NSF's "Broader Impacts" Criterion Gets Mixed Reviews

Every scientist who submits a proposal to NSF must address both the intellectual merit and the “broader impacts” of the proposed research. The broader impacts requirement is supposed to promote education, outreach, and benefits to society, but some scientists view the criterion as confusing, burdensome, inappropriate, or counterproductive.

The broader impacts section of a proposal could include a description of how the researcher will promote teaching, training, and learning; broaden participation of underrepresented minorities; enhance infrastructure for research and education; disseminate results broadly; or benefit society.

Bob Eisenstein, Chair of APS’s Panel on Public Affairs, was at NSF when the criterion was first put in place in the mid-1990s. He said that the criterion is meant to serve two purposes: first, it forces scientists to think more carefully about the ways in which their work impacts society, and second, it helps provide the public with more information about what scientists are doing.

Fred Cooper, a current NSF program director for theoretical physics, said his personal opinion is that this is a good thing for NSF to do. “I’m very happy to encourage people to think about these things,” he said. He says it is in scientists’ self-interest to do so.

However, some scientists object to research funding being coupled to education or outreach efforts. Mildred Dresselhaus of MIT says she has heard from many scientists who are unhappy with the broader impacts requirements, and who feel they should be funded based on the quality of their research, not for outreach. Many physicists feel they don’t have the expertise to do outreach activities, she adds. She thinks education and outreach should be encouraged, but shouldn’t be a requirement for research funding.

Some scientists, especially those applying for their first grants, find the broader impacts requirement confusing and burdensome. Given the low success rate for scientists applying for their first grant, Dresselhaus says that these beginning professors are overstretched trying to survive. They feel they have to do everything possible to get a grant, and they think that they must devote significant time and energy to addressing the broader impacts criterion. Dresselhaus describes this situation as “punitive.”

Broader impacts doesn’t have to be burdensome, said Eisenstein. There are a variety of things one can do, and NSF does not expect individual researchers to move mountains. “I think you can make a good faith effort to do reasonable things without a tremendous effort,” he said.

Cooper also didn’t think the requirements were onerous. He said that almost every scientist should be able to participate to some extent in outreach activities.

But some researchers do have trouble with the criterion. Ann Orel of UC Davis gave an example of a woman she knew who was applying for her first NSF grant. This woman, said Orel, was contributing to diversity simply by being a woman in physics, but the broader impacts criterion had her so confused and distressed because she didn't know what she had to do. "She's already doing outreach by existing," said Orel. By making it harder for this woman to apply for a research grant, NSF was actually being counterproductive.

Some scientists may be confused because the guidelines don't specify what activities a researcher has to do or how much effort is expected. Furthermore, the criterion may not be applied consistently by different reviewers, said Orel.

Greg Miller of UC Davis, who applied for NSF funding recently, also said that the criterion is too vague. "I think it's too open- ended. I don't know how to craft a good answer," he said. He felt the criterion was encouraging scientists to do things that would actually slow down the research, such as having undergraduates work in a lab.

The requirements are deliberately nonspecific in order to encourage creativity, explained Eisenstein.

Orel said that better mentoring might help young scientists understand what's expected. Also, Orel said she has been part of a panel that reviews NSF proposals. Researchers beginning their careers could learn a lot by sitting on these panels, she said.

Cooper suggests that one way to make it easier for scientists to fulfill the broader impacts requirement would be to have established education or outreach programs that individual scientists could join. This way, scientists would not have to develop their own outreach project, which might or might not be effective. For example, Cooper has started a program called TheoryNet, which brings theoretical physicists to talk with high school classes. Scientists could participate in such programs to do their broader impacts.

NSF grants that support large research centers often provide for extensive outreach projects. For instance, the Center for Nanoscale Systems at Cornell University, which is supported by NSF, devotes about 10% of its budget to broader impacts activities, according to Monica Plisch, Director of Education Programs for the center. These programs include workshops for high school teachers that include lab tours, talks by scientists about their current research, and hands-on activities that relate to the high school curriculum. The center also has developed nanoscience classes for undergraduates and mentoring and career advice programs for graduate students. Plisch says that most scientists at the center are supportive of the education efforts. Those scientists who want to participate can do so, and they are happy to work within a well-run established program, says Plisch. Those few scientists who don't want to participate in education and outreach aren't forced to do so, she said. "I want people who are excited about being part of this." Plisch has conducted surveys that show that the Center's education programs are effective. "Everyone gets something out of it," said Plisch.

Large research centers have the resources to set up these kinds of programs, but individual scientists with smaller research grants may not be skilled at planning and carrying out an effective educational activity. Orel said she thinks that educational activities are best left to large organizations that have the resources to do educational projects.

Individual scientists should be able to focus on pure research, and NSF is the only funding agency dedicated to funding pure research, said Orel.

Others, including Eisenstein, argue that broader impacts activities are something most scientists can and should do, and that it's appropriate that an education or outreach effort be related to the research project. Cooper says that being a responsible citizen is part of the duty of being a scientist. "If scientists don't do outreach, there won't be a next generation," he said. "This country is going to have a real crisis."

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