

Authentic Science Research in the Classroom: Does it Promote Science-Related Affective Growth?

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Research Flowchart

Administer Student Survey
(Initial Survey)

Analyze Validity of
Survey Statements &
Replace and Reexamine
Flawed Statements

Administer Treatment
Following Guiding Principles
(Journal Observations)

Administer Student Survey
(Concluding Survey)

Analyze Difference Between
Before and After Data with
Wilcoxon Signed-Rank Test

Look for Meaning in
Teacher Journal and
Written Explanations

Final Student Interviews:
Member-Checking and
Understanding Why

PURPOSE

- This action research was undertaken to understand how authentic science research influences students' science-related affective outcomes.
- Specific subquestions that were investigated include:
 - Is authentic science research in an educational context an efficient way to promote growth in students' science identity, science self-efficacy, interest and enjoyment of science, perceived relevance of science, and intrinsic motivation for science learning?
 - Is authentic science research feasible through an online learning environment?

RESEARCH METHODOLOGY

- Student surveys administered before and after each authentic science treatments.
- Student survey contained eleven statements. Students select level of agreement on a 1-5 scale (1= Strongly Disagree, 5= Strongly Agree). Students also provide an open-ended written explanation for their selection on each statement.
- Responses to statements transformed to five Likert scales: science identity, science self-efficacy, interest and enjoyment of science, relevance of science, & intrinsic motivation for science
- Written explanations and interviews validate Likert statements
- Reliability of Likert scales assessed with Cronbach's alpha
- Wilcoxon's Matched-Pairs Signed-Rank Test and Wilcoxon Effect Size Test used to measure changes in student scale values
- Interviews and journaling observations helped explain results
- Follow-up student interviews for member checking and determining changes in students' perceptions of scientists.
- Four replications to gain statistical power and to probe variables

STUDENT DEMOGRAPHICS

- 120 Seventh & Eighth Grade Students
- ~31% Free or reduced lunch
- Historically ranching community in Gallatin Valley, Montana
- Recent suburban sprawl has shifted socio-economic dynamics
- Community is ~96% white

TAKEAWAYS

- Students do experience significant affective growth through conducting their own authentic science research projects
- Expect only small effect sizes since affective development is slow
- Authentic Science Research would be challenging through an online learning environment due to lack of equity
- Emphasis on nature of science and how professional scientists study natural phenomena essential to affective growth

TREATMENT GUIDING PRINCIPLES

- Students are co-creators in a scientific investigation related to a concurrent unit of study
- Students design their own research question and procedures, collect their data, formulate their own conclusions, and present their findings
- Students use content knowledge to guide their decisions
- Instructions provided in an informational manner
- Localized scaffolding provided throughout
- Nature of Science emphasized throughout
- Emphasis on emulating how scientists study content area
- Authenticity of experience maximized as per Roth (1995)

RESULTS

- All Likert statements validated through multiple means
- All five scales found to be internally consistent (Cronbach's alpha ≥ 0.70) and representatively reliable
- Every treatment increased mean scale values
- Only one treatment by itself (n=66) resulted in statistically significant growth with moderate effect size
- All treatments factored together (n=166) resulted in statistically significant growth with small effect sizes
- Interpretations of data found to be reliable
- Online learning setting lacks equity

- Student autonomy allows students' creativity to guide their learning, but allowed some students to fall behind
- Integration of technology (robotic telescopes) may have been responsible for some observed growth
- Social learning aspect of treatment may also have been responsible for some observed growth
- Benefits of this approach many, but it requires time

Combined Likert Results

(n=166)

