DOES TEACHING SCIENTIFIC INQUIRY THROUGH THE 5E LEARNING CYCLE AFFECT 9TH GRADE EARTH SCIENCE STUDENTS' ENGAGEMENT AND CONCEPTUAL UNDERSTANDING?

Tyler Hollow, Helena High School
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Introduction and Background

→ I teach ninth grade earth science at Helena High School in Helena, Montana. For this research I compiled data from two class periods (51 students). About 20% of these students utilize Special Education Services.
→ The Action Research topic is the affects of scientific inquiry on my earth science students and the affect on me as the teacher.
→ Scientific inquiry has been defined in the Next Generation Science Standards Science and Engineering Practices.
→ The main goal of this research is to teach scientific inquiry and investigate if an improved level of student engagement and conceptual understanding can be obtained through this instructional strategy.

Action Research Questions

Essential Question:
How does teaching scientific inquiry through the 5E Learning Cycle and other strategies affect 9th grade Earth Science students' engagement and their conceptual understanding?

Sub-questions:
1. In what ways, does teaching science inquiry impact me as a teacher?

2. What student attitudes are present during science inquiry lessons?

3. How are students' science inquiry skills affected by this treatment?

Purpose

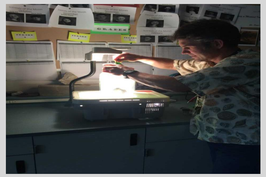
The purpose of this Action Research is to assess the effects of scientific inquiry on students' conceptual learning and engagement, and effects on the teacher. The long-term goal for this investigation is to increase success for ninth grade students by engaging them in their learning, teaching them the process of science and increasing their understanding of the natural world through science inquiry instruction.

Treatment

The treatment was teaching scientific inquiry through a variety of strategies that have been shown to be effective in the classroom:

- 5E Learning Cycle- Engage, Explore, Explain, Elaborate and Evaluate
- Misconception Probes
- Note-booking
- Open-ended inquiry and Teacher-led inquiry
- Phenomena
- Discourse and Sense Making
- Modeling

Students conducting an open-ended inquiry lab.



The researcher demonstrating a phenomenon.

Methodology

→This investigation was designed to compare traditional teaching strategies to scientific inquiry teaching strategies for ninth grade earth science students at Helena High School.

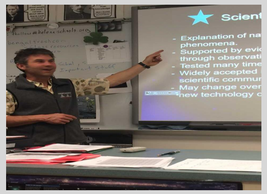
→All earth science students in the study design were taught one unit using traditional teaching strategies (non-treatment unit) and one unit of stud using scientific inquiry teaching strategies (treatment unit).

→Multiple instruments were used to compare the treatment unit with the non-treatment unit:

- Pre-and post-summative assessments
- Pre-and post-open-ended inquiry labs
- Student Interviews
- Misconception Probes
- Classroom Assessment Techniques- One-Sentence summary and Concept Mapping
- Student Questionnaires

Comparison of instructional strategies of scientific inquiry and traditional.

Scientific Inquiry (Treatment Unit)	Traditional (Non-treatment Unit)
Note-booking	Note-booking
Bell Ringers	Bell Ringers
Exit questions	Exit questions
5E Learning Cycle	Cook-book labs
Presentations	Presentations
Phenomena	Textbook questions.
Misconception Probes	Demonstrations
Modeling	
Discourse and Sense Making	
Student-led Open Inquiry	
Teacher-led Inquiry	

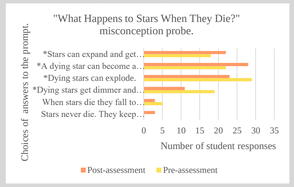


The researcher presented content in the treatment unit and non-treatment unit.

Students conducting a hands-on experiment as partners.

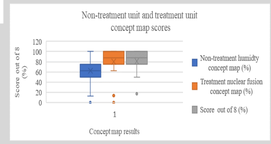
Data and Analysis

→The biggest indicator that scientific inquiry improves students' conceptual understand is that students' scores for the treatment unit's summative assessment had greater normalized gains than the non-treatment unit's summative assessment.
→ Misconceptions improved after treatment unit.



Pre- and post-assessment of the misconception probe "What Happens to Stars When they Die?" (N=30).

Students improved their science inquiry skills by completing open-ended inquiry labs like the one shown above.



Concept mapping results demonstrate that the treatment unit's conceptual learning is greater (N=46).

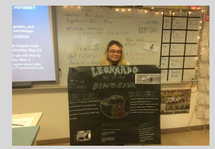
Interpretation and Conclusion

→An increase in conceptual understanding through science inquiry is evident in the results.
→Students were engaged similar in the treatment unit as they were in the non-treatment unit. Engaging activities included demonstrations, hands-on labs, interesting presentations and project work.
→Teaching strategies can affect me positively and negatively. For example, the more engaged the students were, the more positive I felt.
→Ninth grade earth science students generally had a positive attitude during both units of study.
→The students improved in Science and Engineering Practices during the treatment unit.

Value

I learned in this Action Research that…

- → the 5E Learning Cycle improved conceptual understanding because it allowed students to delve into the subject matter through a variety of implemented learning strategies.
- → students were engaged when they are interested in the material and when they are doing science.
- → students showed a high level of engagement and had positive attitudes when completing independent projects.
- → students think they learn better working with others and their engagement increases during group work



Shown above, is a great example of a student that takes pride in her project work because she was engaged in the topic of her choosing.