationallabnetwork.org/>

## **8. Issues Raised and Opportunities for Growth**

There were many issues raised during the session related to barriers and successes of engaging scientists in education and public outreach. One issue revolved around communicating the importance of engaging in EPO activities to scientists. A program officer from the National Science Foundation pointed out that putting EPO into an NSF research grant was considered a positive attribute of the research grant.

There was a general consensus in the room that that message was not getting out to faculty. This was an issue even brought up in the session by a scientist participant.

“As a soft-money funded research scientist, I can't ask for any support money for me in an EPO supplement.”

Although program officers from several organizations discussed the importance of supporting scientists to conduct EPO, there persists an idea that scientists must do the work unfunded. This is an ongoing issue that we as a community need to help mediate to encourage more participation. Several other questions were raised and requests made for improving our work in engaging scientists in these activities. Specific comments included:

“How do we address different levels of scientist engagement, viz., (i) engaging more scientists in proposing for funded EPO projects vs. (ii) engaging and enabling more scientists in volunteer EPO activities?”

“I would love to see a rational online database of scientists interested in public/classroom speaking, that educators could search for a match with; specifically by broad category (i.e. astronomy, planetary science, environmental science, etc).”

“Be careful what you ask for...what to do about scientists eager to do EPO but are bad at it?”

“We need resources for knowing what is age appropriate, what types of things to use with students at different stages in development.”

Each of these concerns provides an opportunity for partnership and development of new tools to assist and engage more scientists in meaningful EPO opportunities. Additionally, there is a need for better dissemination of resources to scientists who would like to use them to support their EPO efforts.

## 9. Future Work

This discussion demonstrates that as a community we have many opportunities to support scientists in doing education and public opportunities. Over the past year, NASA SMD Forum teams leading efforts for scientist engagement in EPO have been compiling resources to help EPO-engaged scientists make their EPO effort more effective. These resources will be made available on the SMD EPO community workspace<sup>1</sup> in the near future.

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## References

- Andrews, E., Hanley, D., Hovermill J., Weaver, A., & Melton, G. 2005, *Journal of Geoscience Education*, 281
- Crettaz von Roten, F. 2011, *Science Communication*, 52
- Poliakoff, E., & Webb, T. L. 2007, *Science Communication*, 242
- Thiry, H., Laursen, S. L., & Hunter, A. B. 2008, *Journal of Geoscience Education*, 23
- Word Craft 2008, COSEE NOW with ASLO Annual Scientist Survey (New Brunswick, NJ: Rutgers University)

## Appendix A

Documented barriers that prevent scientists from participating, or participating more fully, in Education and Public Outreach (EPO) activities:

- Lack of support
- Little support from supervisors
- No funding (charge accounts for civil servants, grants for soft money scientists, and funding for university scientists)

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<sup>1</sup>SMD EPO Community Workspace – <http://smdepo.org>

- Has to be done on their “own” time so it does not conflict with their paid employment
- Not worth it
- Writing NASA EPO proposals is too cumbersome
- The amount of work outweighs the amount of money offered
- Takes too much time away from doing science
- Too time consuming to do without funding
- Too difficult to get EPO funding
- NASA education proposal standards are too restrictive
- Lack of support on crafting EPO proposals that match expectations
- Proposals often rejected
- Too hard to compete with programs that are staffed with education professionals
- Do not know how to get started
- Lack of support with EPO resources
- Need help connecting to teachers and classrooms
- Need knowledge of available opportunities and how to plug into them
- Other professional/systemic barriers
- Feel marginalized by the professionalization of EPO efforts
- Other scientists see them as less serious scientists if they engage in EPO too much

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