Making Science-Engineering Inquiry Culturally Relevant In Rural Colorado
University of Colorado Boulder
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Background
Two-semester course, MCEN 4/5291: Project-Based Learning in Rural Schools, with strong technical objectives around air and soil quality science and engineering along with emphasis on "soft" or professional skills in the form of communication and mentoring skills.

In the fall semester, university students:
- learn the curriculum and the technology
In the spring semester:
- Students work in the schools to implement a project

Research Rationale
Through the examination of HS students' posters and analyzing them as learning artifacts, the current study focuses on investigating how HS student learning is mediated by the relationship with their surrounding environments, and how such relationship unfolds in relation to scientific and data literacy.

Project Design
- Science-Engineering Inquiry Collaborative in Rural Colorado (SCENIC)
- Sub-categories: Soil and Air Quality
- InQuiry Program (SQIQ/AQIQ)
- 2 groups of learners—university and high school students.
- CU students use university-created air and soil quality monitoring devices, known as “Pods”, to support high school student investigation in self-selected projects
- Culminates in a symposium where HS student teams present their projects in a poster session

Why A Rural Focus?
- Most research and development on place-based, culturally responsive and culturally sustaining education in the United States ignores rural contexts in favor of urban and suburban contexts
- Political polarization has led to the rural U.S. being increasingly conservative and Republican; since the 1970s Republican-supporting voters have increasingly come to doubt and distrust science.
- It is important to a well-educated citizenry that rural students find STEM relevant to their lives, hold constructively critical rather than dismissive views of data-informed argumentation, and learn how data can inform life.

Findings

<table>
<thead>
<tr>
<th>Human-presence &amp; activities</th>
<th>Little</th>
<th>Some to Heavy</th>
<th>Comparing 2 places</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity location</td>
<td>Outdoors</td>
<td>Indoors</td>
<td>Comparing 2 places</td>
</tr>
<tr>
<td>Personal relevnce &amp; relationship</td>
<td>No apparent relationship</td>
<td>Apparent relationship</td>
<td></td>
</tr>
<tr>
<td>Uniqueness to local place's culture &amp; history</td>
<td>Generic, not unique</td>
<td>Some relationship</td>
<td></td>
</tr>
<tr>
<td>Affects</td>
<td>Generic, no affect</td>
<td>Affective words and images</td>
<td></td>
</tr>
</tbody>
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Interpretation

- Most students (73%) take advantage of the opportunity for doing personally relevant projects
- Students frequently (38%) pursue outdoor inquiry (either all outdoor or comparative)
- A substantial number (37%) of students pursue topics interpreted as moderately or highly unique to their rural place’s local history and culture
- Mentors saw themselves as role models to the youth they served
- Rural community members noted how students were confident in their projects, but also lacked conceptual understanding of the science involved and had trouble interpreting their results

Place-Based Elements of Student Work: Analysis of 45 posters and PowerPoint presentations, randomly drawn from 225 artifacts submitted by HS students between AY2018-19 and 2021-22.

High School Student Projects
How do the CO2 emissions and VOC levels of a diesel truck compare to a hybrid sedan?
Do different candles emit different particulate matter sizes/amounts when combusted?
Does alfalfa or corn soil contain more nutrients and carbon dioxide?
How does soil quality affect the preservation of fossils or artifacts?

Partnering Schools
Our partnering schools include:
- Northeastern Colorado
  - Lone Star School
  - Fort Morgan High School
- Greeley Area
  - Greeley West High School
- Western Slope
  - North Fork High School
  - Delta High School
  - Fruita Monument High School
  - Palisade High School
  - The Ouray School
  - Pagosa Springs High School
- San Luis Valley
  - Mountain Valley School

Higher Education Partners
- CU College of Engineering and Applied Science, Dept of Mechanical Engineering
  - Michael Hannigan
- CU School of Education
- Colorado Mesa University, Depts of Mechanical and Civil Engineering
- Western Colorado University
- Fort Lewis College

Education and Outreach
- Looking to expand to additional partners in Northeastern Colorado
- Expanding to Pueblo, CO
- Adding support for Spanish language in curriculum

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