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Out of the Tower and into the Classroom OR How Classroom Partnerships Give Marine Science Grad Students an Edge

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During a late summer workshop, GK–12 fellows introduce partner teachers to their research and some methods they use. *Photo credit: C. Hopper Brill*

SIDEBAR

Out of the Tower and into the Classroom *OR* How Classroom Partnerships Give Marine Science Grad Students an Edge

By Carol Hopper Brill

Ocean science graduate students face a challenge. They must prepare for two careers: research scientist and communication specialist. Successful researchers have to be creative, innovative, and competitive within their disciplines in order to promote their work and build collaborations among their peers. But, the higher stakes surrounding current environmental concerns, shifting public perceptions of science, and growing emphasis on broader impacts mean that scientists also have to be effective communicators, able to explain the value of their research to a wide audience. How do we effectively give graduate students an edge in preparing for this dual role?

The National Science Foundation's (NSF's) Graduate K–12 Program was initiated in 1999 in part to address these issues by honing graduate student communication and pedagogical skills in science (Stoll and Ortega, 2013). In 2009, the Virginia Institute of Marine Science (VIMS)—the School of Marine Science at VIMS is a graduate school of the College of William and Mary—began a five-year marine-focused GK–12 project funded by NSF. The VIMS GK–12 Project, titled PERFECT (Partnership between Educators and Researchers for Enhancing Classroom Teaching), supported fellowships and training for 41 graduate students over five years. Through interactions with teachers and students in grades 7–12, fellows were expected to improve their communication skills; enrich classroom science, technology, engineering, and mathematics (STEM) content; and emphasize marine-focused examples, including their own research. The VIMS project accomplished all that and more. My role as co-project manager allowed me to interact with both graduate students and their partnering teachers to get a bottom-up perspective of outcomes.

What did our fellows do?

PERFECT sought continuity by establishing longer-term associations with selected schools and partner teachers. We worked with teachers in five secondary schools, with most acting as mentors for several years of the project. The fellows served as "visiting scientists" in their classrooms for an entire school year, and we found that successful partnerships between fellows and teachers started early. Following spring recruitment and an introduction to science education methods by VIMS educators, fellow-teacher partners began working together. Over the summer, fellows introduced teachers to their research, and teachers helped the fellows start thinking about how their research could fit into the science curriculum. Once the academic year began, fellows spent about 10 hours per week in the classroom (a total of 280 hours served).

Fellows provided authentic examples of the scientific process through hands-on demonstrations and lab and field activities, and within full lesson plans. They shared locally relevant research with students to show how science helps solves real-world problems. Establishing these prolonged relationships among fellows, teachers, and students was key. Fellows and teachers built respect for one another's expertise. Students built rapport with "their" scientist that helped dispel misconceptions and encourage appreciation of science as a career.

What's the value of a GK–12 experience to graduate students and the broader community?

The fellows cited increased competence, confidence, and skills gained from their experiences, and in the fellows' own words, drawn from the project evaluation process:

- *GK–12 has been an amazing experience for me. I have truly grown as a person and as a scientist [over] the duration of the fellowship. It has definitely made me realize how important communication is.*
- *I think that the students' perception of science/scientists has changed because of my presence in the classroom.*
- *The students knew that I was conducting "real" science in graduate school, which helped break down the wall between classroom lessons and real life. The fact that science is my career shifts the focus of memorizing details in a textbook to learning about real-world environmental issues and current events.*

Regardless of what career paths the current fellows decide to follow, the GK–12 program will help them excel. Hopefully, the students in our classrooms will decide to pursue careers in science or at least grow up into scientifically literate members of society.

How did major advisors rate the return on their grad students' investments in GK–12?

Advisors viewed GK–12 as a valuable experience that will help grad students in their job searches and careers. Several advisors reported obvious improvements in a fellow's ability to communicate. Fellows were better able to organize and express their ideas during presentations and interactions with others.

Despite concerns about the time commitment (40% of fellows were delayed by a semester or more), faculty acknowledged that the fellows learned better time management. Nearly 90% of the faculty would recommend this opportunity to other students. Overall, advisors were very complimentary of the project and the opportunities it provided (Kam Tang, VIMS, PERFECT Principal Investigator, *pers. comm*., 2014).

Were fellows effective in their contributions to science education, teachers, and their students?

During evaluation of the program, teachers enthusiastically reported:

- *Learning how to incorporate real scientific work being done by real scientists into my daily lessons is priceless! Students will relate to the scientist far better than they will to a textbook!*
- *Due to increased number of labs and activities in the classroom, and the real world applications emphasized by my fellow, my students' assessment scores were consistently and significantly higher than previous years.*
- *I am now better able to demonstrate the practical/applied value of scientific research, based on the work that fellows are doing.*
- *The program has brought greater variety into the classroom, more areas of science, greater diversity of teaching styles, plus real science career exposure for students that wouldn't have it otherwise.*
- *The long-term relationship students develop with fellows is what makes the big difference. It's not just a shot of science, but a steady diet.*

Continuing support for the GK–12 model at VIMS

Although NSF discontinued the GK–12 Program in 2011, the popularity and efficacy of the concept continues, as highlighted in the American Association for the Advancement of Science and NSF GK–12 Program report, *The Power of Partnerships* (Stoll and Ortega, 2013). Other national and institutional programs use similar tiered structures to bridge the gap between scientists and the educational community. Nationally, institutions are seeking ways to continue GK–12 style models (Ufnar et al., 2012), especially in light of growing emphasis on broader impacts efforts.

At VIMS, the faculty valued the additional skills, tools, and marketability that GK–12 offered their students. In 2012, the VIMS Dean of Academic Studies, Linda Schaffner, began seeking funding to continue our institution's project. At present, we are operating on a smaller scale, using private money. We're testing a variation of our initial model, with fewer graduate students, each working the classroom for a single semester.

Is the value added of GK–12 type program worth the investment?

Can working in a K–12 classroom give graduate students an edge by honing their career skills, helping them communicate more clearly, and encouraging them to view their research from new angles, make contributions to education, and change community perceptions about science and scientists? In my experience—absolutely! We track the career progress of past fellows, who report that GK–12 directly contributed to their success in competing for jobs or fellowships. Fellows are working on higher degrees or postdocs; conducting research; teaching at universities, high schools, or science centers; serving as science policy advisors in government; and running nonprofits or working in private science industry. Two former fellows have jobs involving entrepreneurship.

In the foreword of NSF's final GK–12 program report (Stoll and Ortega, 2013), the fellows are identified as "part of a new generation of renaissance scientists and engineers who can do much more than research—they give back to society through their teaching, public engagement, and rich communication skills." I couldn't agree more. So, let's work to get our marine science graduate students out of the tower and into the classroom. I recommend joining the National Alliance for Broader Impacts (http://broaderimpacts.net) and taking advantage of its online network to get in on the conversation about effective ways to benefit graduate students, faculty, and institutions through broader impacts practices.

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Fellows created diverse activities to stimulate student interest in science. *Photo credit: C. Hopper Brill*