Scientists’ Participation in Education and Outreach

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I presume one of the reasons I am serving on this panel is that I have the privilege to be the Director of Project ASTRO, a program which partners volunteer astronomers with 4th - 9th grade teachers in their local communities in 12 regional sites around the country. You can read more about this project in a separate paper on page 289 of this volume.

Lessons from Project ASTRO

Many of the key things we have learned from nine years of doing Project ASTRO are in resonance with what you heard from Pinky Nelson, Phil Sadler and others at this meeting:

- The most important thing we can do is to help teachers (and students) to be good learners.
- It is best to do fewer topics in an astronomy course or unit, but to do them more deeply.
- If you are not aware of what students (and their teacher) are currently thinking about a particular topic, it is much harder to move them toward new thinking.
- Vocabulary counts: don’t use jargon that your spouse’s family would not understand.
- Empower those you work with to continue their exploration after you are no longer there.

An Impressive Beginning

Looking at the achievements of the NASA OSS E/PO Effort, both here at this meeting, and in the new Annual Report, it is impressive to see what has been accomplished. Jeff Rosendhal and all of you have many, many reasons to be proud. I think it is fair to say that no other program in the history of space science education has had as many resources and as great an effect as the one we are celebrating here. It is a bold experiment, and, happily, it is an on-going experiment, still adapting to its audience and its growing capabilities. I am impressed by:

- The breadth and scope of what you are doing.
• The willingness to make changes as you learn more about what works and what doesn’t.

• The sincere effort of many parts of the Support Network to rethink the way things are being done (to be as effective as possible).

• The creativity of so many individual scientists and educators, trying to see what might work in the crazy educational environment in which we find ourselves in 21st century America.

Creating a New Profession

Not the least of the effects of your work is that a new cadre of “E/PO Professionals” is being created by this infusion of NASA OSS money. These are people whose entire or main line of work is doing education and outreach. Some have backgrounds in science, some in education, some in both. But it appears from discussions at this meeting that this group is beginning to think of itself as belonging to this new profession – a profession whose numbers were much smaller before your effort began.

Like any new profession, some of us have more enthusiasm than training. Some of us have been involved for a decade or more, but others have just recently joined the ranks. We have no agreed-upon credentialing in our profession, and no agreed-upon curriculum to take or give. So, many of us often just make it up as we go along.

Joining our ranks is very different from joining an established area of science. In E/PO there is no program to help new people get to know past practices and materials, or to learn the literature (which is, in any case, spotty and hard to find.) We hope the new journal, Astronomy Education Review, (discussed in a separate paper in this book) will help with this, but work published – or not published – a while ago may be harder to recover than work being done today. And, perhaps most significant, there is now little pressure on E/PO professionals to learn about work going on in other institutions before beginning their own work. These things are not easy to change, but will be absolutely necessary to change if we want to win greater respect for this new profession.

Can you imagine someone saying: “Well, I’ve been reading a bit about supernovae and have been thinking about them for a while. The whole field sounds like it needs a little straight-forward thought. So, while I haven’t taken any courses in astrophysics and I don’t really know the supernova literature, I think I’ll do supernova research.”

I hope that one of the ways we can help this situation is to set up many further opportunities for professional development for new people entering our field, so that they do not have to re-invent the wheel as they begin. On the other hand, the good news is that if anything is going to cause the academic space science culture in our universities to value education more, it is the work you are doing. You’ve got the ingredients that are needed – the involvement of scientists, the encouragement of a wide range of activities, and putting serious money where there were only words before.
Some Provocative Thoughts for the Future

So what about the future of your experiment? Here are a few provocative thoughts that might serve to spark some useful discussion at this meeting and as we return to our programs:

P-R Versus Education

In much of what you do, there is a tension between public relations and education. In public relations, we ask what our paying client needs to get done or sold or publicized, and then devise ways to get the consumer to accept the message or product. In education, we ask what the consumer needs, and try to get the paying client to meet that need. These two perspectives can clearly come into conflict. Those of you working for missions—look deep in the mirror and ask yourself: Would you give up your mission or project identification to do more effective education? Until some people have the courage to say yes to that question, the NASA OSS E/PO effort will remain more parochial and beside the point than it needs to be.

New Projects Versus Existing Ones

There is still too much emphasis in your system on creating something NEW and very specific to make your mark. Wouldn’t it be wonderful if educators in your system got as many kudos for bringing good existing projects and materials to new audiences as they get for creating new materials or programs for the same small group of interested teachers and members of the public?

NASA Chauvinism

Although this is slowly changing, there is in many parts of your system a NASA-centricism or NASA-chauvinism that really doesn’t seem necessary for a maturing organization. What I mean by NASA-chauvinism is that if NASA didn’t do it, it really doesn’t count or matter! This is still too often the case for web sites, written materials, or databases you produce. Ironically, you even exclude materials from others—including nonprofit organizations—that directly use NASA images or data. NSF-sponsored materials have no problems in mentioning the work of other organizations. (One presumes there is proper language that makes such recommendations those of the authors and not official NASA policy.)

Last-Minute Planning

Pinky Nelson reminded us that a typical NASA mission is not cobbled together in a garage overnight, but is planned and carefully built over a long time. Yet all too often the E/PO plan for a mission or project is indeed just thrown together at the last minute from whatever materials come conveniently to hand. There is often very little attempt to determine what is most needed or what could be the most effective. Nor is there much of an effort to seek the best partners for the work to be done. Instead, the work is either automatically farmed out to the group that did work in that subject area the last time or thrown at some local institution that is willing to make plans in a hurry. This, I gather, is as frustrating to the Forums and the Brokers as it is to outside groups hoping to
work with NASA or looking to NASA, with its abundant resources, to take a real leadership role in education. It may even be frustrating to those who eventually have to do this work that was planned too quickly and with too little input. Clearly, we need to find ways to help E/PO proposers do this better – to have a way to reach out to a larger group of E/PO material and service providers.

**Coordination Among NASA and Other Programs and Materials**

As I talk with people at this conference, and those doing astronomy education around the country, it is clear that almost no one has a good grasp of the variety of programs and materials that NASA offers. Even veteran NASA education professionals can’t keep track of who is doing what in E/PO in OSS and elsewhere. As a result, there is inevitable duplication and re-inventing the wheel. We must think of other ways that the entire system can encourage communication and coordination – internally and with the outside world.

Your resource database goes some way toward meeting this goal (and the new journal may help), but I believe that more resources should be brought to bear on organizing what has been done and is being done, rather than on creating even more separate programs and activities. Before a mission or a project prepares an E/PO proposal, wouldn’t it be great if they could ask an E/PO guru or consult a really good information base of past practices: What’s already been done (at NASA and elsewhere) in my arena and topic, and what is still really needed?

And, once materials have been produced (and tested), it would be good to find ways to get them more effectively in the hands of end users. Right now, the system for getting materials to those who need or want them can only be described as quantum mechanical. You never know where materials will pop up or who will get one and who won’t.

**More Evaluation**

The NSF requires both formative evaluation (checking things as you develop them) and summative evaluation (checking things after you’ve developed them). Admittedly, good evaluation is time consuming and expensive. Yet testing one’s materials and approaches under the supervision of people who really know education can improve them tremendously. It would be great if more evaluation help could be available throughout your system and project funds included both a requirement for and assistance with evaluation.

**More Training**

As I discussed earlier, both scientists and educators working for or with NASA could often benefit from further training in E/PO best practices, existing projects, lessons already learned, etc. While Cheri Morrow’s 4-day seminars are excellent, they reach much too small a fraction of those in your network. Other, shorter, more local ways could be found to make sure that everyone doing E/PO is putting his or her talents to best use. There are people and organizations around the country that could help those within your network do such training.
Conclusion

In planning for the future, we must also understand that we may be overtaken by events beyond our control. We have heard, for example, how national and state tests may really reduce the amount of astronomy and space science being taught in this country. With an emphasis on basics, with a focus on biology, chemistry, and physics, it may be that “no student left behind” turns into “no astronomy left” in our nation’s schools. The ongoing shortage of good science and math teachers is expected to get worse in the coming decade, and it is not clear whether our universities and colleges are really prepared to meet the growing need. Who then will be there to teach (or be allowed to teach) that module on the anisotropies in the cosmic microwave background that we have so lovingly developed?

It would be so good to put our “mission ego’s” aside and work together (inside and outside NASA) on the much greater dangers and needs in education that face us all.

Selected Books


Fraknoi, Andrew, et al, eds. *The Universe at Your Fingertips*. 1995, Astronomical Society of the Pacific. Features 87 exemplary astronomy and space science activities, selected from many sources, as well as resource guides and articles on effective teaching techniques.

Fraknoi, Andrew & Schatz, Dennis, eds. *More Universe at Your Fingertips*. 2000, Astronomical Society of the Pacific. Another collection of selected activities from groups around the U.S. and Canada, with additional resource guides and articles on effective K-12 space science education.


Selected Articles


Selected Web Sites

Astronomical Society of the Pacific Education Web Site
www.astrosociety.org/education.html This site has dozens of resource guides, complete back issues of the “Universe in the Classroom” newsletter on teaching astronomy in grades 3-12, information on Project ASTRO and Family ASTRO, sample hands-on activities, a solar system treasure hunt game, and much more.

Astronomy Education Review aer.noao.edu
A new electronic journal/magazine on astronomy and space science education and outreach, with research papers, articles, news, opinion, announcements and the opportunity to network with others doing E/PO.

Biography

ANDREW FRAKNOI is Chair of the Astronomy Program at Foothill College, and the Director of Project ASTRO and Family ASTRO at the Astronomical Society of the Pacific. He served as the Society’s Executive Director for 14 years, and was the founding editor of The Universe in the Classroom, the ASP’s newsletter on teaching astronomy in grades 3-12. For the last 21 years he has organized an annual, national workshop on astronomy and space science for teachers with the same title. He is the lead author on Voyages through the Universe (1997, 2000, Harcourt), one of the leading introductory astronomy textbooks and has written or edited over a dozen other books on astronomy and astronomy education. He has received the Annenberg Foundation Prize of the American Astronomical Society and the Klumpke-Roberts Prize of the ASP for his contributions to astronomy education. Asteroid 4859 was named Asteroid Fraknoi by the IAU to recognize his work in education and popularizing science.