

Mutually Beneficial Classroom Activities from First-Year Fellows

Description of Activity: We developed a lesson that modeled my dissertation research and presented it to 9th grade chem-bio classes at my partner district. For this lesson students were supplied with plastic fish with magnets on them that varied with how magnetic they were. This variation in magnetic strength simulated intra-population variation in behaviors (bold vs. shy). These plastic fish were placed into a 5 gallon bucket (the lake) and fished using a wooden dowel with a string tied to it with a magnet on the end. Differences in fishing regimes, heritabilities, and reproductive success of the behaviors were used to have students observe how the frequency of bold and shy fish can change over generations. The lesson really challenged me to discuss evolution in very simplified terms but I found it very beneficial because the way I conveyed my research to the 9th graders is really the level that I also need to be at when I convey my research to the general public, and specifically, fisherman.

Fellow Contribution: Knowledge relating to the standards that needed to be covered, primarily how evolution by selection works, knowledge of my study, the idea for the lesson and preparing a schematic of how it could go.

Teacher Contribution: working with materials to get the simulation to run right, providing insight on content that the students would have previous experience with and the concepts that would be entirely new, working out the logistics of conducting the lesson in the class and by helping refine the lesson to make it run more smoothly in the classroom.



Nick Ballew- PhD
Candidate in Zoology



Kali Bird- MS student
in Microbial and
Molecular Genetics

Description of Activity: As a scientist, I understand the importance of variability--both natural variability and experimenter-introduced variability. To help a class of AP Biology students working on independent projects also understand this importance, I developed a replication activity. I created experimental scenarios that were similar to several of the students' project designs. Next, in the statistical program R, I created and printed mock data- each datum was cut and placed into a jar for 'sampling.' The students then took either 1, 5, or 10 samples from each jar. We then discussed how the data differed between the first and last sampling events (with increasing replication), and how they differed among jars (which have data drawn from different distributions). The students could easily see how taking only a single sample, could easily lead a researcher to draw false conclusions. They also began to understand that taking many samples also helps us to understand the natural variation in a population.

Fellow Contribution: I designed the lesson from my knowledge of experimental design, statistics, and the students' projects. I then brought the materials and led the activity with the students. I believe that my ability to easily create mock data from defined sample distributions using a statistical program is a skill that most K-12 teachers would not have.

Teacher Contribution: My partner teacher and I had many discussions about the needs of the students and what they continually struggled to understand. She encouraged me to create lessons to help them understand the scientific process, including things such as the importance of replication in experimental design.



Liz Schultheis-
PhD candidate in
Plant Biology

Description of Activity: Another fellow (Melissa Kjelvik) and I designed an activity to teach students about what makes a successful invasive species. Students first had the opportunity to discuss invasive species that they have encountered. They were then given background on what I research - common characteristics of invasive species. Each student was then given a species card, some native, some invasive. Different events allowed the students to move forwards and backwards and eventually make it into the "community". Each round of the activity resulted in a different community and taught students what events help invasive species outcompete native species. This activity was a good challenge for me, as it gave me the opportunity to relate a complex topic in a simple way. This activity addresses topics covered in my research, such as the community assembly, competition, and disturbance. It was very satisfying to see students at the end of the day calling out characteristics that make a good invader.

Fellow Contribution: Melissa came to me after she was asked to help teach invasive species. Because our program encourages collaboration and creativity, I got to use my knowledge of invasive species to teach in another school district. Observing Melissa (second-year fellow) teach and manage the classroom has helped me work with the students in my own classroom.

Teacher Contribution: Melissa's partner teacher (Connie High) received an email from a 4th-grade teacher asking for help with invasive species. Connie's flexibility and openness to distributing her fellow's time allowed Liz and Melissa to work together.



Alycia Reynolds Lackey-
PhD candidate
in Zoology

Description of Activity:

I went into a fourth grade class to help the teacher cover content on vital needs of organisms, habitat use and food webs. The students placed organism cards in different environments and we discussed the relationships of species within and across these environments. I then helped facilitate a discussion on what organisms need to survive-including comparisons of plants and animals. Then small groups of students picked a new organism and had to draw the organism in its habitat and label its needs. We had the students share their pictures and explain how the organisms met all their needs in their habitat.

Fellow Contribution: I led the discussion and worked with the students on developing their drawings to include all the needs. I helped extend the lesson that the teacher already developed by adding more complexity and thought into how food webs can be taught by comparing organisms used in this lesson.

Teacher Contribution: The teacher interjected with stories or descriptions that helped the students identify with the concepts/animals/habitats I was talking about. This co-teaching method helped me learn how to explain the simple, core concepts of organism-habitat relationships.

Recipe for Success Ingredients

The **Partner Teacher-Fellow** team is the centerpiece of our program, and one of the reasons we think we've had success. A good deal of the professional development of fellows takes place through this partnership. During the first GK-12 project we called this "mentor" teacher, but we felt that this implied certain roles in the fellows & teachers that ended up looking more like an apprenticeship, and less like a partnership. Thus, in our new project we have "partner" teachers, which sets a much more equitable tone for this relationship

First Ingredient: GREAT PEOPLE!

- *K-12 teachers*- One of the most important reasons our project is successful is because of the openness, enthusiasm, and competence of the K-12 teachers that we work with. Beginning with its roots in the K-12 partnership, we have established strong working relationships with these teachers over a decade.
- *Partner teachers*- In our program, teachers that want to consistently work with a fellow throughout the school year apply to be a partner teacher. This allows the leadership team to match teachers and fellows based on skills, personality, and experience.
- *Leadership team*- We have a great deal of diversity amongst our PIs in terms of academic discipline. This gives fellows the opportunity to gain professional development through many venues. Having science education researchers working with our project not only provides pedagogical training but gives fellows opportunities to further their interactions with K-12 experiences by helping with this research.

Second Ingredient: Trust and Understanding

The worlds of teachers and graduate students are very different. In fact, not understanding each other's worlds can lead to problems with the fellow-partner teacher relationship. To avoid this:

- Get the fellows IN THE CLASSROOM: A good way to understand the demands and pressures of working in K-12 schools is to get the fellows into the classroom as soon as possible to observe the life of a teacher.
- Get the teachers IN THE LAB: During the summer we have our teachers join their partner fellow in the lab/field. Teachers not only can appreciate the demands of the research world, but also learn more about their fellow's dissertation research.
- We have the partner teacher-fellow team work together at our Summer Institute to develop a lesson plan that addresses education content standards AND is based on the fellow's dissertation research. Starting the partner teacher-fellow relationship in this supportive, collaborative environment facilitates year-long positive experiences together.

Third Ingredient: Clear Expectations

The roles and expectations of teachers, fellow and project leaders need to be clearly defined, communicated, and agreed on early. One of the most important lessons that the KBS GK-12 project has learned is to *clearly state expectations* both of graduate fellows and mentor teachers that *incorporates input from leadership, graduate fellows, and teachers*, and ensures *clear and open communication* between graduate students and their mentor teachers. These expectations include weekly time commitments for fellows and responsibilities of partner teachers.

Fourth Ingredient: Training and Flexibility

Although expectations are set early on, our program encourages creativity and flexibility. This often leads to a "fellow ontogeny". As fellows get comfortable in K-12 classrooms they go from observing and co-teaching lessons to leading and teaching pre-developed lessons to preparing new activities (week-by-week and then multi-day/longer term) to curriculum development and education research.

To summarize, we see successful partnerships as playing on the strengths of fellows and teachers, such that both contribute meaningfully and learn from one another. Allowing flexibility in how this is accomplished opens doors for creativity and motivated fellows to excel. Identifying the strengths of those involved in the project ensures that time is used efficiently and effectively, and that fellows gain meaningful professional development that enriches, and does not hinder, their progress in graduate school. (flip page to see examples of fellow activities)

GK-12 National Meeting-Preparing fellows for the classroom- What works and what doesn't
"A recipe for success" handout- MSU KBS GK-12 program

