Studio STEM: Engaging Middle School Students in Networked Science and Engineering Projects

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PROJECT PRINCIPLES
The principal goal of Studio STEM is to:

- engage high needs middle school rural youth in design-based projects related to the science of energy
- that allow them to acquire critical knowledge, skills, and dispositions in STEM,
- while enhancing and extending the learning setting via social media and digital technologies.
Theory of Action

**Design Principles**
1. **Curriculum:** Interesting problems in energy sustainability
2. **Teaching Approach:** Design-based inquiry integrated with ICT platforms
3. **Learning Environment:** Informal design studios with support from facilitators
4. **Audience:** Youth from rural, low socio-economic communities, site leaders, facilitators, and teachers

**Short-Term Outcomes**
- **Knowledge and Skills:** Students, site leaders, and facilitators will gain knowledge and skills in STEM/ICT
- **Expectancies:** Students will have higher levels of efficacy in STEM/ICT-related activities
- **Value:** Students will be more likely to believe that STEM/ICT-related activities are interesting, important, and useful
- **Career Opportunities:** Students will understand how STEM/ICT knowledge and skills relate to STEM/ICT careers

**Long-Term Outcomes**
- **Achievement:** Students will be more likely to earn higher grades in future STEM/ICT courses
- **Retention:** Students will be less likely to drop out of school
- **Course Selection:** Students will be more likely to enroll in STEM/ICT courses in the future
- **College Major:** Students will be more likely to select a STEM/ICT major in college
Basics of the Program

- After school program + summer camp
- Teams w/STEM undergrad facilitator + technology
- Six weeks of self-directed inquiry + collaboration
- Culmination w/community night + showcase

Working with youth from Roanoke and New River Valleys
STRATEGIES FOR INCREASING DIVERSITY
Recruitment Strategies for Rural Settings

- Work closely with school boards, principals, community orgs (4H), teachers & parents
- Understand local needs as well as hindrances (e.g., transportation, household norms, education expectations)
- Sculpt programming to increase likelihood that participants identify with goals & activities
- Leverage existing programs w/mutual goals, e.g., Center to Enhance Engineering Diversity (VT)
Technologies for Engagement

- Webquests that allow freedom to explore beyond school grounds
- Social networking forum, *Edmodo*, that allows for exchanges within and across sites
- Social media to keep stakeholders connected
Lessons Learned

- Facilitation by site leaders & mentors is critical to retention
- Norms & values of rural communities must be expected at all times
- Resource constraints can *never* be overestimated

<table>
<thead>
<tr>
<th>Types of Questioning</th>
<th>Pedagogical Features</th>
<th>Example</th>
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<tbody>
<tr>
<td>Socratic</td>
<td>To prompt and guide one’s thinking</td>
<td>“What should we do to improve your next design?”</td>
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<tr>
<td>Challenge</td>
<td>To elicit a defense or line of argument</td>
<td>“Why are you putting it together like that?”</td>
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<td>Semantic Tapestry</td>
<td>To help “weave” together different ideas; questions from many angles that promote multimodal thinking</td>
<td>“What’s in your storyboard that tells me about your design?” “Why do you think it worked?”</td>
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The main goal of Studio STEM is to engage middle school students in interesting projects related to environmental issues through STEM with the use of social media.

**Saving Animals**
- Save the Seabirds
- Save the Penguins

**Through STEM**
- STEM Processes

**Social Media**
- iPads & Edmodo
Studio STEM Team

- Dr. Brett Jones, Educational Psychology, Virginia Tech
- Dr. Carol Brandt, Science Education, Temple University
- Dr. Christine Schnittka, STEM Education, Auburn University
- Dr. Tiffany Drape, Project Director, Virginia Tech