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A Lesson in Prairie Conservation: An Example of Collaborative Science Outreach to Local Community Schools through Cooperation between Local Industry and Undergraduate Students at a Local University

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Participants

Individuals from three institutions played a role in the completion of this project: representatives of Purdue University (West Lafayette, IN) Biology Department, representatives of Mintonye (Lafayette, IN) Elementary School, and a representative from Eli Lilly Company. Purdue University representatives included seven undergraduate biology majors, two graduate students, and one biology faculty member. Undergraduate students represented a subset of those enrolled in the sophomore core biology laboratory courses. Mintonye Elementary School representatives included 11 teachers and 300 students, grades K-5. The Eli Lilly representative was the head of the company's Wildlife Habitat Team at the Lafayette branch.

Overview of Project

Eli Lilly Company provided supplies for undergraduate students to plan and deliver lessons in prairie conservation to local elementary school students. The resulting lesson and laboratory experiment focused on purple coneflower germination. Elementary school students planted mature coneflowers, grown during the course of the experiment at Eli Lilly's local prairie restoration plot.

Eli Lilly's Role

Eli Lilly had three main objectives to accomplish through their participation in this project. These included: (1) Community service, in the capacity of providing resources for education of local elementary school students. (2) Improvement of the company's local prairie restoration plot, accomplished with help from local elementary school students. (3) Positive publicity, gained through

media coverage of the community service project and through word-of-mouth among community members involved in the project. Eli Lilly's contributions included funding for supplies needed in both the lesson and the experiment. The Eli Lilly liaison also acted as a resource for idea exchange for elementary school teachers and university students involved in the project.

Purdue University's Role

The objectives for Purdue's undergraduate participants were as follows: (1) Develop a unique, interesting lesson on prairie conservation for use in an elementary school setting. (2) Interact with local elementary school students while teaching the lesson developed for the project. (3) Gauge student and teacher perceptions of the lesson using surveys. (4) Attempt publication of the lesson in an appropriate peer-reviewed science education journal. The graduate students acted as facilitators for achieving these objectives and as coordinators of activities relating to the project. The biology faculty member acted as supervisor for the university student group.

With input from the elementary school teachers and with guidance from the two graduate students and the faculty member in charge, the undergraduate students developed the following objectives for the elementary students participating in the project: (1) Develop a basic understanding of the germination process. (2) Practice applying the scientific method. (3) Recognize the characteristics of purple coneflowers and their importance to prairie conservation. (4) Determine the effects of salt and fresh water on germination of purple coneflower seeds. University students identified the corresponding state science standards for each objective and shared these with the elementary school teachers.

Elementary Students' Experiment

Purdue undergraduates spent two periods in the elementary school classrooms presenting their germination and prairie conservation lessons to the younger students. At the conclusion of these lessons, the undergraduates guided the elementary students in designing an experiment involving purple coneflower seed germination. The resulting hypothesis was that salt water would inhibit the germination rate of purple coneflower seeds. To test this hypothesis, elementary students soaked purple coneflower seeds overnight in either fresh water or salt water. The next day, seeds were "planted" on germination paper in Petri dishes and sealed in plastic bags. Seeds were observed daily for the next few weeks, and germination rates were recorded using graphs, tables, and journals. Data were analyzed, and the elementary students observed that 100% of the seeds germinated in fresh water, while no seeds germinated in salt water. The students concluded that fresh water provides a better environment for germinating purple coneflower seeds, which suggests that conservationists should take care in planning prairie conservation restoration projects along Indiana roadways that may receive a large amount of road salt during the winter months.

Seeds that survived the course of the experiment were grown to maturity in greenhouse trays (about 10 weeks). After hardening off, mature coneflower plants were planted by elementary students at the Eli Lilly prairie restoration site. Eli Lilly provided lunch for participating students. A local television station filmed the field trip, and a Purdue news writer also covered the event.

Survey Results

At the conclusion of the lessons presented by the Purdue University students, anonymous surveys were administered to participating elementary students and their teachers. These surveys

were intended to gauge the elementary students' understanding of the concepts presented in the lessons, and provide helpful feedback for the undergraduates regarding lesson preparation.

The kindergarteners and first-graders received a more simplified version of the survey presented to the second-, third-, and fifth-graders (Figure 1). Results from both versions of the survey were very similar; therefore, only the results for the older group of students are presented here. The survey asked students to rank their responses to questions according to the following 3-point scale: 1 = agree, 2= no feeling, 3 = disagree. Overall, elementary students seemed to agree that the Purdue undergraduates were easy to understand, and that they did a satisfactory job answering questions. Additionally, elementary students seemed to agree that the lesson was interesting, that they learned about the germination process, and that the lesson was well-taught and interesting.

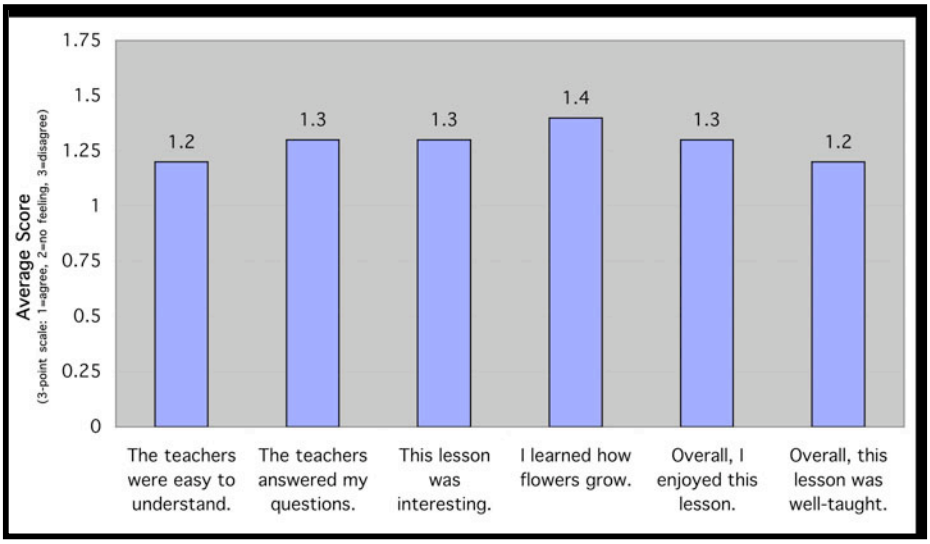

Figure 1. Survey results from the second, third, and fifth graders. Students responded to questions based on a 3-point scale (1 = agree, 2 = no feeling, 3 = disagree). Overall, students agreed to questions asked, with no response above an average of 1.4.

The survey administered to the elementary school teachers (Figure 2) asked them to rank their responses to questions according to the following 5-point scale: 1= strongly agree, 2= agree, 3 = no feeling, 4 = disagree, 5 = strongly disagree. Overall, teachers agreed with most statements, with no responses higher than an average of 1.6.

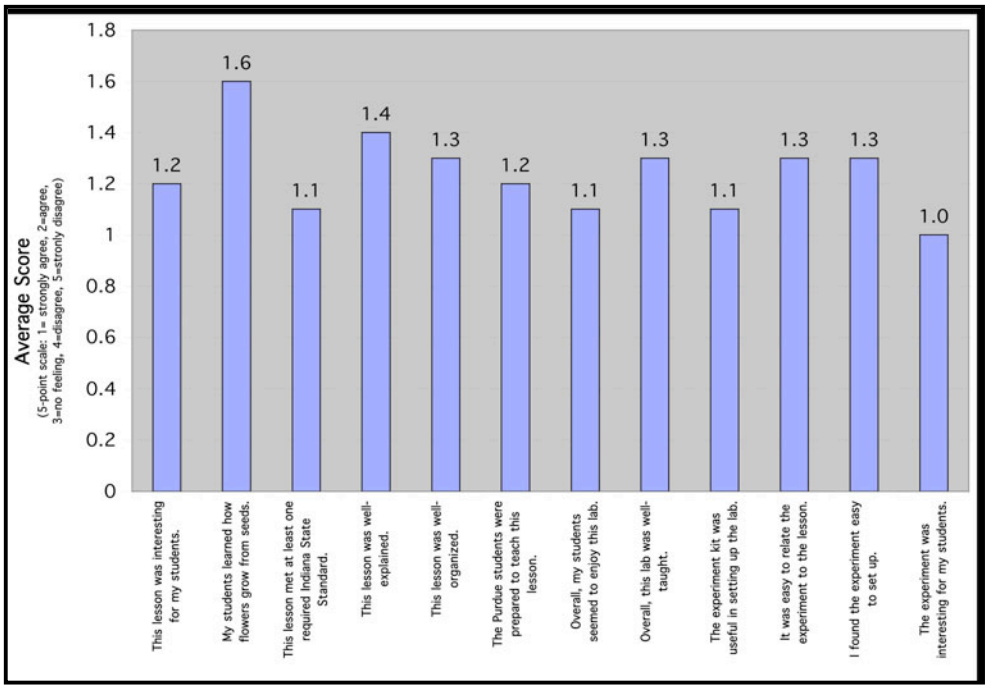

Figure 2. Survey results from the elementary school teachers.

Conclusions

The following conclusions can be drawn from the results of this project: (1) Elementary school students seemed to enjoy the lesson on purple coneflowers and the experiment on purple coneflower germination. (2) Elementary school teachers seemed to think that the project was interesting and useful for students, and that the concepts presented in the lesson and experiment conformed to one or more state science standards. (3) Purdue University undergraduate students gained experience in developing lessons for teaching younger students about science and conservation issues. (4) Eli Lilly Company was able to donate resources back to the local community, as well as receive plants and free labor for their prairie restoration initiative.

Future Goals

Goals for the future of this project are: (1) To continue the cooperative project with Eli Lilly and Mintonye Elementary Schools (achieved in 2004, with about 50 fifth-graders participating in the same project). (2) To increase the number of Purdue undergraduate biology majors involved. (3) To expand the number of local elementary schools involved. (4) To write an article about the project for submission and publication in a national science education journal.

Publications to Date

The group of Purdue University undergraduate biology majors involved in the project has had six papers successfully published on various topics taught to local elementary and middle school students in the past two years. These papers include:

- Paul Hammond, Mark Balschweid, Sue Karcher, Herb Ohm. December 2003. Involving Undergraduates in Research and Publishing: A Holistic Approach. *National Association of Colleges and Teachers of Agriculture*, v47 n4 p2-6.
- Paul Hammond, Nikole Brown, Doug Hauser, Katrina Pomart, Sue Karcher, Mark Balschweid. What Poisoned the Apple Juice? A Gram Staining and Selective Media Lab. *Science Teacher,* v69 n1 p35-39 Jan 2002.
- Amanda Puckering, Lauren Synenki, Kristin Moore, Melissa Steapleton, Paul Hammond, Katrina Pomart, Dorothy Sisken. Become a Laboratory Investigator: Detect the Presence of Nuclei in Red Blood Cells. *Science Activities,* v39 n4 p22-27 Win 2003.
- Paul Hammond, Ann Yager, Brigitte Goble, Jamalyn Evans. A Scenario-Based Seedling Anatomy Exercise for Middle School Students: "What Caused the Cattle to Bleed to Death?" *American Biology Teacher,* v64 n7 p521-24 Sep 2002.
- Paul Hammond, Mary Oxley, Ben Ealing. Gel Separation of Isozymes to Study Relatedness of Common Bean Cultivars from Around the World. *American Biology Teacher*, v64 n5 p358-363 May 2002.
- Sara Florine, Paul Hammond, Katrina Pomart, Mark Balschweid. Testing for Starch, Respiring Tissues, and Vascular Bundles: Inquiry-Based Seed and Stem Anatomy Labs. *Science Activities*, v38 n4 p22-27 Win 2002.

Two of the six papers list undergraduates as a first author; the remaining four papers list one or more undergraduates as contributing authors. The activities of this group provide unique and interesting opportunities for students to be a part of the publication process as undergraduates.

How can this be applied at other institutions?

This or a similar cooperative project can easily be applied at other educational institutions. Most colleges and universities are located near a community that includes local industry or business. Proximity allows for organization and development of a cooperative project that uses resources from the educational, community, and industrial sectors while contributing to the growth of each of those sectors. The project outlined here is an example of one that is important to the community in which it was completed; prairie conservation is a significant issue to northwestern Indiana because of the area's history as part of the Midwestern prairie. This topic is probably not as pressing elsewhere; institutions looking to implement a similar cooperative project should consider science issues that are more appropriate for their geographic region. Any science or conservation issue can be used to foster the type of cooperation that occurred with this prairie conservation project.

To encourage participation from university students, the educational institution may offer an incentive in the form of course credit. For the project outlined above, students received one credit (course offered as "Hours To Be Arranged"). This makes participation attractive to high achieving and self-motivating students, which is a benefit to the overall project. The faculty member in charge should set the guidelines for grading and requirements for satisfactory completion of the credit(s) offered. In this way, each institution may orchestrate project participation to its own needs and objectives.

Finally, a project such as the prairie conservation lesson provides an opportunity for service learning, not only for the undergraduate students writing and teaching the lesson, but also for the elementary students involved in the project. Purdue University biology majors generally do not have opportunities such as this to interact with younger students and spark their interest in science. In addition, the Purdue University undergraduates in this project seemed to look forward to getting off of campus for a few hours and connecting with members of the community around them. The elementary students seemed to enjoy interacting with older students and learning about science, as well as making a difference in the community by adding plants to the local prairie conservation plot.

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