



Richard D. Boone is professor in the Department of Biology and Wildlife and the Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK. E-mail: rdboone@alaska.edu



Pat Marsteller is professor in the Department of Biology, director of the Emory College Center for Science Education, and director of the Hughes Science Initiative, Emory University, Atlanta, GA. E-mail: pmars@learnlink.emory.edu

## Avoiding a Setback to STEM

MANY NATIONS NOW SHARE THE COMMON GOAL OF ACHIEVING A HIGH QUALITY OF SCIENCE education at earlier stages of learning. The shared reality is that this will require the attention and action of thoughtful science and engineering professionals—their input to federal, state, and district education policies, as well as their strong support of science teachers.

In response to a serious decline in the quality of American science and mathematics education, President Obama, in his 2009 address to the U.S. National Academy of Sciences, called on scientists to become more involved in precollege [kindergarten through grade 12 (K–12)] education. But most scientists do not have the skills to interact with precollege students effectively. The best hope for constructive engagement may instead lie with the next generation of professionals—those scientists, engineers, and mathematicians now in graduate school. How will they acquire the skills and interest to engage with K–12 education? The answer is unclear. Most science, technology, engineering, and mathematics (STEM) graduate programs and most science agencies that support graduate education through research grants have not made training in teaching, communication, or outreach a high priority.

Since 1999, the U.S. National Science Foundation (NSF) Graduate STEM Fellows in K–12 Education (GK–12) program has been the outstanding exception. For this reason, NSF's decision to cancel this program\* makes no sense to those concerned with correcting the destructive imbalance that so strongly favors research over education in U.S. universities.

To date, the NSF GK–12 program has provided more than 10,000 STEM graduate students (GK–12 Fellows) with training in communication and pedagogy. The Fellows work directly with K–12 students 10 to 15 hours weekly for an entire school year. These young students engage in hands-on research with the Fellows, who serve as STEM experts in partnership with teachers. The graduate students in turn receive many benefits. An independent NSF-contracted assessment of the program found that compared to their peers, GK–12 Fellows were more engaged in their research, better able to explain STEM concepts to nontechnical audiences, and more interested in the connection between STEM education and public policy.† They also improved their time-management and collaborative skills and completed their degree programs on time. Importantly, the GK–12 Fellows served as positive STEM role models, inspiring young students to pursue STEM careers. The program has benefited more than 6000 public schools, nearly 12,000 teachers, and some 634,000 students.

When NSF decided to cancel the program, it cited a need to reformulate elements into other programs. We suggest that NSF's decision provides an opportunity for developing an enhanced program with many of the same elements. A “GK–12 enhanced” program would strengthen the connection between education and research in graduate training through collaborations with other federal agencies that currently support graduate student stipends (for example, the National Institutes of Health and the National Aeronautics and Space Administration). Fostering collaboration and problem solving across traditional disciplinary boundaries would require that graduate student projects be explicitly interdisciplinary with respect to the STEM learning activities created for the precollege classroom. In assessing the success of such a program, NSF would determine the effects not only on the graduate students but also on K–12 students' learning, attitudes toward science, and interest in scientific careers. A new, enhanced GK–12 program would maintain the partnerships and infrastructure already developed with NSF funding by the hundreds of GK–12 programs around the country (now in 48 states), with a focus on creating cycles of continuous improvement in education at all levels.

The GK–12 program has been a powerful force for strengthening education in the United States. It's time to take it to the next level.

– Richard D. Boone and Pat Marsteller

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\*]. Mervis, *Science* 331, 1127 (2011). †www.gk12.org/2010/11/18/evaluation-of-gk-12-program-now-available-released.