



EFFECTS OF INQUIRY IN A CHEMISTRY CLASS ON COGNITIVE HABITS OF MIND

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Methods



Background

Memphis, Tennessee is home to a significant population of home-educated students. Parents often choose alternative sources for high school science classes through the use of tutorials, online classes, or dual enrollment with local colleges. My weekly classes are one option for parents to select from in their choice of a chemistry course. This chemistry class meets two hours weekly with class time divided between lecture and lab.

Thirteen chemistry students were included in this study. Three students were female and ten were male. All had expectations of a successful year in chemistry. These students did not have prior experience with inquiry-based science. Permission was granted by parents for their student's participation.

My objective was to determine the effects of inquiry-based laboratory methods on cognitive habits of mind specifically metacognition, group interdependence, and the student's ability to persist in problem solving.

Literature Review

• "A Habit of Mind is knowing how to behave intelligently when you don't know the answer. A Habit of Mind means having a disposition toward behaving intelligently when confronted with problems, the answers to which are not immediately known: dichotomies, dilemmas, enigmas and uncertainties (Costa & Kallick, 2001). "

- Inquiry standards were written into the National Science Education Standards by the National Research Council in 1996.
- Inquiry is considered an inspiring tool to motivate the student toward a challenging, critical thought process (Prince and Felder, 2007).

Focus Questions and Data Sources

Research Questions	Data Source 1	Data Source 2	Data Source 3
Focus Question: Will I effectively change my laboratory teaching methods from traditional to inquiry to enhance cognitive habits of mind (HOM) of high school chemistry students?	Pre & Post Student Interviews (3)	Electronic Journal (1)	CAT 22 Video/Audio Recorded Protocols (2) (ISOG)
Secondary Questions: Will guided-inquiry help students thinking about thinking?	Pre & Post Student Interviews (3)	Lab Rubric (1)	MC ² (1) Survey
Has student persistence improved?	Pre & Post Student Interviews (3)	Electronic Journal (1)	MC ² (1) Survey
Do students become more effective working interdependently?	Pre & Post Student Interviews (3)	CAT 47 Team Work Evaluation (1)	Lab Rubric (1)

(1) Artifacts

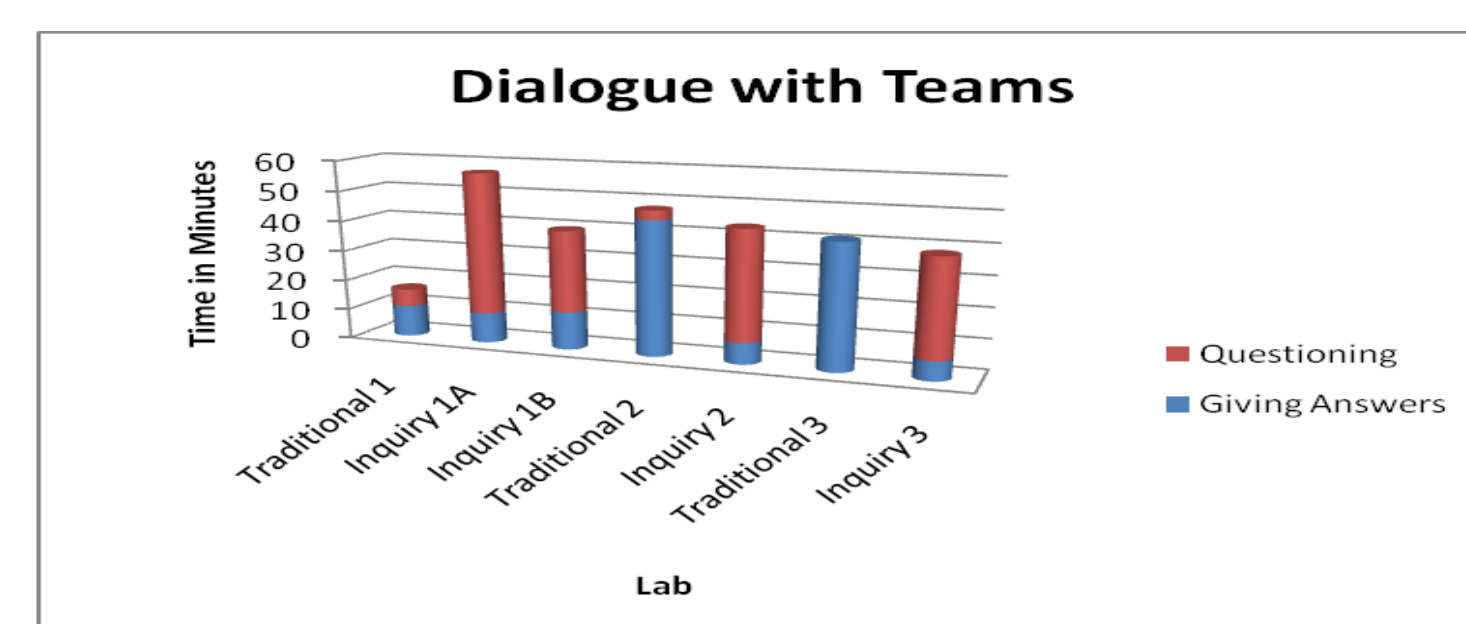
(2) Observational Data

(3) Inquiry Data

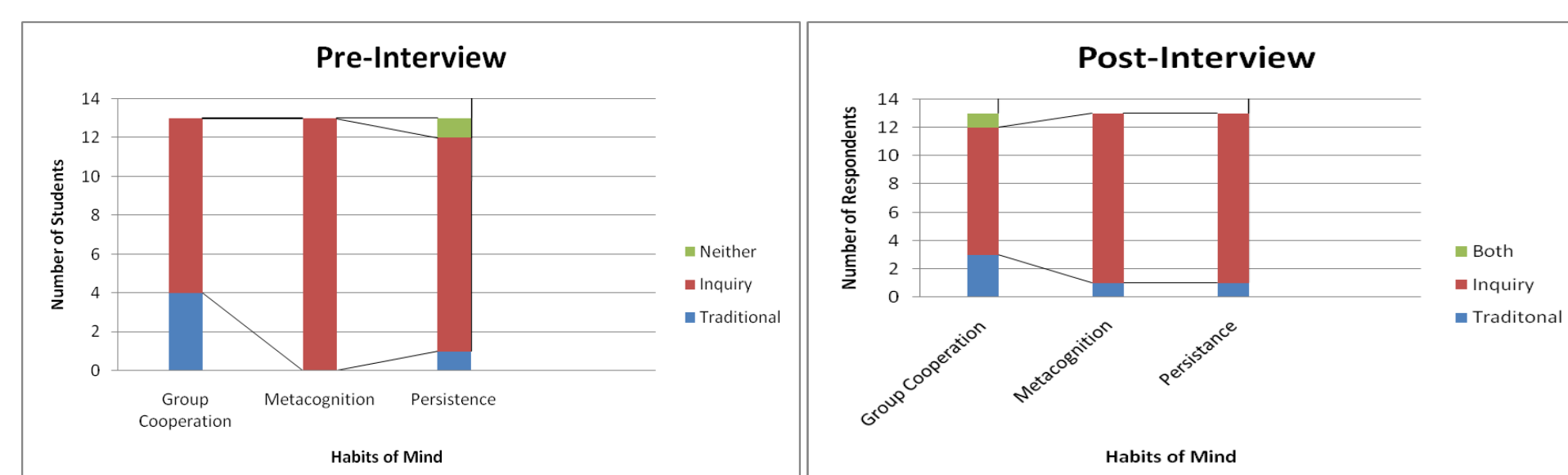
From November 2008 to February 2009 students participated in three treatments comparing traditional to inquiry-based laboratory experiences. For three units, each lab team completed a traditional lab in the first week of the unit and a guided inquiry lab in the second week. Between the first and second week, the student teams communicated background research findings and wrote a procedure to be approved by me via email at least two days before the next class time for the inquiry lab.

Pre- and post-treatment, surveys and interviews were conducted with each student. During each treatment, audio and video of the laboratory class period were recorded. After each treatment, students completed a teamwork evaluation, documented habits of mind reflections in their lab notebook, and I recorded in an electronic journal.

Data Analysis and Interpretation



Over the course of the treatments, my feedback to the students in the traditional lab was consistently based on giving instructions whereas the inquiry lab was primarily guiding questions. Throughout the inquiry labs, these guiding questions forced the students to think, persist and rely on each other through the process.



In the pre-treatment interview, the students unanimously decided it was the inquiry lab which made them aware of understanding their thinking and cognitive processes. In the post-interview, twelve students found the inquiry process to increase their metacognition. The outlier was a student with learning disabilities who found the traditional lab to improve habits of mind.

Prior to treatment, 85% of students (n = 13) considered the inquiry lab to require the habit of persistence more than a traditional lab. The same twelve of thirteen students (92%) found the inquiry to require more persistence post-treatment. Quoting one student, "The inquiry lab makes you follow through with your ideas even if they don't work out. It makes you go through it and realize you did it right or you made a mistake."

Consensus was lacking on whether the traditional or the inquiry lab led to the habit of group interdependence based on their interpretation of the question. Thirty one percent of students (n= 13) took the path of least resistance and chose the traditional lab as promoting group cooperation in the pre-lab interview. Since the procedures were written, there was less room for argument with the lab procedure as the "authority." This was also voiced by 23% of the students in the post-lab treatment.

References Cited

Costa, A., & Kallick, B. (2000-2001) Describing 16 habits of mind. Retrieved September 28, 2008, from www.habits-of-mind.net.

Prince, M., Felder, R. (2007). The Many Faces of Inductive Teaching and Learning. *Journal of College Science Teaching*, 36 (2), 14-20