Bridging the gap: spanning the distance between high school and college education

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As graduate students, we are immersed daily in the practice of evaluating and critiquing research and we have a good understanding of the scientific mindset. Why not share this insight with others who would benefit?

In 2006, a National Science Board survey found that American adults lacked a solid foundation in scientific concepts. Even more worrying, those surveyed were ill-equipped to rectify this knowledge gap: when asked about a simple experimental design, fewer than half understood the value of using a control to calibrate observations (NSF 2008). The methods that scientists use every day have applications far beyond the research lab. Sharing our understanding of creative and systematic methods of inquiry has the potential to benefit more than just our scientific peers.

The National Science Foundation (NSF) views education and outreach as crucial to its mission. NSF supports projects designed to bridge the gap between young students (tomorrow’s citizens) and educators (today’s graduate students and professors) with a passion for their studies. Through collaborations with teaching faculty at public schools (Graduate Teaching Fellows in K-12 Education), over 140 universities nationwide provide graduate students with an opportunity to express their enthusiasm for science to an audience in desperate need of scientific inspiration. These “GK-12” programs span many disciplines, including science, technology, engineering, and mathematics.

Southern Illinois University Carbondale (SIUC) recently initiated a GK-12 program (www.siu.edu/~heartlandGK12/), to which the authors of this article (a pollination ecologist and plant biologist) belong. Other members of the first-year GK-12 team include graduate students in microbiology and geology. Working with students studying environmental science, anatomy, biology, and the physical sciences at all age and achievement levels, we facilitate learning both inside and outside the classroom and now have a better understanding of the challenges public school science teachers face. Without exception, public schools would benefit from increased graduate student outreach. Since we stand to gain as much as the public schools, the relationship is mutually beneficial. If outreach interests you, but you are unsure how to become involved, consider the following ideas.

Does your university have a NSF GK-12 program? The easiest way to become involved with youth science education is through previously established programs. Graduate students currently involved in outreach at participating universities will appreciate any ideas, assistance, or supplies you can provide. If your university does not have a GK-12 program, consider approaching faculty about setting one up.

Involving university science clubs. Set up a branch of your university’s sustainability club for students, bring the insect collections of your entomology club to a classroom, or provide opportunities for club members to act as judges for local science fairs. Those involved in clubs are inherently enthusiastic about their organization, and their excitement can inspire youngsters in ways traditional teaching may not.

Be a liaison. The responsibilities involved in maintaining a classroom leave teachers little time to stay informed about upcoming events at local universities. Informing teachers about guest lecturers, exhibits, or other activities provides an opportunity for teachers to arrange for young students to experience science outside the classroom.

Volunteer to tutor. Public schools frequently provide after-school tutoring for students. Ironically, the students hardest pressed to find appropriate help are those in college-level classes. Many tutors are generally unequipped to help these advanced students. You, on the other hand, possess the appropriate knowledge base to help them understand complex science topics.

Engage teachers and students in fieldwork. If your fieldwork is carried out locally, invite teachers or students to volunteer their time; this is a valuable way for students of all ages to experience the joys of scientific discovery, and it means free fieldworkers for you!

Give school presentations. With your expertise in a particular field, you are well-positioned to bring not only enthusiasm and passion for science to the classroom, but also current technologies, applications, and real-world examples illustrating its value.

Volunteering time for outreach is not without cost. We ourselves have struggled to balance graduate and outreach pursuits. One of us (OM, the pollination ecologist) recently presented to a group of 4-H students. Even though the subject is one she knows well, it took time to prepare an engaging lesson with hands-on activities (they dissected flowers, found the sources of pollen and nectar, and discussed the importance of the spatial relationships between these two). Despite its success, she wondered later – as she scrambled to finish a paper
due for one of her own classes — whether she could have
taught the same material with less effort. Obviously,
prioritization is a challenge; you must be judicious in how
you choose to spend your time.

Considering that, among graduate students, to-do lists
are longer than attention spans, you might be justified
in asking, “Why would any right-minded graduate stu-
dent want to devote time to commune with younger
students?” First, listing previous involvement in out-
reach on your résumé is beneficial in academia.
Outreach is often viewed advantageous by grant
reviewers, some of whom rank such “synergistic activ-
ities” as highly favorable attributes of submitted applica-
tions. Second, a future in academia at the university
level often includes teaching underclassmen who are
recent high-school graduates – the opportunity to prac-
tice the art of communicating science before you are in
this setting will make your first years as a new professor
easier. Regardless of your future plans, such an oppor-
tunity will give you confidence and opportunities to prac-
tice thinking on your feet. Finally, watching students
engage, learn to inquire, and seek out answers is a
refreshing reminder that discovery – the essence of sci-
ence – is fun. Encouraging these activities in the class-
room cultivates critical thinking skills that will serve
students and teachers alike for a lifetime.

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Faculty response

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As co-PIs of an NSF GK-12 grant (#DGE-
0638731), we can attest to the benefits and
costs of graduate students undertaking out-
reach activities in public schools, as outlined
above. As faculty members, we suggest sev-
eral more outcomes that we have observed in
graduate students who have participated in our program.
We have heard similar outcomes from faculty at other
institutions, who work with GK-12 graduate students.

Most notably, we have seen a considerable increase in
the ability of our students to successfully explain their
research to diverse audiences. Students are able to gauge
the information suitable for each audience, and they
understand how to present their research findings in an
organized and clear manner. The experience of teaching
fundamental science principles to children and their
teachers has meant that graduate students have had to
be certain that they themselves clearly understand the
fundamentals to begin with. They are also better able to
talk about science, since they practice doing this in the
schools on a weekly basis. In a well-conceived GK-12
program, graduate students participate in seminars and
activities that prepare them for their teaching role in
the schools. They gain an understanding of pedagogy,
learning styles, class management, and other skills that
benefit their résumés, their job interviews, and their
first college teaching experience. Some graduate stu-
dents in the GK-12 program have produced publica-
tions as a result of their experiences.

We acknowledge the cost, in terms of time taken by
outreach activities, but another important outcome of
participation in the GK-12 program is that students
improved their abilities in time management and priori-
tization of tasks. Our GK-12 students spend 15 hours
per week teaching and preparing for class, yet they are
no slower to complete their degrees than students who
have not participated in the program.

There have also been some unanticipated outcomes.
Students report that their association with school chil-
dren and teachers has provided them with a valuable
connection to the local community and added a dimen-
sion to their lives outside of academia. Our graduate stu-
dents are essentially acting as ambassadors for our insti-
tution, which has had positive benefits in terms of how
we are perceived in the community at large.

We have noted our experience with the benefits and
costs to graduate students, but – as faculty – we could
also make a similar list. The greatest benefit to faculty
is that the GK-12 program provides graduate student
funding and tuition. Just as importantly though, their
participation in outreach produces a more well-
rounded graduate student, who has additional opportu-
nities for employment upon graduation. Finally, as
Messinger and Schuette note, helping others to learn
science can be fun and satisfying. As faculty, we know
that; and by encouraging our graduate students to share
their knowledge with others, we can help build a cul-
ture that values these activities.

References

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