

SOAR Research Proposal, Summer 2019

Title: Towards Project-Based Citizen Science: Environmental Education and Community Action at Lehigh Valley Summerbridge

Student: Erin Anagnost

Faculty Mentor: Tristan Gleason, Assistant Professor, Department of Education

Dates: June 3rd-August 9th

Project Overview:

The goal of this project is to develop an inquiry-based science curriculum framework that combines elements of project-based learning (Holthuis, Deutscher, Schultz, & Jamshidi, 2018), environmental education (National Environmental Education and Training Foundation, 2002), and citizen science (Senabre, Ferran-Ferrer, & Perelló, 2018) to provide learners the Lehigh Valley Summerbridge program opportunities to apply science towards community activism. This project will also draw from the framework of Youth Participatory Action Research, or YPAR, which highlights the efficacy of positioning students as agents of social and environmental change in their communities (Caraballo, Lozenski, Lyiscott, & Morell, 2017). This framework, like project-based learning, emphasizes the importance of having student voice and interest inform the learning process. Accordingly, the curriculum framework will begin with a set of lessons that introduce students to concepts and methods in environmental science, before helping students design and implement projects based on their own unique interests. Students will learn how to assess water and soil quality, map ecosystems, and document the distribution, density, and diversity of biotic components. After students learn these methods, they will develop and implement projects that use these techniques to address issues environmental issues that matter to them and their communities. Finally, these students will have an opportunity to share the results of their inquiries with other members of their community.

As detailed in Erin's rationale below, science education is both a topic of national concern, and a neglected curricular area in elementary schools across the Lehigh Valley. Because of the emphasis on literacy and math, elementary schools in Bethlehem typically provide less than 15 minutes a day for science instruction. Science education has an important role to play in democratic participation, both because scientific issues like vaccinations and climate change are consistently misunderstood by the public, and because science teaches the skills of critical inquiry that are important to being an informed citizen in general. Informal science education can participate in developing what philosopher of science Isabelle Stengers (2018) calls a *public intelligence of the sciences*. The student-driven approach to science teaching and learning adopted here can play an important role in helping all citizens understand the epistemology of science, and the role that science plays in matters of public policy and democratic decision making.

Roles and Responsibilities:

Prior to the beginning of Lehigh Valley Summerbridge, Dr. Gleason and Erin will work together to develop engaging, inquiry-based curriculum that Erin will implement during the 7 week program. We will meet three times per week, and spend another two days per week conducting

independent research. During our in person meetings, we will share our research findings and use them to inform the curriculum that we will develop for Summerbridge.

During the first seven weeks of SOAR, Erin will be teaching full-time at Lehigh Valley Summerbridge. She will be teaching two sciences classes per day where she will implement the inquiry-based curriculum designed during the first part of our research. These classes will serve 10-12 middle school students of diverse backgrounds from around the Lehigh Valley. Dr. Gleason and Erin will meet 1-2 times per week to discuss the science curriculum development as well as the progress being made toward the goals of our research project. Both Dr. Gleason and Erin will seek out additional research and information to help inform Erin’s practice as an emerging educator.

Following the conclusion of Summerbridge, Dr. Gleason and Erin will meet daily to evaluate the curriculum that was implemented. Erin will compile work samples from students as well as additional data collected during the teaching process to create a final presentation detailing how project-based learning, citizen science, and ecological education can generate additional opportunities and structures for diverse learners to participate in science education.

Timetable:

Weeks	Research	Outcomes
1-2* 6/3-6/17	<ul style="list-style-type: none"> -Erin will conduct independent research on inquiry-based science education programs, including project-based learning, citizen science, and ecological education. -Erin and Dr. Gleason will create a framework for an inquiry-based science curriculum for Summerbridge. 	<ul style="list-style-type: none"> • Draft of literature review about efforts and approaches to teach science in non-traditional ways, and the relationships between science education and democratic participation in society. • Development of curricular framework for implementation at Summerbridge
3-8 6/17-7/26	<ul style="list-style-type: none"> -Erin will teach in the Lehigh Valley Summerbridge program 8am-3:30pm Monday through Friday. -Erin will collect student research work samples to use as an analysis of her curriculum. -Erin and Dr. Gleason will meet twice per week to discuss progress and conduct research to enhance the overall curriculum. 	<ul style="list-style-type: none"> • Implementation of curriculum to Summerbridge students • Collection and curation of student work samples, Erin’s reflective teaching practice, and other artifacts that document the impact of the curricular framework on student learning and participation in science and community activism.

<p>9-10 7/26-8/9</p>	<p>-Erin will compile final work samples from students to analyze. -Erin will reflect on her Summerbridge curriculum, highlighting points of strength and areas that need improvement.</p>	<ul style="list-style-type: none"> • Erin and her Summerbridge students will present to other SOAR participants the experiences and results of the science curriculum in the form of a poster and/or through a multimedia platform. • Summerbridge students will share research experiences working with the inquiry-based science curriculum. • Erin will share exactly how this curriculum could be a model science education in public school classrooms.
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* Note- Erin and Dr. Gleason will begin the process of reviewing the literature and creating the science curriculum in May, before SOAR officially begins.

Discipline Appropriate Research Opportunities:

The Moravian College education department works to prepare teachers who are knowledge producers and agents of change in their community. Using methods such as practitioner and action research, I view my development as a teacher to be an example of the emphasis on both research and scholarship that the Moravian education department values and enacts.

To conclude our research development, Summerbridge students will conduct a final presentation addressing the Summerbridge community. These presentations will highlight the research they had conducted over the six week course surrounding the environmental issues that are present in their communities. Students will present their work through various means, including but not limited to written work, oral presentations, and multimedia projects. These presentations will occur during the final week of Summerbridge during All School Meeting, or the end of the summer celebration.

I will be presenting my research to other participants, colleagues and professionals during the final weeks of SOAR. This presentation will include the process of developing a curriculum which was driven by the interests and passions of my students, the research that they conducted individually and in their teams, as well as our experiences with the environment itself. Weekly field trips will be documented in the form of pictures, videos, and written recordings. I intend to include several, if not all of my Summerbridge students in the final presentation as they will be active participants in their own learning and development.

In Fall 2019, I will be presenting this research to Dr. Gleason’s EDUC 323 “Instructional Strategies for Scientific & Quantitative Reasoning” class. This will be an audience of undergraduate, pre-service teachers, that are learning about the importance of science education in early childhood classrooms. The research I have conducted will serve as valuable information for these students as they will be developing their own science unit plan, and implementing science lessons in their field experience classrooms. My research will serve as a model of

inquiry-based science education and the power of lessons that are powered by the interest and passions of students.

I am also interested in considering presenting my research at a National Conference for Undergraduate Research. These gatherings provide a stimulating academic environment to share research with other both professionals and fellow undergraduate researchers and gain insight into the research being done in similar fields across the country.

Rationale:

The federal government emphasizes the importance of the STEM fields, including the importance of providing equitable STEM learning opportunities for children across the country (U.S. Department of Education). In 2019, this push for STEM education remains, but my experiences as a pre-service teacher don't reflect this emphasis. In other words, the priority placed on STEM education from the federal government is not currently reflected in all early childhood classrooms and curriculums. Through Dr. Gleason's EDUC 323 "Instructional Strategies for Scientific & Quantitative Reasoning", I began to recognize the value of quality science education curriculum at the elementary level and beyond, but was faced with the harsh reality of the inequity that plagues our public school systems. I have experienced and observed science education in the public school districts across the Lehigh Valley, including hands-on activities, experiments, and field trips from 2002-2007 when I attended elementary school in the Easton Area School District. Now that I am a pre-service teacher in the field of early childhood education, I have noticed a lack of science education in public school classrooms at the elementary level throughout the Lehigh Valley. The increased emphasis on literacy and math education have virtually eliminated science education in elementary classrooms. Research shows this disproportionate trend extends far beyond the confines of the Lehigh Valley, as numerous public schools across the United States lack equitable Science education programs (Associated Press, 2016).

My interest in this topic was sparked by both my work in the field of education, as well as my own passions about the challenges and opportunities of urban education. A book by Christopher Emdin (2016), *For the White Folks Who Teach in the Hood*, explores the idea of *reality pedagogy*, an approach that abandons the notion of teachers "saving" urban youth, seeking instead to prepare educators to value their students as knowledge creators. Rather than treating students as passive learners, reality pedagogy empowers students to learn while addressing the issues that matter to them and their community. Specific to the issue facing science education, students in urban settings should be empowered to use the tools of science to address the environmental and social issues relevant to their experiences, interests, and communities.

For my project, I intend to address the inequity in science education through my work with Lehigh Valley Summerbridge. I will do this by empowering my students to explore the problems that exist in their communities and provide them with the tools and opportunities to address them. Students will be empowered to become citizen scientists (Wallace & Bodzin, 2017), and will be shown that science is not a set of facts and theories developed by dead white men, but rather an approach to addressing the issues that they are passionate about within their own urban

communities. Through inquiry-based science, my students will become agents of change in both their classrooms and communities.

Expected Outcomes:

My largest goals for this project is to show young learners the value of science education and that they too can become scientists. The representation of scientists in our society lack diversity, limiting minority students' ability to see themselves in the professional field of science. My students will take on the role of citizen scientists through the work they will complete during this project. Students will learn how to conduct research, collect data, present their findings and critique their peers. These skills are not limited to students who desire a future career in science, but serve as necessary skills for well-informed and concerned citizens. As I address the inequity that lies in science education, I hope to educate not only my students, but also the community, on the importance of a quality science education for all students. The curriculum that I will develop for Lehigh Valley Summerbridge will encourage students to think critically, ask questions, and develop hypotheses. This curriculum will be created with an inquiry-based approach to science in mind, allowing my students to inform my practice. I also hope to highlight the value that lies within urban environments that inform science teaching and learning. This curriculum could become a model for science curriculum across districts, as it will highlight the importance of building off of students interests and passions. Through my work with this research project, I intend to improve my own teaching practice as well as positively impact the science community. My teaching practice will be improved through developing this engaging and valuable science curriculum and also by observing the research conducted by my students. Overall, my goal is to create an equitable science education program that embraces the diversity of its learners, and empowers them to become informed citizens.

References

- Associated Press. (2016, October 27). National Report Card: The vast majority of American students still lack a solid grasp of science. Retrieved March 7, 2019, from <https://www.businessinsider.com/ap-modest-gains-but-us-students-still-lag-in-science-learning-2016-10>
- Caraballo, L., Lozenski, B.D., Lyiscott, J.L., & Morell, E. (2017). YPAR and critical epistemologies: Rethinking education research. *Review of Research in Education, 41*, 311-336. DOI: 10.3102/0091732X16686948
- Emdin, C. (2016). *For white folks who teach in the hood...and the rest of y'all too: Reality pedagogy and urban education*. Beacon Press: Boston.
- Holthuis, N., Deutscher, R., Schultz, S. E., & Jamshidi, A. (2018). The New NGSS Classroom: A Curriculum Framework for Project-Based Science Learning. *American Educator, 42*(2), 23–27.
- National Environmental Education and Training Foundation. (2002). Environmental education and educational achievement: Promising programs and resources.
- Senabre, E., Ferran-Ferrer, N., & Perelló, J. (2018). Participatory design of citizen science experiments. *Comunicar: Media Education Research Journal, 26*(54), 29–38.
- Stengers, I. (2018). *Another science is possible: A manifesto for slow science*. Cambridge: Polity Press.
- U.S. Department of Education. (n.d.) Science, technology, engineering and math: Education for global leadership. Retrieved from <https://www.ed.gov/stem>.
- Wallace, D. E., & Bodzin, A. M. (2017). Developing Scientific Citizenship Identity Using Mobile Learning and Authentic Practice. *Electronic Journal of Science Education, 21*(6), 46–71.