

6 What's Next?

In the last two sessions of the workshop, Session IV at the end of day one and discussions on the morning of day two, participants reviewed the ideas and themes that had arisen during the first three sessions and identified the issues that merited further attention.

The background questions for Session IV, moderated by planning committee member Mark Frankel, AAAS, are provided below:

What can we conclude about how to develop and implement programs, how to export them, and how to assess their effectiveness? What can we conclude about the development and use of effective methods and materials? What kinds of research, resource development and dissemination, and assessment activities do we need in order to respond more effectively in the future?

The following topics were on the agenda for the concluding session, which was headed by Rachelle Hollander, director of CEES:

Identify promising materials and practices and provide examples of successful approaches and outcomes, including those that have created bridges between research investigators and scholars and researchers with expertise in relevant domains of science and engineering ethics. Identify gaps in accessible and useful resources and in the knowledge base, and suggest future research, educational innovations, and outreach and dissemination activities.

In both sessions, participants reviewed the topics and summarized major themes that had emerged during the workshop. First, in response to new mandates for ethics

education and mentoring, academic institutions, research investigators, faculty, and students have undertaken many new initiatives and collaborative efforts to develop and implement ethics education and mentoring programs on their campuses. Second, a wide variety of potential resources for ethics education were identified. Third, the measurement of program effectiveness remains an unanswered challenge.

The ideas described below emerged from the workshop presentations and discussions. They are not listed in order of priorities and are not meant to express a consensus.

1. Context Matters.

What has been learned?

Societal rewards influence the behavior of organizations and individuals in ethically desirable and undesirable ways. Therefore, it is unrealistic to teach standards for ethical practice in scientific and engineering research that do not apply to the external environments in which they find themselves. In other words, ethics is not a vaccine that can be administered in one dose and have long-lasting effects no matter how often, or in what conditions, the subject is exposed to the disease agent. Teaching individual students and postdoctoral fellows good professional practices cannot be highly and widely efficacious until academic culture and society also model and reward ethical behavior.

My fantasy...would be if NSF could... actually ask universities every five years or so to do a self-study of their research practices. It would be amazing.

Deborah Johnson, University of Virginia

What should be done?

Academic administrations should provide evidence that they have established wide-ranging cross-institution programs to stimulate and reward ethically appropriate behavior, particularly in research settings. Professional societies, government funding organizations, and universities can cooperate on workshops to promote ethics, prizes for outstanding ethical leadership, and changes to the tenure process that reward outstanding mentors, for example. They and other individuals and organizations involved in ethics education in science and engineering should also look for ways to engage prestigious organizations and individuals in promoting these activities and expectations. For instance, laboratory directors might be asked to become members of the board of universities' ethics centers.

2. Learning Matters.

What has been learned?

Successful ethics programs generally require mandatory student participation,¹ involve relevant faculty, use interactive formats and case materials, and are scheduled throughout the year. Best practices include teaching for field-specific standards.

What should be done?

Examples of best practices in ethics education and ethics mentoring should be collected, and a repository or clearinghouse of information about these practices and

¹Carlin, D. and D. Denecke, *Best Practices in Graduate Education for the Responsible Conduct of Research*. Washington, DC: Council of Graduate Schools, 2008.

available materials should be created.² Ways should then be developed to disseminate these practices to many colleges and universities. Ethics educators and programs should also develop materials that are easily accessible and indexed for relevant audiences. The international aspects of graduate science and engineering education might require special attention.

NAE member Paul Citron, Medtronic (retired), urged that particular efforts be made to engage employers of scientists and engineers, to ensure that ethics education programs examine ethical issues in non-academic laboratories, government-university-industry cooperative research programs, and other settings engaged in or incorporating results from research activities. Many students and post-doctoral fellows do not become researchers or academics but work in settings influencing and influenced by research. This involvement would also provide a reality check about what industry wants in graduate education.

3. Criteria for Ethics Programs and Activities

What has been learned?

Reports from administrators, faculty members, postdoctoral fellows and graduate students indicate that stand-alone, online programs that students, post-docs, and faculty take on a “pass/fail” basis do not provide an adequate introduction or enough practical experience to prepare them for ethical problems that arise in academic and professional life. Additionally, they indicate that web-based resources that are regularly checked and updated, and part of a broader program can be useful, and that successful activities and

² NSF has announced its intention to solicit proposals to support the development of a digital library of ethics education resources of this kind; see Federal Register 74:37, 8818-9. NSF Responsible Conduct of Research, February 26, 2009.

programs include ethically relevant perspectives that take account and model different disciplines and professions.³

What should be done?

Successful programs have some common features: use of case studies, interactive formats, involvement of research faculty, and clear take-home messages. Even successful programs can be reinforced with supplemental material; and online resources and tools should be identified and classified to assist academic institutions, professional associations and societies, principal investigators, and faculty, employers, and individuals to develop and implement ethics activities of all kinds. These activities can range from mentoring programs to campus-wide, multi-level educational modules to consideration of materials from symposia that can be adapted and disseminated online or at meetings of professional organizations.

4. Interactivity Matters.

What has been learned?

Students have demonstrated a facility for and an interest in using online resources that are interactive and adaptable to meet their needs.

What should be done?

³ Carlin, D. and D. Denecke, *Best Practices in Graduate Education for the Responsible Conduct of Research*. Washington, DC: Council of Graduate Schools, 2008.

Online resources targeted to students should have accessible, engaging interfaces to take advantage of students' affinity for new media. Online materials must be updated to reflect changing issues and interests.

5. Mentoring

What has been learned?

Not all types of mentoring activities improve ethical outcomes. For instance, mentoring postdoctoral fellows to be successful in highly competitive environments can encourage unethical behavior.⁴

What should be done?

Institutions and principal investigators should identify ways in which research scientists and faculty or administrators with ethics education responsibilities can work together on mentoring postdoctoral fellows, especially, but also graduate students at the dissertation level. Particular attention should be paid to issues that affect international, minority, and female students and students who satisfy other diversity criteria, such as age or disability. Finally, professional societies and academic associations should establish and update a repository--or repositories--of information about successful mentoring activities and programs that can assist principal investigators and provide a basis for evaluating other mentoring activities and programs in the future.

⁴ Anderson, M. S., Horn, A., Risbey, K. R., Ronning, E. A., De Vries, R., and Martinson, B. C. (2007). *What do mentoring and training in the responsible conduct of research have to do with scientists' misbehavior? Findings from a national survey of NIH-funded scientists*. *Academic Medicine*, 82(9), 853-860.

6. Evaluation

What has been learned?

Attempts to evaluate and improve ethics education for scientific and engineering research and practice are just beginning. However, they do show that even though the immediate results of some programs are positive, circumstances and pressures can overwhelm graduate students, postdoctoral fellows, and junior faculty and researchers and undermine those results.

What should be done?

Agencies with an interest in ethical research should fund a workshop to develop evaluation criteria and measures for ethics education in science and engineering curricula, particularly graduate programs, and for mentoring postdoctoral fellows and last-stage graduate students. These measures should be applicable at the individual and institutional levels. Results from a portfolio of evaluation projects should be disseminated so the findings can be used to modify ethics education and mentoring practices. In addition, agencies should consider expanding assessment measures to include compliance officers in businesses, as well as academic institutions.

7. Social Responsibility and RCR (Responsible Conduct of Research)

What has been learned?

Approaches to RCR (often considered synonymous with “research ethics”) have focused on the internal demands of specific fields of endeavor and professions for standards of practice. The focus is mostly on meeting minimal standards of acceptable practice rather than on exemplary or recommended practices. The teaching of social

responsibility in science and engineering has focused mostly on issues arising from interactions between science and technology and society, such as environmental risk, medical and social equity, and computers and terrorism. Not much dialogue has been initiated between the developers of RCR programs and those engaged with issues of social responsibility of science and engineering. Employers, faculty, postdoctoral fellows, and students should be aware of questions arising in both. The larger issues of science, engineering, and technology in society are of great interest to everyone, including junior scientists, engineers, and students.

What should be done?

Educational institutions and federal agencies that support ethics education should encourage and reward programs that develop creative approaches to ethics education and teach the social responsibilities of science and engineering, as well as RCR, that carefully define and explore exemplary practices, and that integrate the issues of social responsibility and RCR.