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

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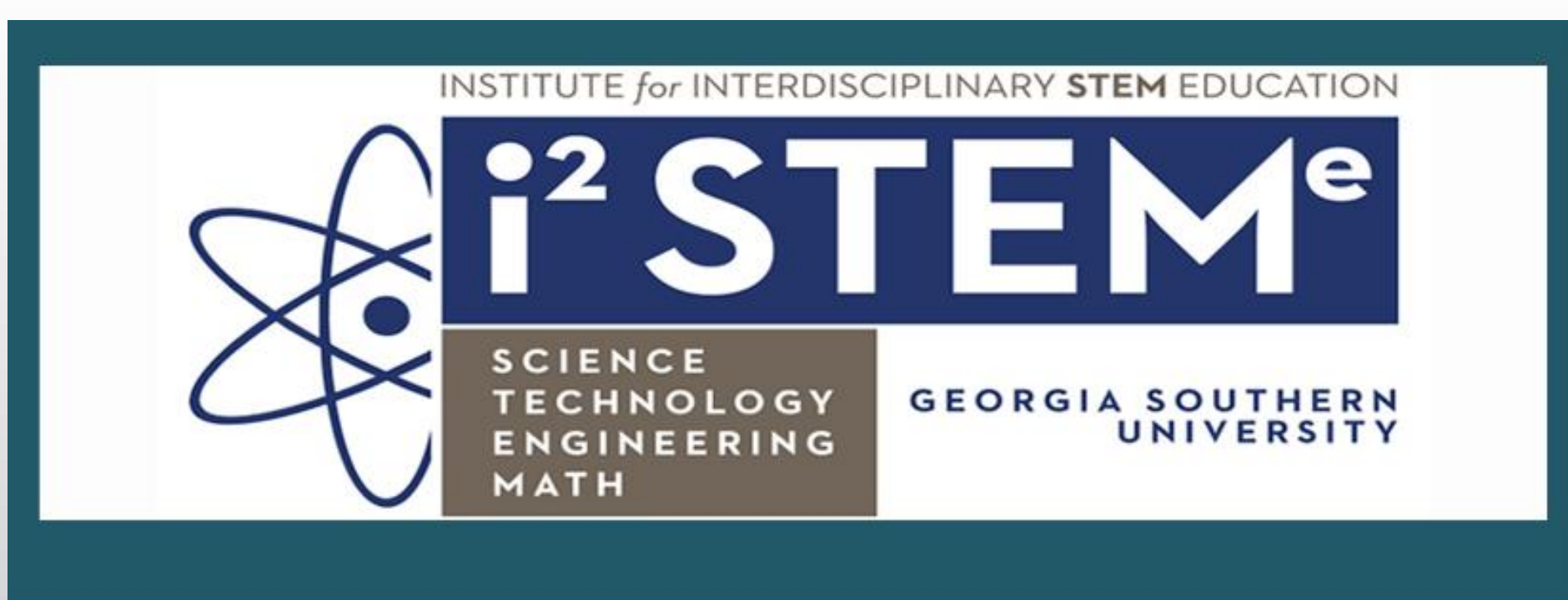
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Real STEM

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Real STEM Grant

A Race to the Top Grant funded through the Governor's Office of Student Achievement (GOSA) awarded to Georgia Southern University.

Through partnerships, develop and implement high school courses that focus on interdisciplinary STEM scientific research, leading to a three course sequence that constitutes an academic pathway and supports a STEM school designation.

This grant proposes that when teachers are trained in the tenets of the grant, they will use these strategies in designing course work for students that will result in increased STEM achievement, increased interest in STEM and STEM careers, and STEM literate citizens better prepared to make informed decisions about grand challenge issues which will impact their lives.

Tenets of the Grant - Authentic Learning

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. Coaches student thinking and guides student inquiry, facilitating learning toward deeper levels of understanding

III. Teaching for Understanding (UbD)

- A. Identify Desired Results
- B. Determine Acceptable Evidence
- C. Planning Learning Experiences and Instruction



IV. 21st Century Reasoning

- A. Engages student 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, Enjoyment of STEM, Interest in STEM Career, Intrinsic Motivation (3.36-3.95) and Intent to Persist (3.32-3.59). Increases were also shown in Self-Management/Self-Regulation Skills (3.81-3.92) although they were not statistically significant. The program specific pre-post 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 interests. The student survey did not show statistically significant increases in student attitudes, but did show a gain in student interest in STEM careers in Fall 2013 (3.38 to 3.55) and spring 2014 (3.22 to 3.38). The survey did also indicate a high level of program satisfaction. Students were very positive about the courses. The mean rating across the sites was 4.53 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.

Collaborative Partnerships

Team 1 – Research Institutes	Team 2 – GSU Faculty
Georgia Southern University	Engineering – Dr. Mitra
Gray's Reef – NOAA	Biology – Dr. Leege & Dr. Gleason & Dr. Colon-Gaud
Southeastern Natural Sciences Academy	Chemistry – Dr. LoBue
Sapelo Island National Estuarine Research Reserve	Geology – Dr. Smith
Georgia Adopt A Stream	Mathematics – Dr. Lanier
Skidaway Institute of Oceanography	Physics – Dr. Gatch & Dr. Balaraman
Camden County Cooperative Extension	Education – Dr. Mayes

Team 3 – Partner Schools

Burke County High School 	Metter 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 Frasier Middle School
Ware County High School 	Brantley County Middle School 	Southeast Bulloch High School

Grant Timeline

Spring 2013 – PLC work and implement a 1-2 week research module



Summer 2013 – PLC members participate in field experiences and an education symposium



School Year 2013/14 – Cohort 1: PLC work and implement a high school scientific research course
Cohort 2: PLC work and implement a 1-2 week research module



Summer 2014 – Continue PLC field experiences and pedagogy exploration



School Year 2014/15 – Cohort 1: Continue PLC work and course implementation
Cohort 2: Continue PLC work, module and/or course implementation
Cohort 3: Begin PLC work, 1-2 week research module and/or course implementation



December 2014 – December 2016 – Real STEM Scale Up grant – implement a scientific research course at a high school and a feeder middle school – Partners: Bulloch County, Burke County, Bryan County, Bibb County, Fulton County and Mercer University

Participant 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 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.