

The Diversity of Roles for Scientists in K-14 Education and Public Outreach

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Scientists offer much that is needed to contribute to the realm of K-14 education and public outreach (EPO), including: 1) respect and influence in their communities; 2) deep knowledge of science and the scientific process; 3) exciting connections to real world exploration and discovery; 4) educational access to data and facilities; and 4) role modeling for students and teachers. Traditionally, many scientists have made school visits, acted as role models, and taught single lessons. Although helpful, there are much broader and deeper ways that the expertise of scientists and engineers may contribute. It is a misconception to think that participation in K-12 education and public outreach should be left to those few who are especially good at classroom or public presentation. There is a vast array of ways in which scientists can make valuable EPO contributions. Scientists bring a diversity of talents, interests, and time commitments to the realm of EPO and these can be well matched through a more comprehensive consideration of the options for their involvement.

Raising awareness about this greater diversity of EPO roles for scientists is the primary point of the attached Table: “A Sampling of Roles for Scientists in Education and Public Outreach”. The Table¹ offers a framework that describes the different levels of involvement in a variety of activities that contribute to improving science education in both formal and informal settings. Various entry points into the system are listed in the left-most column. One can advocate, be a resource, or join as a partner in different components of the educational system. The items listed in the Table are not comprehensive, but they are representative of a broader variety of EPO roles for scientists that are too often unrealized or unrecognized.

Each row of the Table represents a different type of entry point into the array of EPO activity. These range from Formal Education [classroom teachers, school districts, curriculum development, systemic reform efforts, etc.], to Informal Education [museums, planetariums, youth organizations, etc], to Public Outreach [educational TV/radio, popular science articles, public lectures, etc], to management of EPO programs that may entail all of these elements.² Engaging at the level of one classroom may not have as much leverage as engaging at the level of teachers, or at the level of a school district or state education program. Informal education and public outreach activities may reach large numbers of people, but might have less of an impact on learning than a long-term partnership with a teacher. There is a general trade-off between number of people reached and the depth of the impact. A balance of activities are needed across the EPO spectrum.

¹ The original version of this table was published in “Improving Science Education: The Role of Scientists,” by Rodger W. Bybee and Cherilynn A. Morrow, *Fall 1998 Newsletter of the Forum on Education of the American Physical Society*. The new Table adds rows for Public Outreach and for EPO Program Management, and separates introductory undergraduate teaching and working with schools of education into two separate rows. These changes complement rows representing many other points of entry into the realms of formal and informal education.

² Another white paper, entitled “A Framework for Education and Public Outreach Programs Associated with Scientific Research Programs” [available from camorrow@colorado.edu] provides further discussion of the terms “Formal Education”, “Informal Education”, and “Public Outreach”, and how these can be related to other important science communication activities such as support for the news media and marketing.

The columns of the table represent the nature of a scientist's EPO involvement: Advocate, Resource, and Partner. An **advocate** inspires, encourages, gives permission, and generally empowers others in their EPO efforts. This role is very often overlooked and yet when embraced by scientific leadership and scientists who are well regarded in their communities, it can have a very powerful, positive impact on education and the meaningful involvement of scientists in education. Well-informed advocacy can provide invaluable support for systemic reform and the EPO efforts of scientists in research institutions, academic departments, and government laboratories.³

A scientist acting as an EPO **resource** helps when called upon, and generally makes resources and facilities available to others in support of their EPO efforts. This can be a good intermediate level of involvement, basically responding when asked for information, access to data, presentation, or review. An EPO **partner** works "shoulder-to-shoulder" with EPO specialists to create new products or opportunities. This type of involvement is generally the deepest and most time consuming and may be remunerated. Nevertheless, time commitments can be fairly small or extensive for scientists acting as advocates, resources, or partners. Scientists engaged in EPO can usually be classified as one of the following three types:

1. Volunteer – those scientists whose professional focus is research, but who spend up to 10% of their time supporting K-12 education and public outreach (EPO) without any paid compensation. Volunteers are usually advocates or resource people who can benefit from having EPO professionals set up the partnerships and pathways for them to be effectively and efficiently involved.

2. Paid Part Time – those scientists who maintain professional standing as research scientists, but who spend some substantial portion of their paid professional time on EPO. The new trend for 50-50 appointments falls into this category.

3. Paid Full Time – those who have been trained to do scientific research, but who change careers, crossing over into becoming an EPO professional. Many EPO managers for NASA flight projects fall into this category. Those paid full time usually are involved in all ways, as EPO advocates, resources, and partners.

The contributions of scientists to education and public outreach are vital. Each scientist has an opportunity to match his or her own motivations, capabilities, and time commitment to the broad diversity of possibilities for valuable EPO involvement. The author invites any space or earth scientist to contact her for ideas about choosing an appropriate and enjoyable way to make a meaningful and rewarding contribution.

³ Bruce Alberts (President of the National Academy of Sciences), Daniel Goldin, (the NASA Administrator), and Rita Colwell (head of the NSF), have all made strong advocacy statements in favor of education and the science community's participation in education at all levels. See the presentation: "Scientists' Involvement in Education: Making the Case" by visiting <http://www.space-science.org/> (Go to Quick Links at the bottom of the page, and click on "Papers on EPO")

A SAMPLE of ROLES for SCIENTISTS in EDUCATION and PUBLIC OUTREACH (EPO)

Entry Point		Nature of EPO Involvement		
	ADVOCATE	RESOURCE	PARTNER	
K-12 STUDENTS	<ul style="list-style-type: none"> Participate in PTA 	<ul style="list-style-type: none"> Judge a science fair Answer student email Give tour of research facility 	<ul style="list-style-type: none"> Mentor a student Tutor a student 	
IN-SERVICE K-12 TEACHERS	<ul style="list-style-type: none"> Speak out in support of appropriate professional development opportunities for teachers. 	<ul style="list-style-type: none"> Answer teacher email Present in teacher workshop 	<ul style="list-style-type: none"> Work with a teacher to implement curriculum. Hire a teacher intern. 	
INTRO UNDERGRADUATE SCIENCE TEACHING	<ul style="list-style-type: none"> Speak out in a faculty meeting in favor of attention to educational research that supports the reform of undergraduate science teaching. Support the teaching profession in your science classroom. 	<ul style="list-style-type: none"> Teach a segment of a science or science methods course for pre-service teachers. 	<ul style="list-style-type: none"> Teach an intro science course that applies innovative inquiry-based methods Develop a science course or curriculum in your department for teachers-to-be. 	
SCHOOLS OF EDUCATION (Science Courses for Pre-Service Teachers, Graduate Students, Faculty Members)	<ul style="list-style-type: none"> Speak out in your department or organization in favor of closer ties with Colleges of Education Support the teaching profession in your classroom 	<ul style="list-style-type: none"> Teach a segment of a science course or science methods course for pre-service teachers. Collaborate with education faculty to improve courses on teaching science 	<ul style="list-style-type: none"> Hire a graduate in education as evaluator of an education project Work with an Education professor to develop a new "science methods" course for teachers-to-be. 	
SYSTEMIC CHANGE (District, State, National)	<ul style="list-style-type: none"> Speak out at professional meetings about the importance and value of scientist involvement in systemic change. 	<ul style="list-style-type: none"> Review science standards for science accuracy. 	<ul style="list-style-type: none"> Collaborate on writing or adapting science standards. 	
EDUCATION MATERIALS DEV. (NSRC, EDC, Lawrence Hall)	<ul style="list-style-type: none"> Speak out at a school board meeting for adopting exemplary educational materials. 	<ul style="list-style-type: none"> Review science educational materials for science accuracy. 	<ul style="list-style-type: none"> Collaborate to create exemplary science education materials. 	
INFORMAL EDUCATION (e.g., Science Centers, Scouts, Planetaria, Elderhostels, Amateur Astronomy Groups)	<ul style="list-style-type: none"> Participate on the board of a science center or planetarium. 	<ul style="list-style-type: none"> Review scripts for science exhibit or planetarium show. Serve as a science advisor for an exhibit 	<ul style="list-style-type: none"> Create content for a museum science exhibit or planetarium show. Serve as science coordinator for a scout troop 	
PUBLIC OUTREACH (e.g., NPR, PBS, popular magazines/books/encyclopedias, lecture circuits, public websites)	<ul style="list-style-type: none"> Advocate that quality science news be covered by your local newspapers and television stations 	<ul style="list-style-type: none"> Give a public lecture Review an article or web site on science for accuracy and currency 	<ul style="list-style-type: none"> Collaborate in the production of a PBS television show Write an article for a popular science magazine 	
EPO PROGRAM MANAGEMENT	<ul style="list-style-type: none"> Advocate the involvement of scientists in education and public outreach 	<ul style="list-style-type: none"> Assist a scientist with matching their talents and interests to an EPO project 	<ul style="list-style-type: none"> Design EPO programs with effective partnerships between scientists and educators. 	

