Using Simple Class-Based Research Projects to Introduce Non-Science Majors to the Scientific Method in General Education Courses

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MAIN POINTS

- **Introducing community college non-majors to scientific research doesn't have to be complex or intimidating to be effective** 1
- **Technologically non-intensive research questions and projects can still introduce students to the value of the scientific method and the use of data to answer questions** 2
- **Projects were graded using a rubric that emphasized the process and logic of the conclusions derived from their data rather than obtaining the "correct" answers** 3
- **Students were able to see the basics of the scientific method in their simple projects and derive lessons from their attempts** 4
- **Reactions spanned the range of grades and engagement, with some students being moved to try more projects and others learning primarily that it was nice to get outside of the classroom to learn. For a non-majors general education environmental science class without a lab, both ends of the spectrum were seen as positive developments** 4

Abstract

When it comes to understanding scientific research, non-science majors in community colleges often receive little attention and may not recognize their surroundings as a subject for research. To try to reach students on both counts, simple research projects based on observational questions were inserted into non-majors gen ed environmental science courses. The projects were designed to be technologically non-intensive to encourage a focus on the process to obtain the answer rather than the tools, and a post-project critique was included. The project demonstrated problem solving and curiosity in the scientific method, using data to obtain answers, and the value of self-critique and next questions, allowing for later extrapolation to modern research and their own surroundings.

URE Type: Course-Based URE (CURE)
STEM Focus: Environmental Science and Technologies

1 The Idea

- Hard-core scientific research can be intimidating to non-science majors in general, and community college students in particular due to background and experiences
- Research experience is as important to these students as others for effective participation and decision making in society, so reaching them with exposure to the scientific process in an understandable, non-intimidating fashion is both important and valuable, particularly if the course doesn't otherwise have a lab
- Scientific research does not require complex theories, expensive equipment, or complicated equations in order to convey the value of the scientific method to learning and decision making
- A simple hands-on introduction can reinforce course concepts and provide a baseline for understanding the scientific method and the use of data to answer questions that the students can use to help relate to more complex issues in the future
- Secondarily, placing the projects outdoors enabled students to become more comfortable with their local environments

2 Examples of Questions Utilized

The theory you learned in class suggests that in an area there should be more individuals of producers (like plants) than things that eat them (like caterpillars, grasshoppers, etc.). It often looks like that in passing, but have you ever really checked to see if that is true? Well, we have a nice field of grass nearby….

Have you ever looked at the pine trees by the campus parking lot? They are all the same type of pine tree, but some are much older than the others. Do the needles on the smaller trees look longer to you than the needles on the older trees? That seems kind of odd: maybe you should check to be sure.

Have you noticed that, when it rains, some areas of the campus stay wet a lot longer than other areas? Some places that don't get a lot of traffic, like the nearby field and woods, don't seem to ever get muddy while the paths through the field seem to stay wet a long time. Do you suppose that places where people walk a lot, like those trails, hold water at the surface longer than the areas where people don't walk much, lie the field or woods?

The sundews growing near the pond on campus are pretty cool, sitting there in the sun trying to catch insects. But is it just me, or does their spacing look a little suspicious to you? Doesn't it look like they have spaced themselves out so they all have about the same amount of room from each other? Is that an illusion, or are they really pretty evenly arranged?

The little stream on campus has some neat snails in it; have you looked? They are pretty easy to spot on the surfaces of rocks and plants, but I wonder: do they prefer one of those surfaces over the other? I wonder how we could figure that out?

It's dandelion season again! They grow in the field and in the lawns, but I always feel bad for the ones in the lawn because they get mowed a lot. Do you think it matters to the dandelions? Maybe the ones in the lawn are just shorter than the ones in the field!

3 Evaluation Principles

The projects were graded using a group project rubric that evaluated the logic of their process design, the linkage between their data and their conclusions, and the depth of analysis of their process and potential improvements relative to principles of the scientific method as reflected in their project paper and a short class presentation. Being a group project (3 per group), there was also an opportunity to react individually to the contributions of team members, which was also figured into the grade as a sliding scale modifier.

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DO NOT CITE

The Distribution of the Blue Springs Hydrobe (Aphaostracon Asthenes) In Blue Spring Run, Florida

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4 What They Gained

- **Students were able to relate more complex data-based conclusions to their own simple experiences**
- **Their analysis of their approach and conclusions made it easier to understand the value of principles such as replication, statistics, controls, etc. later in the course**
- **"It was nice to get out of the classroom for a while" and "It was fun figuring out how to answer the question" were the most common single-line responses to the project. While reflecting different levels of engagement with the project's goals, both were considered a success for these non-science majors in an introductory general education course without a lab or research component. Some students decided to become involved in more complex research efforts.**
- **As desired, the majority of reflection was on the process rather than the tools used to answer the question, though some did note that more sophisticated tools might have led to better answers (an observation upon which I could build when discussing technological methods important in environmental science such as modeling, GIS, etc.)**
- **Grades on the project spanned the scale, and I taught no similar activities in other classes with which to compare**