

Mar 7th, 2:45 PM - 2:05 PM

# Real STEM: Scientific Research for Rural Georgia High School Students

Deborah M. Walker

Georgia Southern University, [dwalker@georgiasouthern.edu](mailto:dwalker@georgiasouthern.edu)

Robert L. Mayes

Georgia Southern University, [rmayes@georgiasouthern.edu](mailto:rmayes@georgiasouthern.edu)


Raushanah Oglesby

Georgia Southern University

Rich McCombs

Statesboro High School

Follow this and additional works at: <https://digitalcommons.georgiasouthern.edu/stem>

 Part of the [Educational Methods Commons](#), [Higher Education Commons](#), [Science and Mathematics Education Commons](#), and the [Secondary Education and Teaching Commons](#)

---

## Recommended Citation

Walker, Deborah M.; Mayes, Robert L.; Oglesby, Raushanah; and McCombs, Rich, "Real STEM: Scientific Research for Rural Georgia High School Students" (2014). *Interdisciplinary STEM Teaching & Learning Conference*. 8.  
<https://digitalcommons.georgiasouthern.edu/stem/2014/2014/8>

This event is brought to you for free and open access by the Conferences & Events at Digital Commons@Georgia Southern. It has been accepted for inclusion in Interdisciplinary STEM Teaching & Learning Conference by an authorized administrator of Digital Commons@Georgia Southern. For more information, please contact [digitalcommons@georgiasouthern.edu](mailto:digitalcommons@georgiasouthern.edu).

INSTITUTE *for* INTERDISCIPLINARY **STEM** EDUCATION



**i<sup>2</sup>STEM<sup>e</sup>**

SCIENCE  
TECHNOLOGY  
ENGINEERING  
MATH

GEORGIA SOUTHERN  
UNIVERSITY

# Real STEM

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



# Goal:

Through partnerships, develop and implement a high school course that is an interdisciplinary STEM scientific research course

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 student STEM achievement, increased student interest in STEM and in STEM careers, as well as students will become STEM literate citizens better prepared to make informed decisions about grand challenge issues which will impact their lives.

# Tenets of the Grant Work

- Place-based Education
- Problem-based Learning
- Teaching for Understanding (UbD)
- Modes of Reasoning
- Interdisciplinary STEM (interdisciplinary vs multidisciplinary)

# Real STEM Grant – Teacher Reference Sheet

Theory	Definition	Application	Implementation	Goal
Problem Based Learning (PBL)	A student centered context-specific approach to learning which engages students in real-world challenges similar to those they might encounter as a practitioner of a specific discipline. These challenges are usually present in the form of cases to be studied rather than specific problems to be solved. There is rarely a right or wrong answer but rather solutions based on the knowledge necessary to address the issue.	Through a process of discussion and research, students identify a selection of questions that might be workable for their project, work on solutions, and publish those solutions online.	*Students assume a major responsibility for their own learning and teachers are facilitators. *Learning occurs in small groups and collaboration is emphasized.	Students gain meaningful skills through these projects, including how to share work, collaborate, organize, and express themselves more effectively.  PBL emphasizes solving complex problems in rich contexts and aims at developing higher order thinking skills
Place Based Education (PBE)	It is an educational approach which uses local community and the surrounding environment as the primary context for interdisciplinary learning. It focuses on student-driven, project-based explorations of local issues, including environmental, social, cultural, and civic.	It is characterized by interdisciplinary learning, team teaching, hands-on learning experiences that often center on problem-solving projects, learner-centered education that adapts to students' individual skills and abilities, and the exploration of the local community and natural surroundings.	What are four or five overarching questions might guide your students' study? How will you assess student learning? (Possible strategies and projects) What field studies, monitor, or other inquiry activities might students become involved in What community needs might students address as part of this unit or project? How might students become involved in community activities related to unit or project? How can they participate in data gathering, reporting, etc...? What creative possibilities relate?	The goal is to become more aware and conscious of the community or "place" and focusing educational components on that place (Nespor, 2008).  Engage students in how global challenges impact their place
Understanding by Design Framework	A framework for teaching that works within standards-driven curriculum which helps teachers clarify the goals, devise assessments which are effective measures of student understanding, and engage students in learning activities. It works on a 3 stage design process called "backward design" which starts with the end in mind and delays the planning of activities until the goals have been clarified and assessments designed.	Teachers are coaches of understanding, not mere purveyors of content or activity. Focus on ensuring learning, not just teaching. Aim and check for successful meaning making and transfer by the learner.	Three stages: Stage 1- Identify Desired Results <ul style="list-style-type: none"> <li>Goals</li> <li>Essential questions</li> <li>Knowledge and skills</li> </ul> Stage 2- Determine Acceptable Evidence <ul style="list-style-type: none"> <li>Performance products</li> <li>Criteria assessed</li> <li>Alignment</li> </ul> Stage 3- Plan Learning Experiences and Instruction Accordingly <ul style="list-style-type: none"> <li>Activities, experiences, and lessons</li> <li>Learning plan</li> <li>Progress Monitoring</li> <li>Unit sequence</li> <li>Alignment</li> </ul>	To develop and deepen student understanding- the ability to make meaning of learning via "big ideas" and to transfer learning.

<p>Quantitative Reasoning</p>	<p>Is the application of mathematical concepts to solve real-world problems where students learn to apply basic quantitative skills to the devise solutions. QR is a skill that students learn that has practical applications.</p>	<p>Framework includes four key components:</p> <ol style="list-style-type: none"> <li>1. Quantification Act (QA): Mathematical process of conceptualizing an object and an attribute of it so that the attribute has a unit measure.</li> <li>2. Quantitative Literacy (QL): Use of fundamental mathematical concepts in sophisticated ways for the purpose of describing, comparing, manipulating, and drawing conclusions from variables developed in the quantification act.</li> <li>3. Quantitative Interpretation (QI): Ability to use models to discover trends and make predictions.</li> <li>4. Quantitative Modeling (QM): Ability to create representations to explain a phenomenon and to revise them based on fit to reality.</li> </ol>	<p>-Begin with a problem (task) which needs to be specified and should lead to the construction of a working model.</p> <p>-This model needs to be tested and tried and if needed re-designed.</p> <p>-Finally, students need to elaborate the important ideas behind their model and data.</p> <p>*Students need to understand the quantities themselves and visualize that their images include values that vary. They need to form a representation of the "object made by uniting those quantities in thought and maintaining that unit while also maintaining a dynamic image of the situation in which it is embedded" (Thompson 2011, p. 27).</p>	<p>To align classroom activities with how scientists in the real world work</p> <p>The development of a model to offer explanation for the situation under investigation</p>
<p>Modes of Reasoning</p>	<p>Approach problem-solving from various directions. Some use the scientific method, or engineering design, where others use inductive or deductive reasoning. Helping develop innovative interdisciplinary teaching and learning strategies.</p>	<p>The three main modes of reasoning to be focused on include quantitative reasoning, scientific method, and engineering design.</p>	<p>When students get stuck in problem solving they can be asked to consider the problem a different perspective. For example, some will begin with the problem whereas others will begin with the desired solution.</p>	<p>To help students think creatively and outside of their one world view and to learn that different approaches can be used to get to the desired result.</p>

Summary Checklist for Teachers	Accomplished	Developing	Not Demonstrated
<b>I. Teaching For Understanding</b>			
A. Identify Desired Results			
I. Identify Enduring Understandings			
I. Research Question			
A. Determine Acceptable Evidence			
I. Pre-Assessment			
I. Variety of formative and summative assessments			
I. Key Performance Task with Accompanying Rubric (Report out Research Findings)			
A. Planning Learning Experiences and Instruction			
I. Module Outline			
I. Instructional Strategies			
<b>II. Place-Based</b>			
A. Learning takes students "out" of the classroom and into the community and natural environment			
A. Students learn how local systems relate to regional and/or global systems			
A. Students collaborate with research scientists, local citizens, organizations, agencies, businesses, and/or government			
<b>III. Problem-Based</b>			
A. Engages students as participants immersed in a real-world, ill-structured, problematic situations.			
A. Organizes curriculum around a holistic problem, enabling student learning in relevant and connected ways.			
A. Coaches student thinking and guides student inquiry, facilitating learning toward deeper levels of understanding			
<b>IV. Modes of Reasoning</b>			
A. Engages student in multiple approaches of investigation ( i.e. Scientific Method, Engineering Design, and Quantitative Reasoning )			
A. Students create, test, and refine models of real-world situations.			
A. Recognize and accurately interpret data			
<b>V. Interdisciplinary STEM</b>			
A. Emphasizes connections between traditionally discrete disciplines			
A. Works with a range of sources of information and perspectives			
A. Integrates multiple disciplines to solve problems			



# Grant Structure

## **Team 1 – Research Institutes**

- Georgia Southern University
- Gray's Reef – NOAA
- Southeastern Natural Sciences Academy
- Sapelo Island National Estuarine Research Reserve

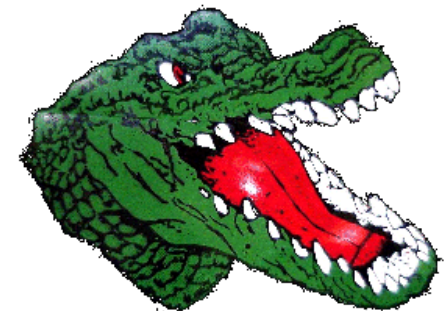
## **Team 2 – GSU Faculty and 2 High School Master Teachers**

- Engineering – Dr. Mitra
- Biology – Dr. Leege
- Chemistry – Dr. LoBue
- Geology – Dr. Smith
- Mathematics – Dr. Lanier
- Physics – Dr. Balaraman
- Education – Dr. Mayes

# Grant Structure

## Team 3 – School Partners

- Statesboro High School
- Burke County High School
- Camden County High School
- Ware County High School



## Team 3 – Professional Learning Communities

- Interdisciplinary
- Science
- Mathematics
- Engineering

# Timeline

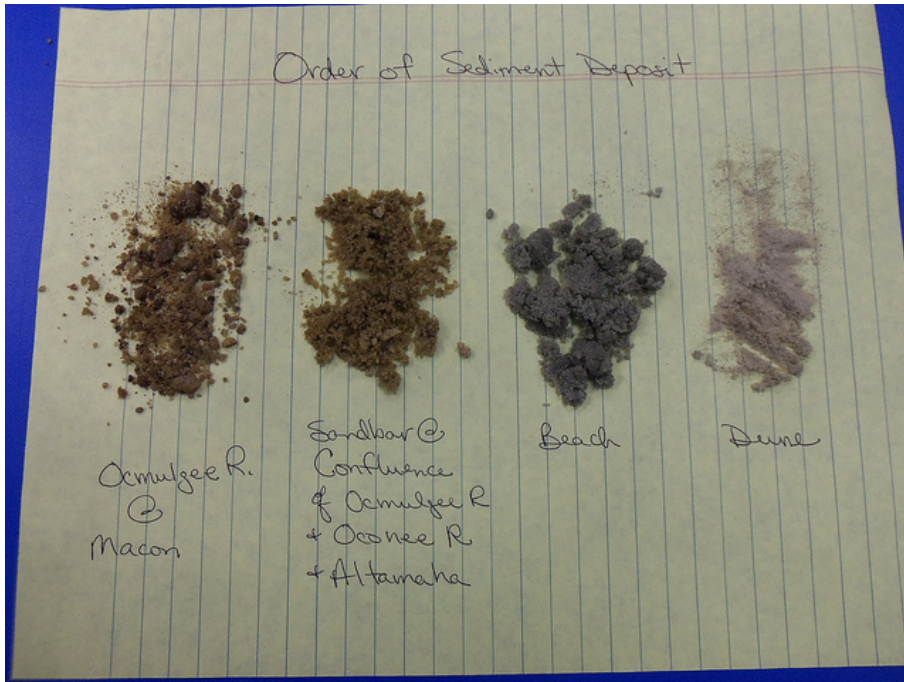
Spring 2013 – PLC work and implement a 1-2 week module



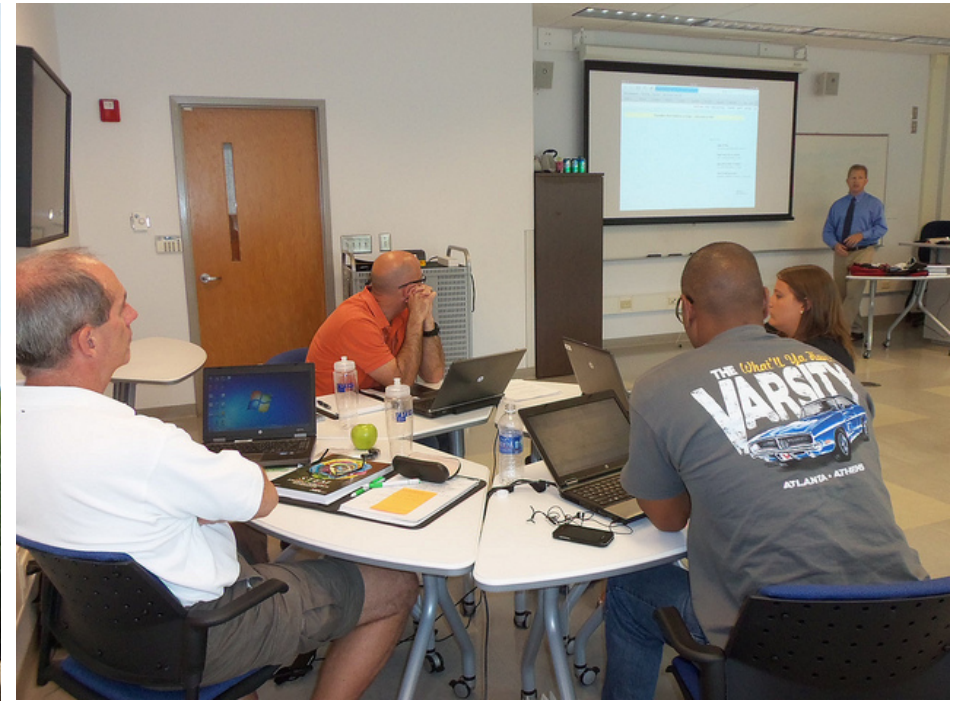
# Timeline

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









# Timeline

Fall 2013 – PLC work and implement a high school scientific research course





# GSU STEM Day

# Timeline

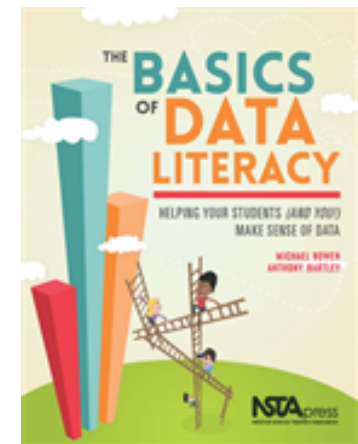
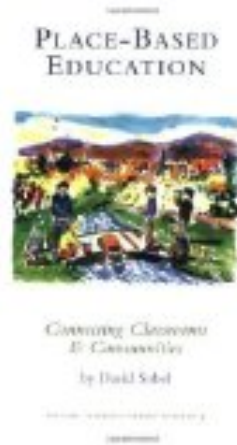
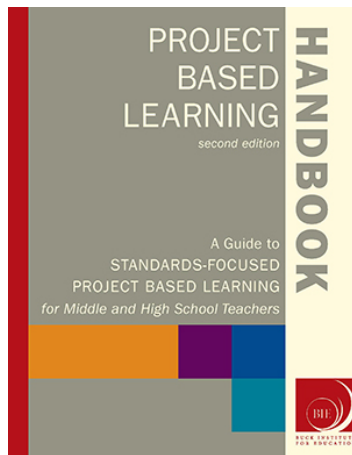
- Spring 2014 – continue PLC work and course implementation
- Summer 2014 – continue field experiences and pedagogy exploration



# Student Presentation of Research

# Recommended Resources

Project Based Learning (PBL) Buck Institute for Education  
[www.bie.org](http://www.bie.org)



# Real STEM Contact Information

- Dr. Robert Mayes, PI  
[rmayes@georgiasouthern.edu](mailto:rmayes@georgiasouthern.edu)
- Debbie Walker, Project Coordinator  
[dwalker@georgiasouthern.edu](mailto:dwalker@georgiasouthern.edu)
- Raushanah Oglesby, Graduate Assistant  
[ro00320@georgiasouthern.edu](mailto:ro00320@georgiasouthern.edu)