The Effect of Open Inquiry in High School Chemistry on Student Understanding of the Nature of Science and their Attitude, Confidence, and Motivation

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Background

The NSES stressed the importance of inquiry in the science classroom, and the NGSS emphasized the need for student understanding of the development of scientific knowledge (NRC, 1996; NGSS Lead States, 2013). This capstone project was conducted in three introductory chemistry classes at Holderness School. Senior Thesis became mandatory for graduation from Holderness in 2014. Although my chemistry classes consisted mostly of underclassmen, I chose this study after realizing that students seldom chose an investigative science Senior Thesis at Holderness. My goal was to improve student understanding of the Nature of Science through explicit instruction and open inquiry investigations, as well as improve student attitude, confidence, and motivation with regards to scientific methodology. Ideally, this would lead to more investigative science Senior Theses at Holderness.

Treatment

Start of Treatment
- Instruction on experimental design and data analysis
- Instruction on precision in measurement and dimensional analysis

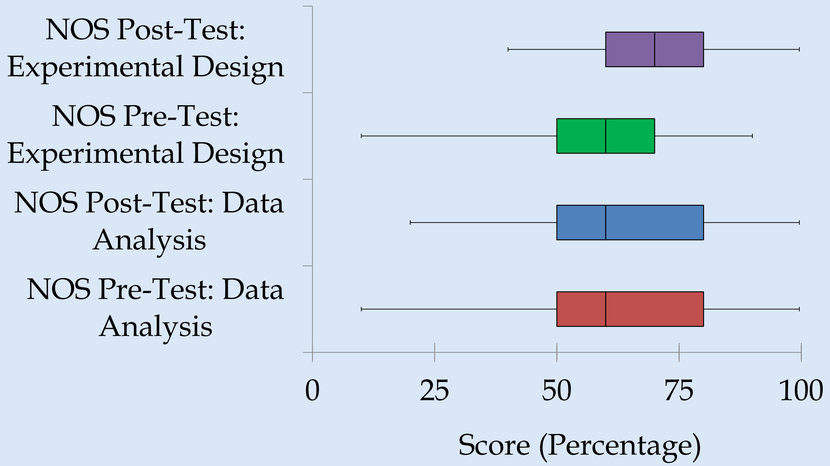
Middle of Treatment
- Guided scientific inquiry laboratory investigations

End of Treatment
- Open inquiry investigation—students formulated a testable scientific research question, completed a literature review, and designed an investigative plan to answer the research question

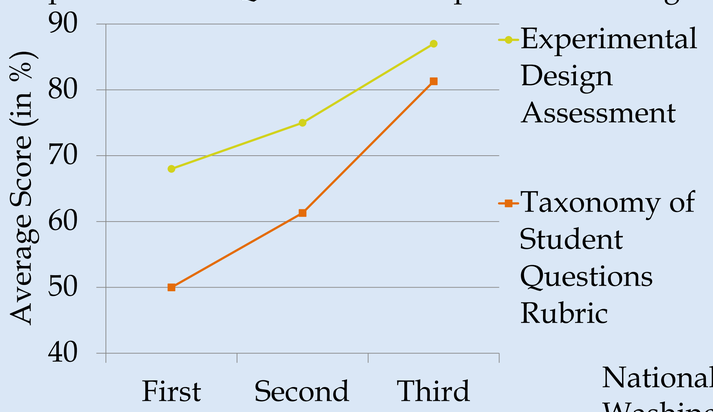
Data Collection & Analysis

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: *Will student understanding of the NOS be impacted by explicit NOS instruction and engagement in inquiry investigations?*	Multiple Choice Data Analysis and Experimental Design Questions on NOS Pre- and Post-Test (Parts A and B, respectively)	Open-ended Understanding NOS Questions on NOS Pre- and Post-Test (Part C)	Student Post-Treatment Interviews
Secondary Question: *Will students' abilities to write scientific research questions be impacted?*	Experimental Design Assessment: throughout research question design	Taxonomy of Student Questions Rubric: throughout research question design	Student Post-Treatment Interviews
Secondary Question: *Will student attitudes, confidence, and motivation in using scientific methodology be impacted?*	Pre- and Post-Treatment Likert Survey	Student Post-Treatment Interviews	Pre- and Post-Treatment Likert Question on Senior Thesis

Multiple Choice Test: Student Understanding of NOS



Improvement in Question and Experimental Design



Results

Students improved their ability to and confidence in designing a testable scientific research question and corresponding investigation. Their NOS understandings and ability to apply their knowledge to hypothetical data and experiments did not improve. Student attitude and motivation did not change, nor did their interest in doing an investigative science Senior Thesis.

References:

National Research Council. (1996). *National Science Education Standards.* Washington, DC: The National Academies Press.

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By States.*