Literature on Scientist Involvement in E/PO

The contribution of scientists to education and public outreach has been a persistent topic of interest in this nation. This largely-bibliographic article combs some of the presentations and literature on the subject: what is known about the varieties of roles of scientists play, what they need in order to have an impact, and the barriers to their participation in E/PO.

Involvement and Roles of Scientists in E/PO

Key roles in K-12 outreach – dependent on career stage, gender (Andrews et al 2005):

- Give presentations on scientific topics away from or at workplace
- Tutor students
- Organize or judge science fairs
- Act as resource for K-12 teachers
- Help with teacher PD
- Mentor students and/or teachers

(Parsons 2008): E/PO activities of oceanographers and limnologists:

- Teach science at college level (68%)
- Contribute data, content or other services to public website (48%)
- Make presentations to the public, policy makers et al (44%)
- Contribute to / advise the media on science content (39%)
- Judge science fairs or other science competitions (38%)
- Make presentations to K-12 students in the classroom (34%)
- Help develop programs/materials for K-12 teachers and students (28%)
- Conduct lab/field experiences for K-12 students (26%)
- Involve the public / policy makers in their research (21%)

Motivations or Barriers to Scientist Participation in E/PO

Main motivating factors (Andrews et al 2005):

- Desire to contribute (volunteer work)
- Outreach is fun/enjoyable
- (For grad students) Chance to improve teaching and communication skills

Impediments (Andrews et al 2005):

- View of outreach as volunteer/auxiliary work, lower priority
- Time constraints
- Low value of outreach to the Department
- (For grad students) Lack of support from advisor or department
- Lack of information about outreach opportunities
- (Less important) Funding, Lack of interest, Lack of support for outreach, Not feeling comfortable doing outreach

Barriers mainly to scientists' participation in E/PO PD opportunities (inferred from Thiry et al 2008):

- (For both academic and government scientists) Low motivation due to lack of rewards, i.e. organization structure rewards research over teaching and service including outreach
- Lack of training in education, including availability and accessibility of training
- Lack of easily available knowledge of empirically proven best practices i.e. "what works"
- Lack of information/evidence about challenges in current educational practices

Barriers mainly to scientists' participation in E/PO (Parsons 2008):

- Lack of time (79%)
- Lack of financial support (53%)
- Lack of acknowledgment by institution / agency for such work (38%)
- Lack of staff (29%)
- Not sure what the public, teachers, and students need (22%)

Support/Assistance Scientists Need for E/PO Involvement

Recruitment into K-12 outreach (Andrews et al 2005) by:

- Institution-based/local outreach coordinator
- Colleagues/peers
- (For grad students) Professors
- Community or science organizations
- Own kids' school
- Flyers, posters, or ads

Professional development needs (Thiry et al 2008):

- Effective presentation techniques and teaching skills
- Ways to see how to apply E/PO PD to their own work
- Realistic (not burdensome) structure for involvement with outreach within their constraints
- PD workshops where both scientists and educators attend
- Research-based empirical knowledge and primer on best practices ("what works") in education
- Availability and accessibility of training in education, both to initiate outreach and to maintain commitment
- Better institutional reward structure for involvement and training in outreach
- Public valuing of E/PO work
- Professional network of colleagues for advice and support
- Building relationships with others also engaged in outreach

Support needed to overcome negative experience (inferred from Andrews et al 2005):

- Classroom management skills
- Logistics/organizational support
- PD on outreach skills

Assistance needed to be more involved or do a better job at E/PO (Parsons 2008):

- More funding (40%)
- More time (26%)
- Institution recognition / support including funding, tenure and training (21%)
- Match-making with educators, opportunities, funding sources (13%)

The Value of Scientist Participation in E/PO

From Laursen et al (2007):

- K-12 students engage in authentic, hands-on science activities that engage their interest in STEM, and influence their perception of scientists and STEM careers
- K-12 teachers learn science content and new ways to teach that content
- Scientists gain teaching skills and confidence, and better understanding of education and diversity issues
- Negative outcomes are rare, and can be avoided with advance communication and clear expectations between scientists and teachers, adequate contact time between scientists and students, a good understanding of target audiences' knowledge/skills/learning needs

Parsons (2008):

- Increasing public understanding of science (80%)
- Providing accurate information (61%)
- Focusing attention on environmental issues (60%)

References (refereed or non-refereed articles, reports, etc):

Andrews, E., Weaver, A., Hanley, D., Shamatha, J. H., and Melton, G. 2005, "Scientists and Public Outreach: Participation, Motivations, and Impediments," Journal of Geoscience Education,

Bybee, R. W., Morrow, C. A. 1998, "Improving Science Education: The Role of Scientists," Newsletter of the Education Forum of the APS, retrieved from http://www.spacescience.org/education

Drayton, B. and Falk, J. 2006, "Dimensions that shape teacher–scientist collaborations for teacher enhancement," Science Education, 90, 734

Jensen, P., Rouquier, J.-B., Kreimer, P., Croissant, Y. 2008, "Scientists Who Engage With Society Perform Better Academically," Science and Public Policy, 35, pp 527-541

Kim, C., Fortner, R. W. 2008, "Great Lakes Scientists' Perspectives on K-12 Education Collaboration," Journal of Great Lakes Research, 34, pp 98-108

Laursen, S., Liston, C., Thiry, H., Graf, J. 2007, "What Good Is a Scientist in the Classroom? Participant Outcomes and Program Design Features for a Short-Duration Science Outreach Intervention in K–12 Classrooms," CBE-Life Sciences Education, 6, pp 49-64

Laursen, S. 2008, "Scientists' Participation in Education and Outreach for the PBO Nucleus Project: A Report to UNAVCO"

Morrow, C. A. (date unknown), "Scientist Involvement in Education and Public Outreach: Making the Case," retrieved from http://www.spacescience.org/education.

Morrow, C. A. 2002, "Misconceptions Scientists Often Have About the K-12 National Science Education Standards." Astronomy Education Review 1, p.85-94

Palaez, Gonzalez 2002, "Sharing Science: Characteristics of Effective Scientist-Teacher Interactions," "Advances in Physiology Education" Vol. 26 No. 3, pp 158-167

Parsons, C. 2008, "COSEE NOW Annual Scientist Survey 2008 Report," retrieved from http://coseenow.net/files/2008/12/coseenow_scisurvey2008.pdf .

Poliakoff E., Webb, T. 2007, "What Factors Predict Scientists' Intentions to Participate in Public Engagement of Science Activities?," Science Communication, vol. 29 no. 2, pp 242-263

Taylor, A. R., Jones, M. G., Broadwell, B., Oppewal, T. 2008, "Creativity, inquiry, or accountability? Scientists' and teachers' perceptions of science education," Science Education, Volume 92, Issue 6, pp 1058–1075

Thiry, H., Laursen, S. L., Hunter, A.-B., "Professional Development Needs and Outcomes for Education-Engaged Scientists: A Research-Based Framework,"

Von Roten, F. C. 2011, "Gender Differences in Scientists' Public Outreach and Engagement Activities," Science Communication, vol. 33 no.1, pp 52-75

(Most recently updated in June 2012.
If you have additions or suggestions for topics to be added to this list, please email Mangala Sharma at MSharma@stsci.edu. Thanks.)