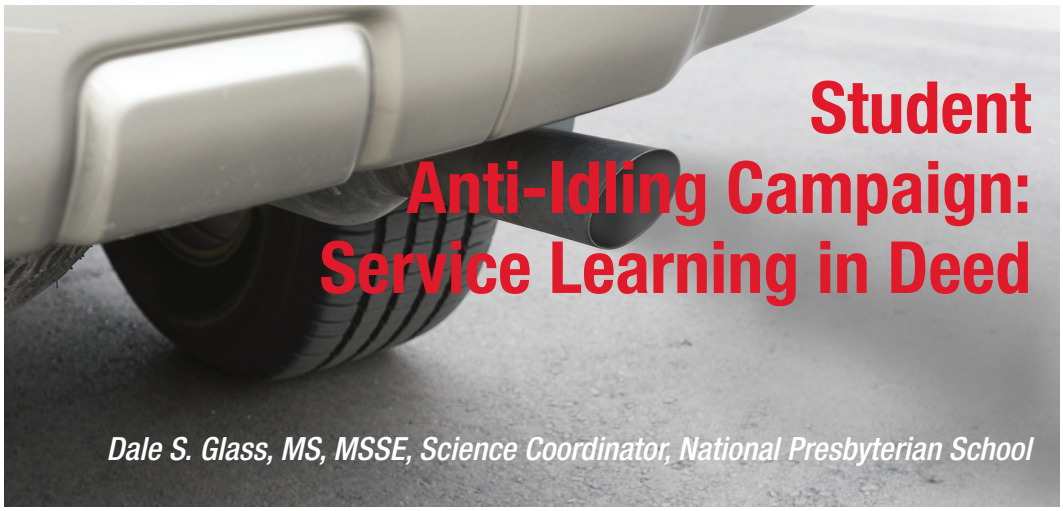

Student Anti-Idling Campaign: Service Learning in Deed

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Abstract

Adding a science service learning project to a standard inquiry-based environmental science curriculum helped fifth grade students learn climate science as they made connections between a real-world problem and their classroom learning. Students brainstormed, researched, and developed a project to address idling in the carpool lane at school. They collected and analyzed data, and used it to build a compelling anti-idling campaign for the school community.

Introduction

Service learning has been shown to help with student confidence, engagement, attitudes, and academic achievement (Berger, 2010). Science service learning is an ideal way to connect science with other curricular areas, to include related social issues, and to provide opportunities for students to explore the outside world; all these practices and skills are recommended in the Framework for K-12 Science Education (NRC, 2012). Science service learning projects combine science coursework and student action to make a difference. The goals of adding the service learning component to the Environmental Science unit were to improve students' understanding of science, involve them in a climate mitigation project, and help them to view scientists (and themselves) as agents of change in the world.

Methods

The science service learning project was interwoven throughout the fifth grade environmental science unit during the spring quarter at National Presbyterian School, an independent Nursery-6th Grade school in Washington, DC. To provide structure to the entire unit, a "Discover, Connect, Take Action" plan based on Berger's steps for service learning (Berger, 2010) was laid out. The plan used some investigations described in the FOSS Environments Module (FOSS, 2005). Assessments were incorporated throughout to evaluate students' knowledge, attitudes, and learning. The service learning project included class work to learn about the environmental impacts of several factors, collecting data, and designing and implementing an action plan. The National Oceanic and Atmospheric Administration (NOAA) Climate Stewards Education Program funded the stewardship project with a mini-grant.

To begin the discovery process, students investigated the impact of some biotic and abiotic factors on different organisms. Once students had an understanding of some of the influences different environmental variables have on living things, they then started to examine the campus

Table 1: Structure of a Science Service Learning Project within an Environmental Science Unit

GOAL	DETAILS
Discover	Learn about environmental factors & preferences Isopods (light/dark, moist/dry); creating a good habitat Guinea pigs (food type or shelter type preferences) Learn about the impact of some environmental factors Bioassay on radish seeds grown in plain, slightly soapy, or very soapy water Fish make tank water acidic (from CO2) Aquatic Plants reduce acidity Fish + aquatic plants = good balance Research biomes (library book research on desert, arctic, savannah, etc)
Connect	**Look at environmental factors at school** **Brainstormed inputs/outputs** • Concept maps of NPS environmental factors • Decided on carpool idling project **Learn about the carbon cycle** **Research impact of idling** (small group projects) • Greenhouse gas and temperature (with demonstration experiment measuring the temperature of soda water and plain water when the sealed bottles were exposed to sunlight) • Acid Rain • Air pollution and health • Gasoline as a fossil fuel **Data Collection** • Brainstorm data collection activities • Collect data - tally sheets of idling cars - time-lapse photos of cars arriving - CO2 probe - temperature probes • Analyze data - calculated CO2 output, pollution output, and financial cost of idling per day - determined daily and weekly averages **Present Anti-Idling Campaign** • Assembly Powerpoint and student speakers • School website • Carpool line outreach **Follow-up** • Post-campaign data collection • Data analysis • Report results
Take Action	**Communicate** • Celebration of Service Chapel • NOAA CSEP Video Contest

Figure 1. Student concept map showing environmental factors around the campus.

Figure 2. Fifth graders using indicator solution to see CO_2 levels in a mini-aquarium containing a goldfish and a plant.

environment. Students brainstormed environmental factors on the campus by drawing concept maps (Figure 1) of the inputs and outputs of the school. They decided to focus on air pollution from unnecessary idling in the carpool line.

Students investigated connections between automobiles and the environment. They played the Carbon Cycle Game (1.usa.gov/1LFnAgt) They learned how to use Vernier data-logging equipment, plunging temperature probes into ice water and exhaling into bottles to measure carbon dioxide. They observed the CO_2 balance between aquatic plants and fish in an aquarium (Figure 2). The fifth graders, working in small groups, researched auto exhaust pollutants, cost of fuel, and impacts of acid rain and greenhouse gases.

Next, students designed a data collection protocol and recorded the number and types of cars, how long they waited in line, and if they were idling (1.usa.gov/1TTIlHK). The CO_2 and temperature probes set up along the driveway generated positive attention from the community (Figure 3). They collected data for five days and calculated exhaust outputs and fuel costs associated with the unnecessary idling (1.usa.gov/1QqYYqF).

No change in atmospheric CO2 or temperature was measured. Over this average week with pleasant weather, 35 of 165 cars (22%) which arrived early for carpool idled for a total of 509 minutes. This put out 75 kg of CO_2, and cost $34.00 in fuel.

Armed with data, students created an anti-idling education campaign. They presented their research findings to the student body during an all-school gathering, and to the parents through the school's weekly e-newsletter and website. They collected post-campaign data on idling cars and analyzed their campaign's impact. Students documented and celebrated their work in an all-school assembly and through a video which was shared with the school community and NOAA.

Figure 3. A laptop computer with two Vernier temperature probes and one CO2 probe was set up in the carpool lane while a time-lapse camera recorded the arrival of cars.

Results

Students reflected on their service and their learning during class discussion, assessments, interviews and surveys. They saw how their actions impacted the school community even beyond their initial goal. Academic achievement was assessed throughout the project with standard FOSS

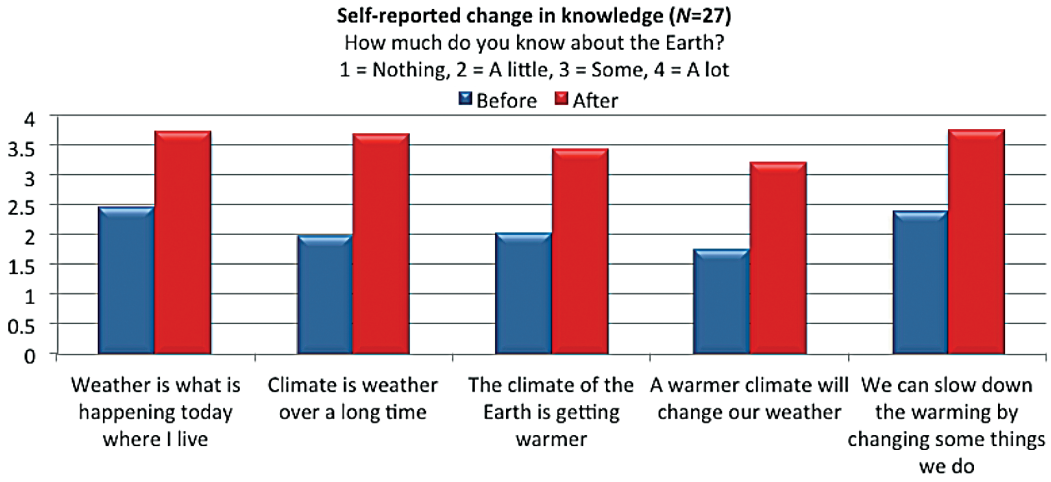

Figure 4. Students self-reported change in knowledge on questions 2 and 3 from the NOAA CSEP Elementary Audience Knowledge Survey.

benchmark quizzes, the NOAA Climate Stewards Education Program (CSEP) Elementary Audience Knowledge Survey (http://cselemaudience.questionpro.com) and a knowledge and attitudes questionnaire developed for this project (1.usa.gov/1QyPqaV). Grades on the benchmark assessments were comparable to the two prior years' students, with a B+ average for all years. Students said they learned about climate during the service learning project, with their self-reported scores moving from an average of knowing "a little" before the project, to an average of "a lot," after the project as shown in Figure 4.

Conclusion

During interviews (1.usa.gov/1VWDsM1), students related that they particularly enjoyed the connection between science class work and the real world, and knowing that they could do something to help. One fifth-grade student said, "When we found the data for our service learning project, it was easier for people to take us seriously."

Participating in a science service learning project changed students' attitudes about science because they were empowered to make a difference. Although there was no significant change in the number of cars that were idling immediately post-campaign (students attributed that to the steamy June weather; folks needed to run the air conditioning), the school responded to the students' actions by implementing several related "green initiatives." These include priority spaces in the pick-up line and parking lot for carpoolers and a public-transportation subsidy for faculty and staff. Fifth grade students who participated in a science service learning project demonstrated academic achievement and enthusiasm for science. The opportunity to apply what was learned in science class to help the environment made the service learning project a success. Connecting classroom activities to service supports learning indeed (Glass, 2013).

Connections to the Next Generation Science Standards (NGSS Lead States, 2013)

The FOSS Environments Module is aligned with the NGSS. The specific areas addressed by the service learning project are:

MS-ESS3.C: Human impacts on Earth Systems
Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
Typically as human populations and per-capita consumption of natural resources increase, so to the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
Performance expectation 5ESS3-1: Students who demonstrate understanding can: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

References

Berger, Cathryn Kaye (2010). *The Complete Guide to Service Learning:* Proven, Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum, & Social Action *2nd Edition*. Golden Valley, MN. Free Spirit Publishing.

Foss Environments. (2005). Berkeley: University of California Board of Regents.

Glass, Lelia "Dale" Soutter (2013). *Science Service Learning: Learning In Deed.* (Master's Degree Thesis). Retrieved from http://scholarworks.montana.edu/xmlui/bitstream/handle/1/2785/GlassL0813.pdf?sequence=1

National Research Council (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

NGSS Lead States (2013). *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

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