The Impact of Laboratory Visits on Biology Students' Achievement and Attitudes Towards Science

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Abstract:
The purpose of this investigation is to improve achievement in Biology in distinguishing the characteristics in domains and kingdoms. This inquiry will also focus on students' attitudes towards science. Students will conduct and inquiry to culture bacteria and investigate it's resistance to antibiotics. After, student will visit the Horticulture Center at the University of Florida to study virology, bacteriology, epidemiology, mycology and plant diagnostic.

Before this investigation, students will take a pretest to review their understanding of the standard, as well as, a science attitude survey. At the conclusion of the investigation, students will once again take a posttest and the science attitude survey to compare the data.

Rationale:
The Florida Department of Education requires students enrolled in Biology to take an end-of-course exam. This exam is calculated as 30% of the student's overall grade. This assessment is comprised of 10-20% low level complexity, 60-80% moderate level complexity and 10-20% high level complexity for depth of knowledge. It is imperative that students not only learn the standards for recall, but are able to interpret, describe, explain, differentiate, apply, analyze and evaluate.

Ruth K. Broad Bay Harbor K-8 Center was formerly an elementary school. It evolved into a Pre-K through 8th grade school. A small percent of the students are enrolled in accelerated courses. In 7th grade, students are enrolled in Algebra I Honors and Physical Science Honors. In 8th grade, they are enrolled in Geometry Honors and Biology Honors. One of the constraints of being in a K-8 Center is the limited resources and equipment. By visiting science labs at the university level, students will be able to use high tech microscopes and see first-hand real samples of protist, bacteria, fungi, viruses and plants. They will be able to categorize for themselves the similarities and differences in the living and non-living things.

Preliminary research suggests, that when students visit science center outreach labs combined with learning in school, they show higher student achievement. Our students need to be exposed at an early age to science and other STEM careers. "Effects of a science center outreach lab on school students' achievement- Are student lab visits needed when they teach what students can learn at school?" (Itzek-Greulich, Flunger, Vollmer, Nagengast, Rehm, Trautwein, 2015)

Intervention:

Students will engage in a protocol to culture Escherichia coli K12, Living, Bacteriophage Host. Students will then test to see if this strand will be resistant to 3 different antibiotics. To follow up, students will visit various labs in the Horticulture Science building at the University of Florida to collect and examine samples from fungi. Students will also examine and classify viruses and bacteria from plants collected in the gardens outside the building. Students will learn to distinguish characteristics of the domains and kingdoms of living organisms (SC.912.L.15.6) . They will explain the reasons for changes in how organisms are classified. (SC.912.L.15.5). Students will also be able to explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines and antibiotics. (SC.912.L.14.52).

Data collection and analysis:

Students will take a pre and post survey about science attitudes.
Students will take a pre and posttest on the classification of protist, bacteria and fungi kingdoms.

Connections to CATALySES summer institute:
Antibiotic Resistant Bacteria Protocol by Dr. Erin Mack
Plants Get Sick Too!- Virology, Bacteriology, Epidemiology, Mycology and Plant Diagnostic

Literature cited:

Heike Itzek-Greulich, Barbara Flunger, Christian Vollmer, Benjamin Nagengast, Markus Rehm, Ulrich Trautwein, Effects of a science center outreach lab on school students' achievement – Are student lab visits needed when they teach what students can learn at school?, Learning and Instruction, Volume 38, 2015, Pages 43-52, ISSN 0959-4752, https://doi.org/10.1016/j.learninstruc.2015.03.003. (http://www.sciencedirect.com/science/article/pii/S0959475215000213)

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. International Journal of Science Education, 25(9), 1049–1079. https://doi.org/10.1080/0950069032000032199

Permissions: District approval is needed for out-of-county field trips from Miami to Gainesville. Parent permission to participate in the study. Parent permission for students to travel to the Horticultural Sciences at University of Florida.