Teaching 21st Century Reasoning Skills through an Authentic Interdisciplinary STEM Research Experience

Deborah Walker  
*Georgia Southern University*, dwalker@georgiasouthern.edu

Robert Mayes Dr.  
*Georgia Southern University*, rmayes@georgiasouthern.edu

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I. Place-based Education
A. Learning takes students "out" of the classroom and into the community and natural environment
B. Students learn how local systems relate to regional and/or global systems
C. Students collaborate with research scientists, local citizens, organizations, agencies, businesses, and/or government

II. Problem-based Learning
A. Engages students as participants immersed in real-world, ill-structured, problematic situations
B. Organizes curriculum around a holistic problem, enabling student learning in relevant and connected ways
C. Coach students thinking and guides student inquiry, facilitating learning toward deeper levels of understanding

III. Teaching for Understanding (UDT)
A. Identify Desired Results
B. Determine Acceptable Evidence
C. Planning Learning Experiences and Instruction

IV. 21st Century Reasoning
A. Engages students in multiple approaches of investigation (i.e. model-based reasoning, computational reasoning, Engineering Design, and Quantitative Reasoning)
B. Students create, test, and refine models of real-world situations
C. Recognize and accurately interpret data

V. Interdisciplinary STEM (interdisciplinary vs. multidisciplinary)
A. Emphasizes connections between traditionally discrete disciplines
B. Works with a range of sources of information and perspectives
C. Integrates multiple disciplines to solve problems

Results
The required ALSQ project student assessment shows statistically significant increases in student attitudes related to Importance of STEM. Emphasis of STEM Interest in STEM Career, Intrinsic Motivation (3.65-3.95) and Intent to Persist (3.20-3.93) with all also shown in self-Management Self-Regulation Skills (3.51-3.82) although they were not statistically significant. The specific specific project STEM Interest survey asked students to indicate interest in STEM in four areas: general STEM interest, confidence in STEM ability, interest in advanced STEM courses, and STEM career interest. This student survey did not show statistically significant increases in student attitude but did show growth in interest in STEM careers in Fall 2013 (3.26 to 3.55) and spring 2014 (3.26 to 3.56). The survey did also indicate a high level of program satisfaction. Students were very positive about using the method used across the sites was 4.33 with 95.1% giving the course a rating of 4 or 5. Students were also asked to indicate how likely they were to recommend the course to another student. The mean rating across the sites was 4.56 with 90.2% of the students responding with a 4 or 5.

III. Tenets of the Grant - Authentic Learning

IV. Collaborative Partnerships

Collaborative Partnerships

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<th>GSU Faculty</th>
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<td>Engineering – Dr. Mira</td>
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<td>Gray’s Reef – NOAA</td>
<td>Biology – Dr. Leoge &amp; Dr. Gleason &amp; Dr. Colon-Gaud</td>
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<td>Southeastern Natural Sciences Academy</td>
<td>Chemistry – Dr. LoBue</td>
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<td>Sapelo Island National Estuarine Research Reserve</td>
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<td>Skidaway Institute of Oceanography</td>
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<td>Camden County Cooperative Extension</td>
<td>Education – Dr. Mayes</td>
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| Burke County High School                      | Meter High School                        | Richmond Hill Middle School |
| Camden County High School                     | Langston Chapel Middle School            | Snelson-Golden Middle School |
| Statesboro High School                        | William James Middle School              | Lewis Frazer Middle School  |
| Ware County High School                       | Brantley County Middle School            | Southeast Bulloch High School |

Participants Reflections

Once a year, high school grant participants arrive on the campus of Georgia Southern University to share with each other in a research roundtable discussion and to participate in informative sessions in each of the GSU STEM departments. Students are exposed to the many STEM career opportunities available to them through a college experience.

"We learn that things that aren't normally taught at school. We take real world problems and try to solve them through STEM. That is something that we aren't able to do in other classes." - Student

"...we were able to have experiences that we can take back to the classroom to our students so that they can use the same processes that the people that work in the field use every day. This gives our students experience in using science, technology, engineering, and math..." - Teacher

Institute for Interdisciplinary STEM

The Institute for Interdisciplinary STEM Education (i2STEMe) will establish collaborative interdisciplinary programs committed to excellence in K-20 STEM teaching and learning, with a focus on rural, diverse, low SES, and under-represented populations. The Institute will address problems indigenous to the rural environments of the region, including issues of cultural diversity and cultural relevance within our diverse population, matters of equitable access to STEM for low SES students, and concerns about the relevance of STEM for rural students. Long-term goals of the Institute are to establish partnerships across Georgia, the southeastern region of the United States, nationally, and even internationally to address issues of STEM education in rural areas.