

Georgia Southern University

## Georgia Southern Commons

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Interdisciplinary STEM Teaching & Learning  
Conference (2012-2019)

2012 Interdisciplinary STEM Conference (March  
9, 2012)

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Mar 9th, 3:00 PM - 3:45 PM

### STEM II Initiative-Updates from Participating Institutions (Part 2)

Pamela Gore

*Georgia Perimeter College*

Dabney Dixon

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Charles Kutal

*University of Georgia*

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# USG STEM INITIATIVE: OVERVIEW AND LESSONS LEARNED

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Dr. Nathan W. Moon

Associate Director for Research  
Center for Advanced Communications  
Policy (CACP)  
Georgia Institute of Technology

Project Director / Lead Evaluator  
STEM Initiative Policy and Programmatic  
Support Project  
Office of Educational Access and Success  
University System of Georgia



**OFFICE OF EDUCATIONAL ACCESS AND SUCCESS**

# Introduction

- Launched by Chancellor as Presidential Initiative in 2007
- Led by Office of Educational Access and Success (OEAS, formerly EPIR)
- Building on, advancing successful USG programs (e.g. Georgia PRISM)
- STEM I Initiative: 2007-2011
- STEM II Initiative: 2011-present



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# Initiative Overview, Pt. 1

## Three Objectives (abbreviated)

1. To increase P-12 student preparation for and interest in STEM in college,
2. To increase the success rates and number of students in college who pursue the STEM disciplines, and
3. To increase the number of teachers who are prepared in science and mathematics.



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# Initiative Overview, Pt. 2

## Strategies and Implementation

### 12 strategies, including key programs

- Academy for Teachers (AFT)
- Mathematics, Engineering, Science Achievement (MESA)
- Fostering Our Community's Understanding of Science (FOCUS)
- Mini-grants for P-16 Learning Communities

Annual budget: ~\$2.6 million - \$2.8 million

- All funds go back to USG institutions



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# Evaluation of STEM I Initiative

- Formative evaluation - late 2010
- Summative evaluation - late 2011
  
- Based on initial evaluation findings, STEM I Initiative revised, re-competed as STEM II Initiative in early 2011
  
- 5 returning institutions, 2 newcomer institutions



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# Key Evaluation Findings – Student Success Rates

*Among participating institutions, FY2007-FY2011*

- Total increase in STEM majors by *minimum* of **7.84%**, up to a *maximum* of **66.18%**
- Increase in A/B/C rates in biology (**1.4%**), chemistry (**3.0%**), mathematics (**1.1%**), and physics (**1.5%**)
- Increase in STEM degree completion: **1.71%** (with controls); **19.71%** (without controls)



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# Key Evaluation Findings – Teacher Preparation

*Among Six Baccalaureate Institutions, FY2007-FY2011*

- STEM education majors increased by **40.56%**  
(from **633** to **946**)
- STEM education degrees increased by **37.67%**  
(from **215** to **296**)



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# Key Evaluation Findings – Ongoing Challenges

- Comparability and reliability of data collected
- Outputs-oriented indicators regarding programs;  
Need for outcomes-oriented indicators
- Despite overall progress, variable institutional performance



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# STEM II Initiative Competition

## Two RFPs Released in December 2010

- Category 1 - Returning institutions (5 selected)
- Category 2 - Newcomer institutions (2 selected)
- Total of 28 proposals received
- Review panel included USG leadership, USG university president, outside reviewer



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# Priorities for STEM II Initiative

- Emphasis on **innovation** (newcomers) and **refinement and scaling of best practices** (returners)
- Higher priority placed upon institutional programs
- Dissemination of findings for benefit of entire USG



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# Update on the STEM II Initiative at Columbus State University

Tim Howard, Director  
Math & Science Learning Center

Kim Shaw, Co-Director  
UTeach Columbus



# Components of the CSU Project

- Service learning course
- Peer instruction study
- Faculty SoTL mini-grants



# Service Learning Course

Hired a New Master Teacher, Gail Sinkule

- National Board certified
- 30+ years of K-12 experience
- Former president of GSTA
- Taught to a broad spectrum of socio-economic backgrounds
- First offering of course Spring 2012



COLUMBUS STATE  
UNIVERSITY

# Service Learning Course

## Step 1: Inquiry Approaches to Teaching (*new*)

- Teach math/science lessons in elementary schools
- Students from any major
- One credit hour
- Meets UTeach Columbus requirement
- Spring 2012 enrollment 32 (25% above goal)



Step 2 course planned for Fall 2012



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UNIVERSITY

# Peer Instruction Study

Investigators: Cindy Henning, Tim Howard,  
Kathleen Hughes, Kim Shaw

- 19 Peer Instruction Leaders (PILs)
- About 1400 students served
- Core courses in BIOL, CHEM, MATH,  
PHYS, STAT





# Peer Instruction Design

- Matched-pair design
- PIL assigned to one lab section
- PIL attends lectures, *lab*
- PIL meets with instructor at least 4 times
- Help sessions available to all students with that instructor, both in Peer Instruction section and in control section
- Data collection ongoing to determine effectiveness on larger scale



# Faculty SoTL Mini-grants

Funding to support

- Participation in efforts to strengthen student learning and achievement
- Contributing scholarship that promotes student learning and achievement
- Development and/or implementation of new instructional methods or techniques
- Projects that promote the success and recruitment of traditionally underrepresented groups



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# Faculty SoTL Mini-grants

**Zdeslav Hrepic:** Methodology and/or Technology: Making a Difference in Improving Students' Problem Solving Skills

**Rajeev Dabke:** Development of Undergraduate Curriculum in the Area of Experimental Physical Chemistry

**John Barone:** Use of a Writing Consultant in a Science Course

**Kathleen Hughes:** Evaluation of Two Peer-Assisted Learning Strategies in BIOL 2221





# Reaping Additional Benefits

- UTeach Columbus - \$1.4 million grant
- Robert Noyce Teacher Scholarship program – \$1.2 million grant from NSF
- SoTL STEM Seminar
- Math & Science Teachers Council (MAST)
- Math & Science Learning Center
- Higher profile for STEM Education efforts



# For Additional Information

See our poster following this session!

Contact us!

- Tim Howard

[Tim.Howard@ColumbusState.edu](mailto:Tim.Howard@ColumbusState.edu)

- Kim Shaw

[shaw\\_kimberly@ColumbusState.edu](mailto:shaw_kimberly@ColumbusState.edu)



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# Georgia Gwinnett College

School of Science & Technology

## STEM Initiative II Program

Dr. Thomas Mundie, PI

Dr. Judy Awong-Taylor, Dr. Allison D'Costa, Dr. Greta  
Giles, Dr. David Pursell, Dr. Clay Runck, Co-PIs

# USG STEM Initiative II

## Core Goals

1. *Promote K-12 student preparation for and interest in majoring in STEM in college.*
2. *Increase the success of STEM majors in college.*
3. *Advance the production of science and mathematics teachers for the schools, which in turn will lead to improved preparation of K-12 students in science and mathematics.*

## Strategies

1. *Establish a structured mini-grant program targeted toward STEM faculty*
2. *Develop a service learning course to provide STEM undergraduates the opportunity to gain teaching experience in science and math at K-12 level*
3. *Institution-specific strategies that address instructional needs specific to the institution in the area of STEM through innovative approaches*



# GGC SST STEM Initiative Strategies

## Strategy 3

Establish a 4-Year Undergraduate Research Experience Program (4-yr URE)

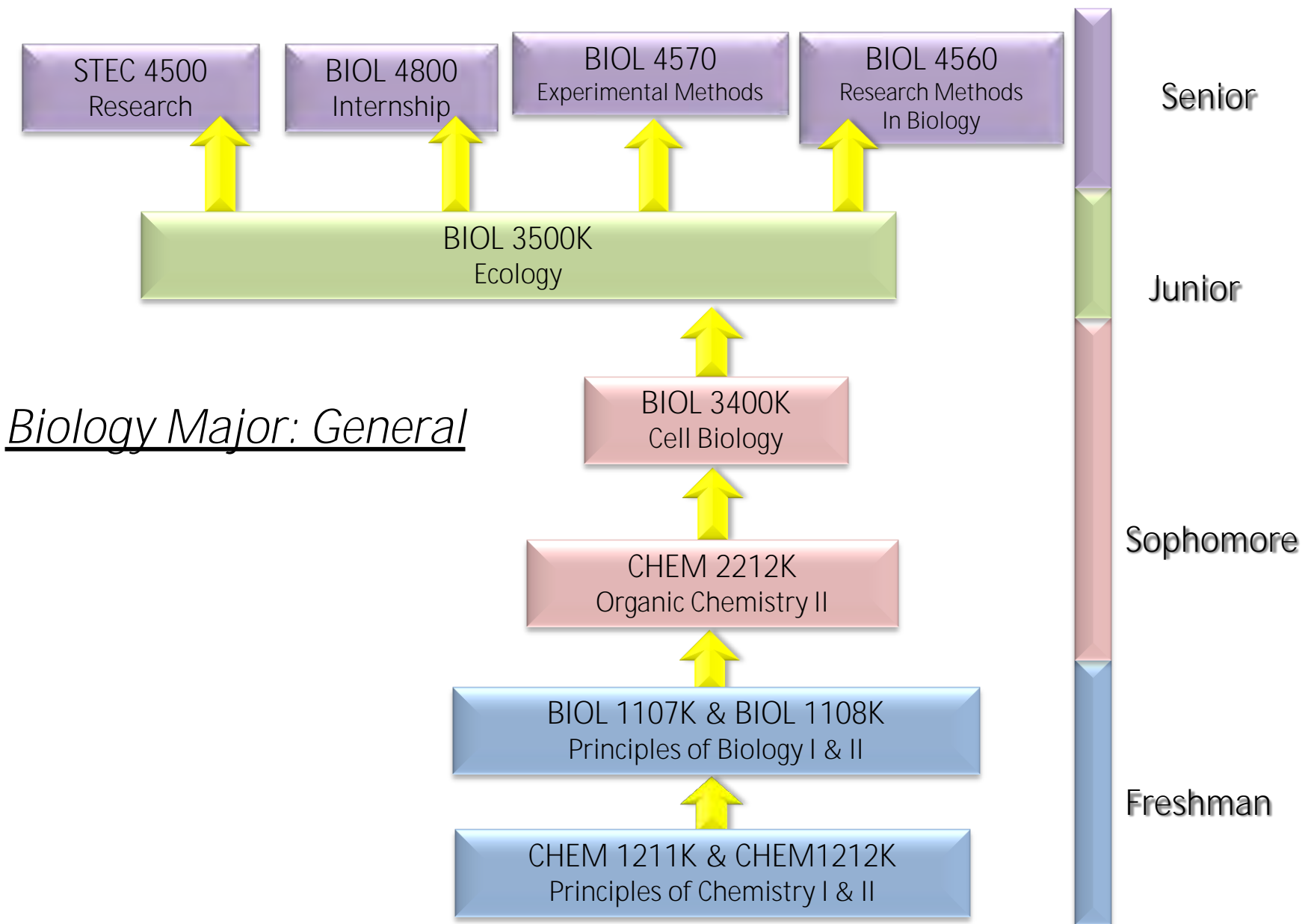
- ***Aligned with SST's 4-yr URE Program***
  - *SST 4-yr URE Committee*
  - *Early and active involvement in systematic investigation and research.*
  - *Promote the success of STEM students*

## Strategy 1

**Structured “mini grant” program**

- *Fund 4-yr URE Mini-Grants*

# 4-Year Undergraduate Research Experience



## General Research Skills

### Communication

Scientific communication requires good listening and note-taking skills, the ability to find information from current primary literature sources, and the skills to disseminate information in both written and oral form using proper scientific formatting.

- Ability to search for appropriate materials using both traditional (journals, books) and electronic libraries
- Ability to read, understand, and follow complex directions and instructions, including lab/equipment manuals and system references;

### Critical Thinking and Quantitative Reasoning

Scientists must collect and analyze data using proper statistical significance, controls, and mathematical analyses. They must apply these same quantitative reasoning skills to literature and peer submissions .

- Ability to follow a scientific/technical methodology, to apply mathematical or IT solutions, and to adapt the methodology/models if necessary;
- Ability to problem-solve or trouble- shoot an experiment/ experimental procedure / equipment using appropriate resources

### Creativity:

Scientists exhibit creativity through the development of research projects, including the generation and testing of a hypothesis and the troubleshooting skills necessary to overcome experimental obstacles.

- Ability to design and implement research projects

### Collaboration:

Scientists must act in a global, diverse, and multidisciplinary context and follow universal moral and ethical principles at all times. They are leaders in their community and must always act in good faith.

- Ability to participate or take lead in a research team setting;
- Ability to follow required regulations and to act ethically during research.

# Research Skills for Math Majors

## Senior

- Synthesis of all freshmen, sophomore, junior experiences

## Junior

- Writing reports more advanced
- Read research articles
- Propose research problems

## Sophomore

- Visualization for 3D and other types of functions
- Analyze and model data
- Writing reports
- Proof writing

## Freshmen

- Visualization for 2D of Polynomial functions
- Use technology (Computer algebra system like Maple)
- Analyze, model data - Optimization Problems

# Strategy 1: SST's 4-Yr URE Mini-Grant Program

## Three Categories of 4-yr URE Mini-Grants

- Course-imbedded research projects that promote the 4-yr URE model (*Priority*)
- Individual or small group Undergraduate Research (STEC 4500) Projects aligned with the 4-yr URE model
- Development, implementation, and research of innovative instructional strategies that pertain to the Scholarship of Teaching and Learning (SoTL)

# Strategy 1: SST's 4-Yr URE Mini-Grant Program

## Project Types

- Pilot Projects (*involve one section to test an idea; one semester; funds used for supplies*)
- Small Scale Projects (*involve 2-3 sections; 1-2 faculty; 1-2 semesters; funds for supplies/equipment; possible funds to support decrease in teaching load*)
- Large Scale Projects (*involve multiple sections; 2 or more faculty; 2-3 semesters; etc.*)
- Collaboration: *strongly encouraged within disciplines & between schools*

## Funded Projects

- 22 funded mini-grants

# GGC SST STEM Grant Strategies

## Strategy 2

Develop a service learning course

- ***Aligned with GGC's mission***
- ***Provide opportunities for GGC's STEM majors to gain teaching experience at the K-5 level***
- *Promote research-based science projects*
- *Curriculum Repository*
  - *Virtual Labs*
  - *Resources*

# Assessment & Data Collection

## Strategy 3 & 1: Assessment of 4-yr URE & Mini-Grant Program

### Assessment of 4-Yr URE Program using Mini-Grants

- 1. *Student attitudinal surveys*
- 2. *Course content assessment*
- 3. *Faculty Attitudinal Survey*
- 4. *Student Performance Data (BOR)*

## Strategy 2: Assessment of Service Learning Course

### Assessment of Service Learning Course

- 1. *Student attitudinal survey*
- 2. *Course content assessment*
- 3. *Student Performance Data (BOR)*





# Georgia College



## USG STEM Initiative Programs

Rosalie A. Richards

## Georgia College

- Georgia's Public Liberal Arts University
- three locations: Milledgeville, Macon, Warner Robins
- over 6,000 students (~5,000 undergraduates)

### Four STEM II Components

- STEM Faculty Mini-grant program
- Service Learning - Project FOCUS
- STEM Retention Initiative
- STEM Faculty lines



## Faculty Mini-grant Program

### GOALS

- *to stimulate innovative projects that improve instruction and student learning in STEM and in programs that lead to initial teacher certification in these areas*
- *to foster collaborations among faculty within/external to GC*
- *to seed projects that are competitive for external funding*
  - grants up to \$7,000
  - 57 projects funded since 2008
  - annual STEM Symposium



## Examples of Projects Funded: 2011-12

- *Assessing learning gains and the role of Tutoring Services in successful completion of students in an introductory physics course* – **Hauke Busch, Lori Robinson**
- *Peer-teaching in computer science through videos* – **Gita Phelps**
- *Isolating, identifying and characterizing bacteriophages: new course designs that target STEM educators, K-12 and undergraduate students* – **Amanda Chase, Samuel Mutiti**
- *From Shallow to Deep: revising the Introduction to Environmental Science Lab Manual with a focus on local water issues* – **Caralyn Zehnder**





## Impact of Mini-grant Program

- **Numerous presentations and publications**
  - North American Diatom Symposium, 2009
  - *Physics Teacher*, 2011
- **External funding**
  - SENCER Grant, 2010
  - Robert Noyce Scholarship Program - NSF
- **Support for innovation** → more than a dozen STEM/STEM Ed. courses revised, novel instructional materials developed
- **Student learning** → FY07 - FY11, DWF rates decreased from 27% to 20% across courses in STEM disciplines
- **Impact on over 3,000 K-16 faculty, teachers and students**





# Service Learning Initiative -

## Project FOCUS

- *provide service learning experience for STEM and STEM education majors in area schools*
- *work with host teachers to develop learning experiences for K-12 students*



### **BENEFITS OF Project FOCUS**

- Inquiry-based, hands-on STEM instruction
- Learning about schools and community
- Interest in teaching as a career
- Developing habit of service to the community





## STEM Retention Initiative

***Supplemental Instructors*** - advanced undergraduate students in targeted STEM courses

- *SIs meet with classes*
- *SIs provide bi-weekly tutoring support for students enrolled in course*
- *departments collect data on effectiveness of SIs in their courses.*
  - *e.g. multi-year study in biology showed 50% reduction in DFW rates using SIs*

## Supplemental Instructor Program

- SIs in 55 sections of introductory STEM courses in FY12
- faculty SI coordinator (Lori Robinson), regular meetings
- professional development for SIs
- maintaining student logs and examining student performance data and feedback
- debriefings at end of each semester





## STEM Faculty Lines

- three faculty lines in mathematics, middle grades education, and physics
- increases in number of majors and degrees conferred in STEM and STEM Education
- Some data
  - FY07-FY11, 24% increase in STEM and STEM education majors
  - 81% increase in STEM degrees conferred
  - 11% increase in STEM Ed. degrees



## **Cultural Shift and Sustainability:**

- ***Collaboration with institutional programs*** - connecting to campus initiatives: Service Learning, Academic Outreach, Milledgeville YES, Science Education Center, Middle Grades Ed, STEM departments and institutional initiatives (e.g. GC1Y courses)

## ***Acknowledgement:***

- ***College of Arts & Sciences***
- ***College of Education***
- ***Center for Program Evaluation and Development***
- ***Science Education Center***

# STEM II Initiative at Georgia Perimeter College

Pamela J. W. Gore  
Kouok Law



*Two Years That Will Change Your Life*

# Georgia Perimeter College



- Five locations + online
- 26,470 students Fall 2011
- 3rd largest institution in the Univ System of GA
- GA's largest freshman class - 15,700 students
- The college of choice for more Georgia students



# STEM II Faculty Mini-Grants

- Encouraging faculty collaboration
- Producing innovating educational materials
- Offering field research experiences for students in STEM gateway courses
- 8 mini-grants funded
- \$4500
- More in review



# STEM II Faculty Mini-Grants

1. **Kim Bennekin** – *Fostering meaningful interaction in online college algebra courses*
2. **Behnaz Rouhani** – *Identifying students' misconceptions in Calculus*
3. **Amy Cook** - *Lecture slides for Principles of Chemistry I and II*
4. **Amy Cook** – *Teaching demonstration videos for Principles of Chemistry II*



# STEM II Faculty Mini-Grants

5. **Ilse Ricketts** – *Introduction to Science Laboratory Bootcamp*
6. **Allison Wolf** – *More effective Resources – better results*
7. **Jonathan Lochamy** – *Discover Life Research Interns*
8. **Carmen Hall** - *Undergrad research at Snapfinger Creek Mitigation Bank*



# STEM Peer-Led Undergraduate Study (PLUS) Tutors



- Hired 6 tutors
- 10 hours/week
- 1-2 per campus
- CHEM 1211
- CHEM 1212





# Workshops and Seminars for Faculty and K-12 Teacher Professional Development



# Project MESA

- Preparing educationally disadvantaged STEM majors (**female, minorities, low-income, 1<sup>st</sup> generation**) to transfer and graduate from a four-year institution with a **math-based degree**.
- Assists students in:
  - ✓ developing academic and leadership skills,
  - ✓ increasing educational performance, and
  - ✓ gaining confidence in their ability to compete professionally



# GPC MESA Students & Faculty



# MESA Conference 2012



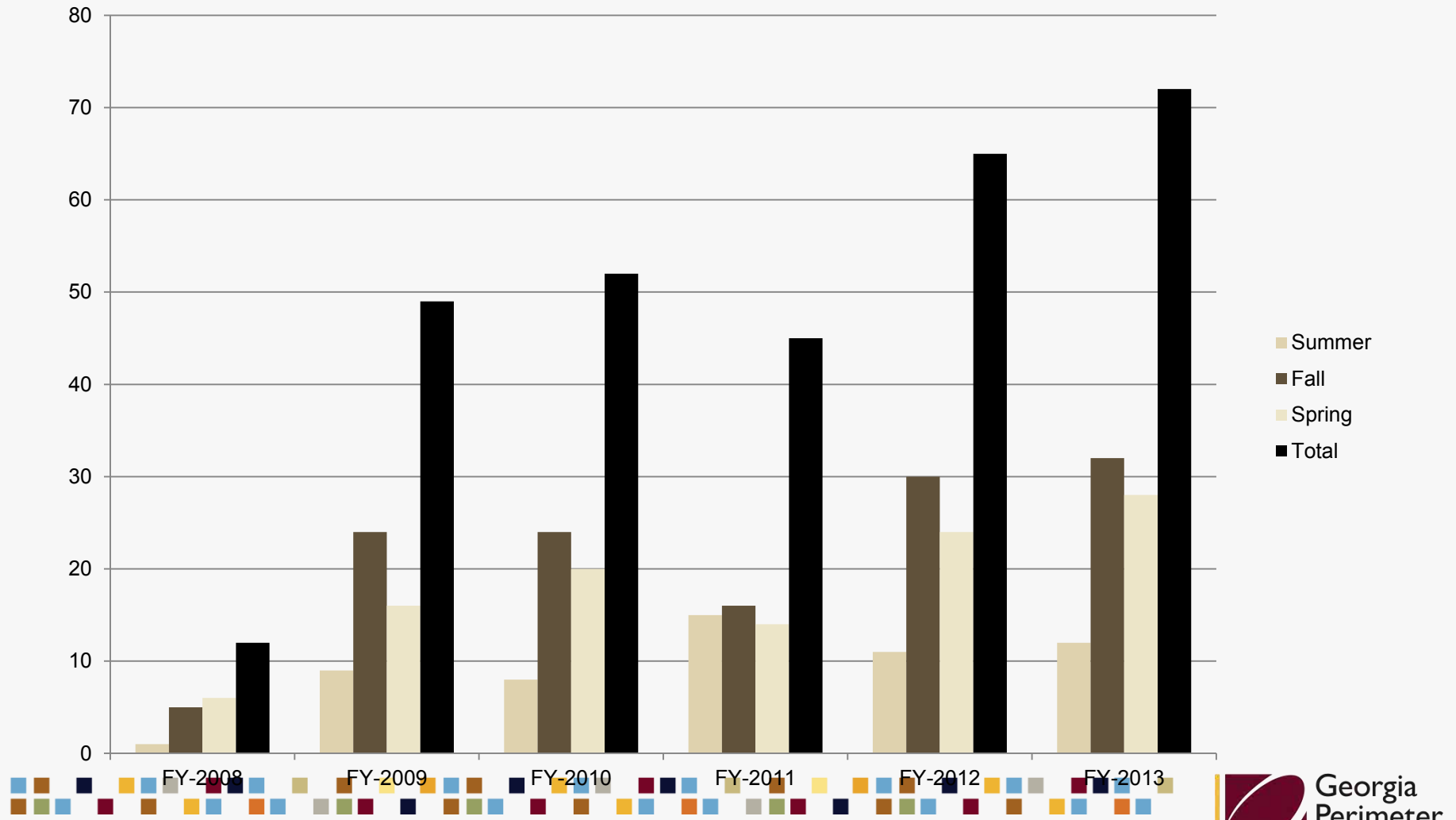
# GPC MESA Scholars

	Summer	Fall	Spring	Total
FY-2008		49	55	70
FY-2009	35	96	115	142
FY-2010	32	79	53	110
FY-2011	24	69	71	95
FY-2012	28	77	85?	125?
<b>TOTAL</b>	<b>119</b>	<b>370</b>	<b>379?</b>	<b>542?</b>

# GPC MESA Transfers

	<b>Summer</b>	<b>Fall</b>	<b>Spring</b>	<b>Total</b>
FY-2008	1	5	6	<b>12</b>
FY-2009	9	24	16	<b>49</b>
FY-2010	8	24	20	<b>52</b>
FY-2011	15	16	14	<b>45</b>
FY-2012	11	30	24	<b>65</b>
FY-2013	12?	32?	28?	<b>72?</b>
<b>TOTAL</b>	<b>56</b>	<b>131</b>	<b>108</b>	<b>295</b>

# GPC MESA Transfer Chart



# GPC-MESA Cumulative GPA

<b>FY</b>	<b>2007*</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
CGPA $\geq$ 3.5	20.5%	30.0%	31.0%	25.5%	37.9%	?
3.0 $\leq$ CGPA<3.5	31.8%	21.4%	22.5%	35.5%	28.4%	?
2.5 $\leq$ CGPA<3.0	20.4%	25.7%	19.0%	18.2%	21.1%	?
2.0 $\leq$ CGPA<2.5	9.1%	18.7%	20.4%	13.6%	9.5%	?
CGPA<2.0	18.2%	4.3%	7.1%	7.3%	3.2%	?



# GPC-MESA STEM Grades

STEM Course	MESA #	MESA ABC	MESA ABC %	
Math-1111	14	10	71.4%	
Math-1113	20	19	95.0%	
Math-2431	35	20	74.3%	
Math-2432	17	11	64.7%	
Phys-1111	15	11	73.3%	
Phys-1112	1	1	100.0%	
Phys-2211	16	16	100.0%	
Phys-2212	20	18	90.0%	
Chem-1211	28	24	85.7%	
Chem-1212	20	20	100.0%	
<b>TOTAL</b>	<b>186</b>	<b>156</b>	<b>83.9%</b>	

# Culture Shift and Stimulus for External Funding

The USG STEM Initiative stimulated GPC faculty to collaborate and apply for external funding, resulting in nearly \$3.5 million in new funding to promote student success over the next five years.



# Grant-Funded STEM Programs at GPC

- **STEP** (Science, Technology, Engineering, and Mathematics Talent Expansion Program)
- **ENLISTEM** (Educate and Nurture Leadership in Science Technology Engineering and Mathematics) scholarship program
- **PSLSAMP** (Peach State Louis Stokes Alliance for Minority Participation Scholars Program)
- **BreakThru STEM Accessibility Alliance**



# New Executive Director of STEM

## Dr. Cynthia Lester



- Providing collegewide coordination of STEM grants and grant-related activities

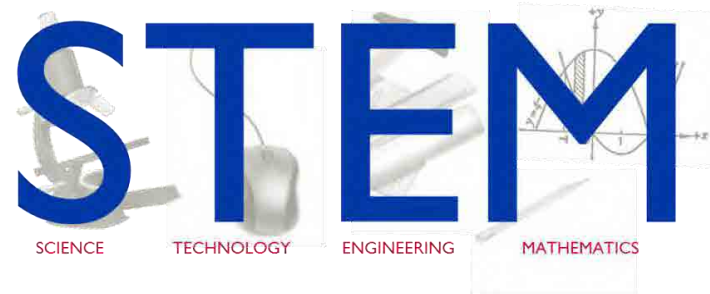


**We thank you for  
your support.**



**math + science = success™**

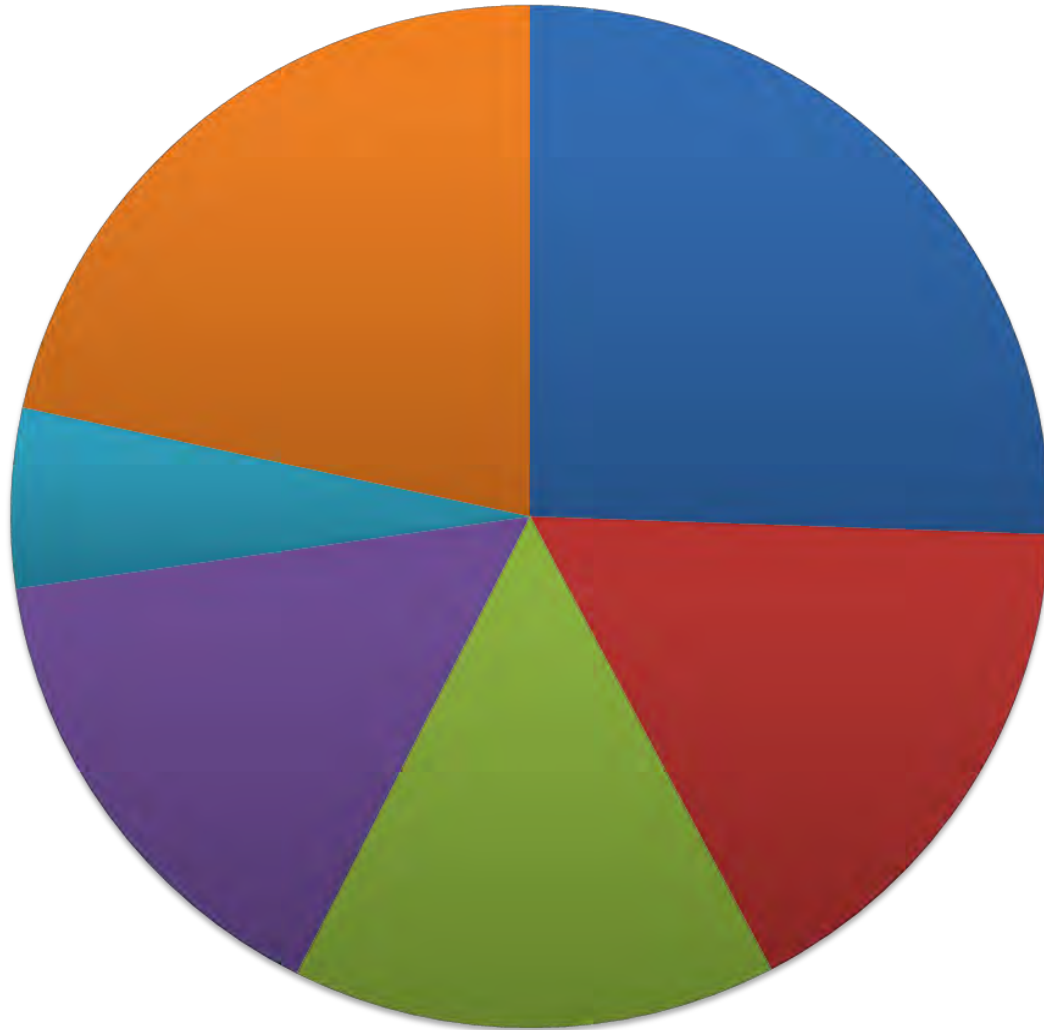




STEM Education  
at Georgia State University:  
Innovation and Administration

Dabney W. Dixon

# STEM BUDGET



- STEM Mini-grants
- Enhancement of Peer Tutoring
- Academy of Future Teachers
- FOCUS and Service Learning
- Calculus
- Other

# STEM MINI-GRANTS

PI(s)	Project
Xiaochun He	Advanced Hands-on Real-world Technology Development for Physics
Iman Chahine and Margo Alexander	Building Technology-Supported Environments for Teaching Undergraduate Mathematics Courses to Early Childhood and Middle Level Prospective Teachers
Marcus Germann and Valerie Miller	Calculus for Biological Sciences
Jeremiah Harden and Joan Comar	Computer-based Homework in Organic Chemistry
Sumith Doluweera and Brett Criswell	Creating a Formula for Preparing Better Physics Teachers in Georgia
Timothy Hawthorne and Dajun Dai	Enhancing STEM Education through Field-Based Problem Solving and Real-World Applications of Geographic Information Systems
Sutandra Sarkar and Gigi Ray	Freshmen Chemistry-based Problems in Mathematics
Saeid Belkasim and Raj Sunderraman	Improving Student Learning Using an Online Tutoring Community
Mark Grinshpon, Iman Chahine, and Robert Clewley	Improving Supplementary Calculus Instruction through Enhanced Coordinated Support of Student Assistants
Stephanie Behm-Cross, Nermin Bayazit, and Christopher Jett	Learning to Teach Mathematics in Hybrid University and Field Spaces
Mark Grinshpon, Iman Chahine, and Robert Clewley	Monitoring and Assessing Weekly Homework to Improve Student Learning and Success Rates in Calculus Courses
Anu Bourgeois and Raj Sunderraman	Online Portal for Computer Science Education Visualization Tools
Yanqing Zhang	Portable Multi-course Lab for Enhancing the Research Ability of Undergraduate Students
John Evans, Gigi Ray, and Therese Poole	Redesign of College Physics for Biological Science Majors
Lisa Martin-Hansen and Chris Atchison	Refining and Examining a Collaboratively Taught Earth Science Course for Future Middle School Teachers
Marion Reeves and Chris Atchison	Revising ISCI 2001 to Better Support Future Elementary Teacher Science Understanding
Iman Chahine, Mark Grinshpon, and Robert Clewley	Using Hybrid Instructional Support in Precalculus Concepts to Advance Undergraduate <b>Students' Success in Calculus</b>
Brian Thoms	What Limits the Learning of Students in Introductory Physics Courses at GSU?



# STEM MINI-GRANTS

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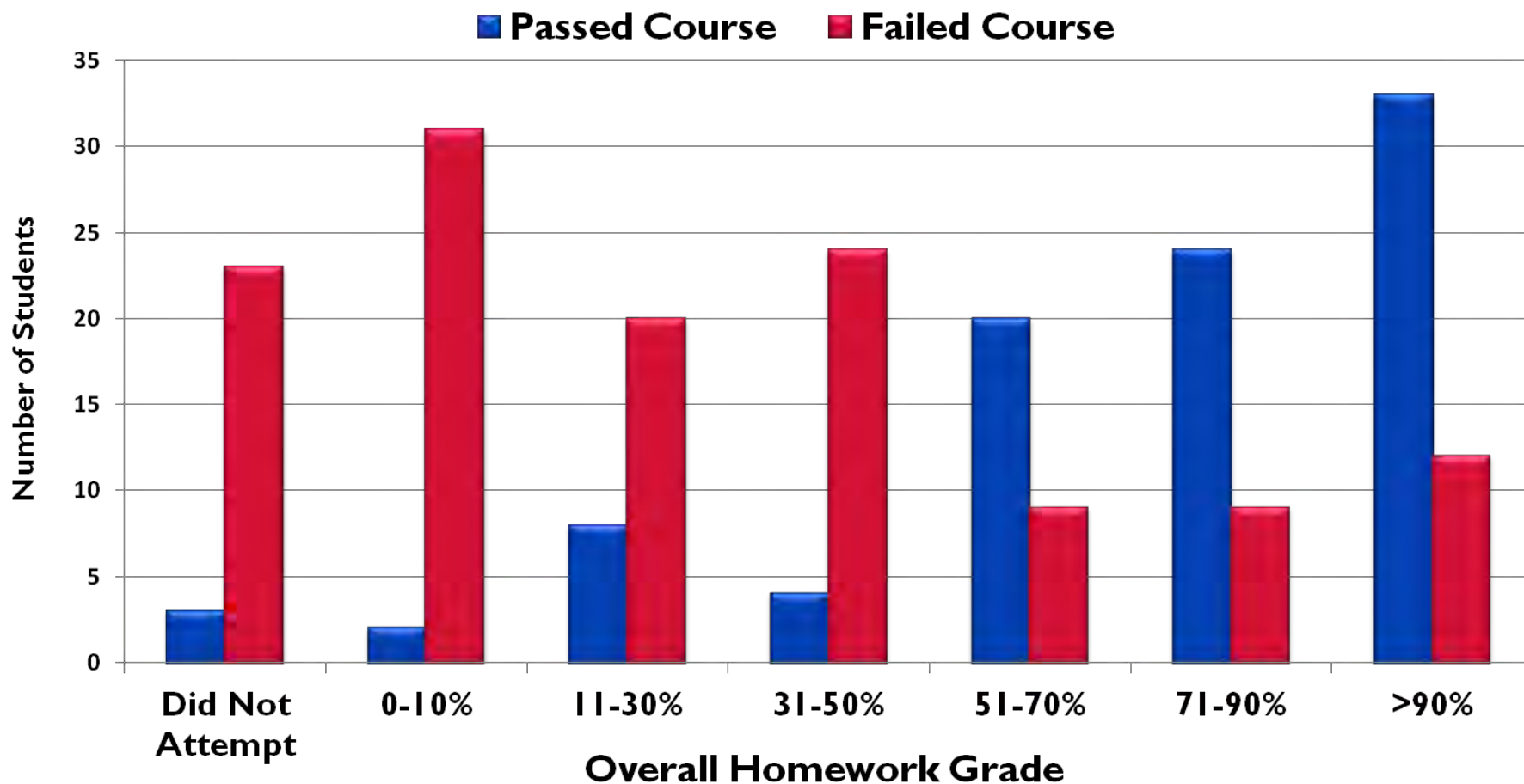
Organic Chemistry

Iman Cahine

# DATA ANALYSIS FOR ON-LINE ORGANIC CHEMISTRY HOMEWORK

## The Effectiveness of OWL Homework in Organic Chemistry II

Fall 2011 MWF 3:00pm-4:10pm



# DATA ANALYSIS FOR ON-LINE ORGANIC CHEMISTRY HOMEWORK

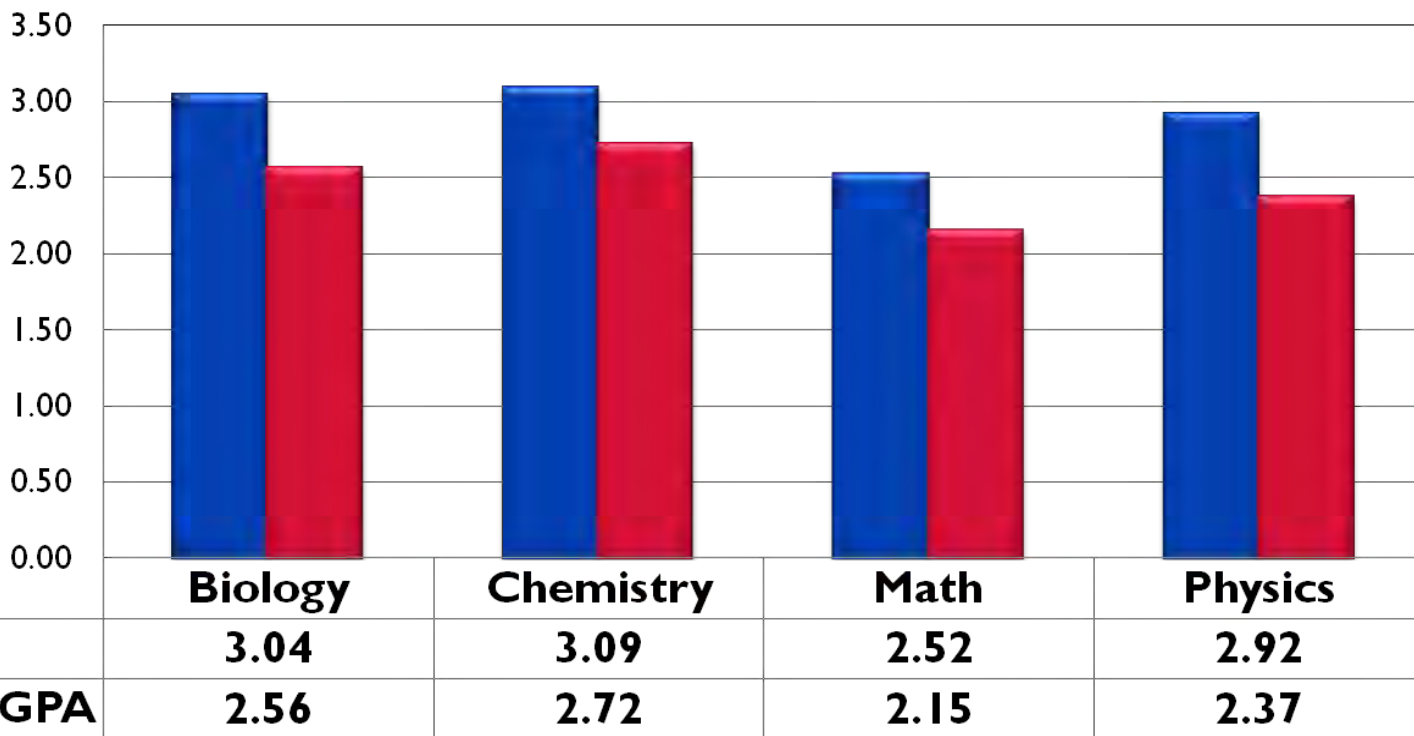
- STEM Office provides data analysis for the online-homework
- Data collection and analysis begins immediately after the homework is due
- The STEM Office works to provide 24-hour turnaround
- List of the easiest and hardest problems for each assignment as well as the average student score and percent of students completing the assignment

Assignment	% Who Attempted	Average Grade	Most Missed Question
Chapter 1 Homework Questions	92%	90%	1.6-1.10d TUT - Determining Shapes of Molecules (Tutor)
End of Chapter Questions	82%	74%	9460 - There are four different substances with the formula C <sub>5</sub> H <sub>10</sub> that contain a ring with 3 carbons. Draw them.
Chapter 2 Homework Questions	86%	81%	2.9 - Answer questions a-c about the Brønsted acid-base reaction below
End of Chapter Questions	68%	64%	9720 - What is the pH of a 5.00E-2 M solution of acetylsalicylic acid, pK <sub>a</sub> = 3.52.

# SUPPLEMENTAL INSTRUCTION

- Peer-assisted study sessions; leaders attend same classes as students
- Offered for historically difficult courses, including Organic Chemistry and Calculus
- SI leaders trained in proactive learning and study strategies and facilitation skills
- Approximately 8 SI leaders are funded by the GSU STEM Office each semester

**Course GPA ( $\geq 5$  sessions/semester)**



# EXTRA GRADING TO FREE UP FACULTY FOR WEEKLY SI/TA SESSIONS

- Well-trained and prepared teaching assistants and supplemental instructors are a key factor in the success of students in traditionally difficult courses
- The STEM Office is funding extra grading hours for instructors in these courses
- Graders are paid for an extra 2 hours of grading per week and an extra 5 hours of grading for each exam given in the course
- The extra grading hours free up the instructors to hold weekly meetings with TAs and SI Leaders for their courses
- The weekly meetings consist of a review of the material covered in the course that week and instruction on how to best present that material to students in review and SI sessions
- TAs and SI Leaders are paid for the time they spend in these meeting each week



- Approximately 80 students and 5 teachers from Clayton County
- Lectures (45 min)
- Lab tours by ugrad STEM majors:
  - Mass Spectrometry Facility
  - Biology laboratory
  - VizWall
- Students were also given a Glactone demonstration and teachers were provided with copies of the program for classroom use
- The event closed panel



# AP Science Visit

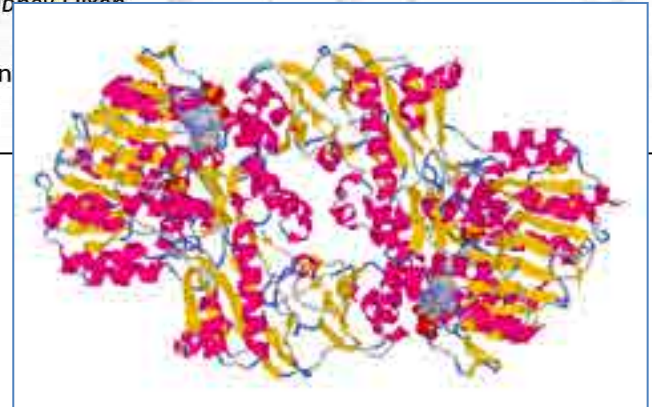
November 11, 2011



## Schedule of Events

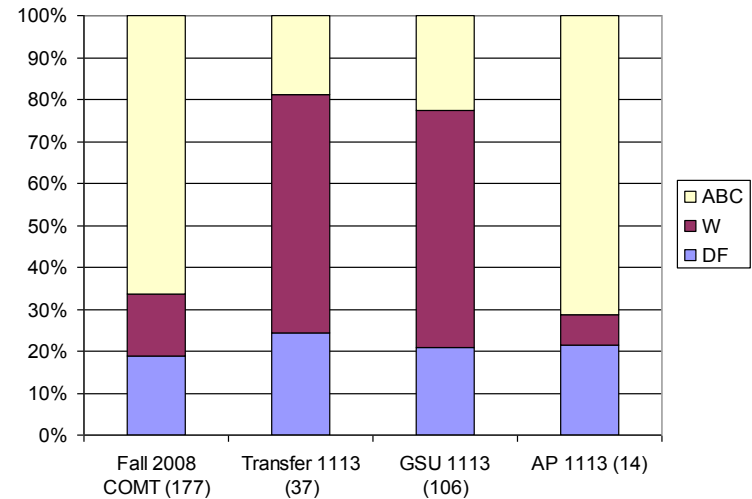
9:30am	Arrive at Petit Science Center (PSC), Room 101
9:35am	Welcome <i>Dr. Timothy Renick, Associate Provost for Academic Programs</i>
9:50am	Introduction of Speakers <i>Dr. Dabney Dixon, Coordinator of STEM Education Initiatives</i>
9:55am	Science Talk <i>Dr. Donald Hamelberg, Assistant Professor of Chemistry</i>
10:15am	Lab Tours, Glactone Demonstration, and Viz Wall Viewing <i>(a schedule of tours will be provided upon arrival)</i>
11:40pm	Lunch and Student Panel Discussion
12:25pm	Closing Remarks <i>Dr. Dabney Dixon</i>

Student

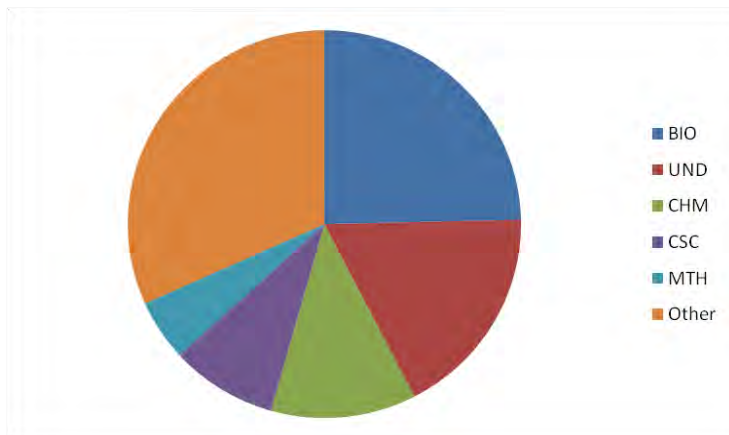


# DATA ANALYSIS FOR CALCULUS I

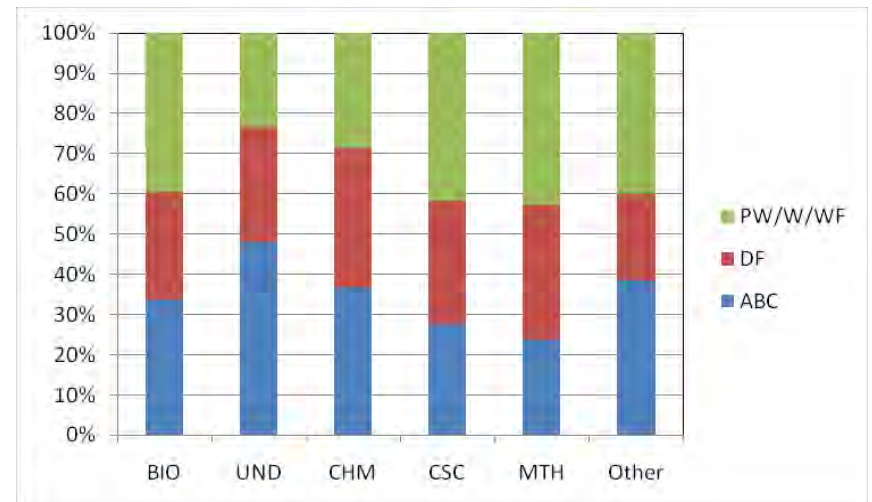
How is performance a function of the prerequisite course?



What majors take Calculus I?



How does major affect performance?



# DIRECTING STEM MAJORS TO TAKE APPROPRIATE MATH COURSES

- Science majors were taking *Introduction to Mathematical Modeling* (MATH 1101), a course designed for non-science students
- The STEM Office collaborated with the Office of Graduate and Scheduling Services to create a registration restriction that restricts science majors registering for the course



- Most pre-med Biology majors are under the impression that Calculus is required for Medical School; this is no longer generally the case
- The STEM Office has worked to make pre-med advisors aware of this
- To help students make informed decisions, we have begun to email all Biology majors enrolled in Calculus I prior to each semester to make them aware that it is not a required course



# ADVISING EXCEL SPREADSHEET

Georgia State University		Department of Chemistry	
Undergraduate Advising Worksheet			
Name			—Required Classes—
Email			Chem 1211K - Unmet
Date prepared			Math 1113 - Unmet
Academic Years			Chem 1212K - Met
<input checked="" type="checkbox"/> Optional Fifth Year			Math 2211 - Met
Fall	Spring	Summer	Chem 2010 - Unmet
2012	Chem 1212K	Math 2211	Math 2212 - Unmet
			Chem 2400 - Met
			Chem 3100 - Met
			Physics 2211K - Unmet
			Chem 3410 - Unmet
2013	Chem 2400	Chem 3100	Physics 2212K - Unmet
			Chem 3110 - Unmet
			Chem 4000 - Unmet
			Chem 4110 - Unmet
2014			Chem 4010 - Unmet
			Chem 4120 - Unmet
			Chem 4160 - Unmet
			Chem 4190 - Unmet
			—ACS Certification—
2015			Chem 4330 - Unmet
			Chem 4170 - Unmet
			Chem 4210 - Unmet
			Chem 4600 - Unmet
2016			

- Gives students a visual picture of their plans to graduation (courses in the major only)
- Can require students to fill out before seeing advisor
- Especially useful if not all courses are taught in all semesters
- Useful in majors with many prerequisites for a given course (e.g., Chemistry)

# OVERNIGHT STEM INCEPT

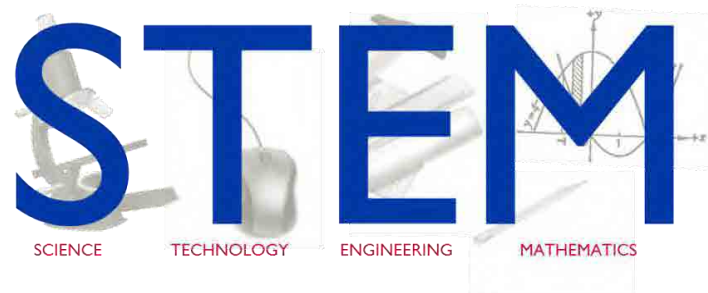
- INCEPT is the new student orientation required for all incoming freshmen
- Recognizing the need for math and chemistry placement testing prior to advising, the STEM office worked with INCEPT staff to develop an overnight program
- Math and Chemistry exams are held the first morning
- Immediate grading provides results to students just before dinner on the first day (colored cards outline their course options)
- Advising takes place on the second day
- The event was a success and a second Overnight Incept has been scheduled for summer 2012



# STEM WEBSITE

- Portal for Georgia State's undergraduate STEM majors
- Calendar of Events highlights STEM speakers, seminars, and club meetings, as well as local and regional STEM events
- Showcases USG funded STEM mini-grants and other funded STEM projects at Georgia State
- Lists of Summer Internships and Paid Programs
- Georgia State's College of Education is currently constructing a second STEM website that will highlight the College's STEM projects and faculty





With thanks to:  
Dr. Susan Swars  
Dr. Timothy Renick  
Dr. Charles Derby  
Dustin Butts  
Luna Liu

The USG STEM Initiatives Program of the  
Board of Regents of the State of Georgia



science technology engineering mathematics

# **The University of Georgia STEM Initiative II Projects, Programs, and Partnerships**

Charles Kotal and Nancy Vandergrift  
UGA Office of STEM Education



# STEM Faculty Dedicated to Improving Instruction and Student Learning

## Four Tenure-Track Faculty Hired

- Mathematics – David Gay
- Engineering Education – Joe Walther
- Science Education – Ji Shen
- MS Science Education – Ajay Sharma
- Awards: NSF CAREER, NSF REESE



## STEM Mini-Grants Program

- Encouraging **innovative instruction** in introductory STEM courses
- Contribute to the **Scholarship of Teaching and Learning**
- Approximately **10 mini-grants** awarded each year
- Amount awarded per grant = **\$9,000**



- **Norris Armstrong** – *Moving from an Instructor-Centered to a Student-Centered Class in Introductory Biology*
- **Fanbin Kong** – *Development of a Video Game as a Tool to Teach “Heat Transfer” Fundamentals in Undergraduate Courses at UGA*
- **Leidong Mao** – *Lab-on-a-Chip Teaching Module for Undergraduate Students at UGA*







# STEM Learning Communities

## UGA Faculty and K-12 Educators Work Collaboratively

- Meet on a regular basis
- Discuss, share, and implement ways to improve teaching and student learning
- 8-10 funded each year



# A.P. Calculus Learning Community

The Mean of A.P. Calculus Students' Scores of Teachers in A.P. Calculus LC

State of LC	School Year	AP Calc LC	State	Nation
Prior to LC	2004-05	2.00	2.80	2.94
Began 12/05	2005-06	2.63	2.85	3.02
Second Year	2006-07	3.73	2.82	2.92
Third Year	2007-08	3.35	2.70	3.01



# Fostering Our Community's Understanding of Science **Project FOCUS**

- Service-learning course
- STEM undergraduates teach inquiry-based lessons in K-5 classrooms
- This year:
  - 114 undergraduate students enrolled
  - 8 elementary schools served



# 2012 Regional STEM Institute on Teaching and Learning

Saturday, April 14  
Classic Center, Athens, GA

## Presentations and Discussions:

- The importance of STEM Education Reform
- Leveraging the NSF Broader-Impacts Criterion
- Contributions to the Scholarship of Teaching and Learning





# The UGA Office of STEM Education

## Provide Campus-Wide Leadership for STEM Activities

- Clearinghouse of STEM opportunities
- Partner with local school districts
- Proposals submitted: CIRTL, NSF STEP
- Website: [www.ose.uga.edu](http://www.ose.uga.edu)



## Acknowledgements

- USG STEM Initiative II
- The University of Georgia





# STEM Initiative at West Georgia: *Our Story*

Farooq A. Khan

Myrna W. Gantner

Satyanarayana Swamy-Mruthinti



## UWG UWise

- **STUDENTS**
  - Summer Bridge Program (Summer)
  - Follow-up Interdisciplinary Course (Fall)
  - Research and Peer Mentoring (Spring)
  - UTeach Connection (Step 1 and 2 Courses)
- **FACULTY**
  - Mini-Grants (Fall and Spring)
  - UTeach Connection (Teaching)





# Summer Bridge Program

- 2 weeks in early August
- 100 incoming freshmen interested in majoring in STEM
- **The summer program's designed outcomes:**
  - **Give students a taste of what's to come as a STEM major**
  - Students build bonds among themselves and with faculty



# Summer Bridge Findings

- Overall Sense of Accomplishment
- “Summer Bridge Program taught [me] that effort can make things possible.”
- Math Instruction
  - Statistically significant improvement in pre-post math scores ( $t=7.80$ ,  $p=.000$ ), although 2 weeks too short
  - Males outperformed females
  - Each group improved (males, females, whites, nonwhites)
  - Whites made the greatest gains
  - Nonwhites made the least gains



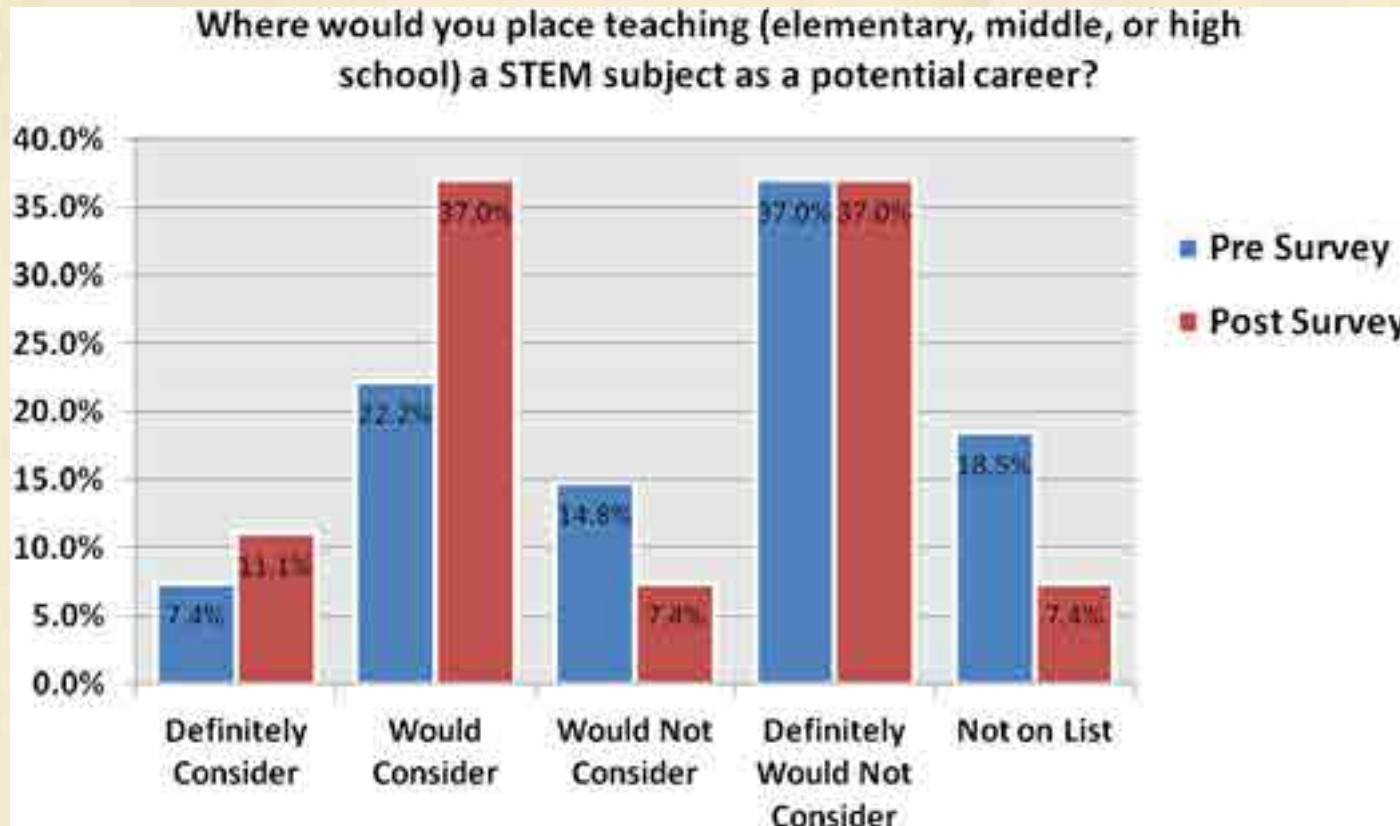
# XIDS Seminar Course (Fall)

- Students:
  - 81% (N=79) of Summer Bridge participants (N=98) enrolled in Fall XIDS 2002
- Design:
  - 8 weeks - Informal dialogue with invited speakers, professors
  - 6 weeks – Selected from 2 tracks
    - STEM communication (anticipated Uteach enrollment)
    - STEM discipline-specific activities
- Learning goals:
  - Increased awareness of STEM careers, to include teaching
- Significant result:
  - 38% of XIDS students (N=30) enrolled in UTeach Step 1 course
  - These students are giving serious consideration to teaching as a career
  - UTeach is a national replication program designed to prepare secondary teachers in mathematics and science



# A Success Story!

GO WEST





# Faculty Mini-Grants

## Biology

Podcasts for intro biology labs

## Mathematics

App based learning Software  
Tutoring  
Online tutoring

## Chemistry

Vernier data collection in intro  
chemistry labs  
Video, iTunesU in chemistry labs

## Physics

Worships in Intro Physics  
Recitations in intro Physics

## Computer Science

Learning videos for intro CS  
Robots as a teaching tool in  
introductory CS

## STEM Education

Calculator-Based Learning for  
Pre-service teachers



# Initial Lessons Learned

- 2012 adjustments based on lessons learned from 2011:
  - Build more time and structure into Summer Bridge
  - Provide students with intense writing instruction within the context of STEM critical thinking
  - Purposefully address learning styles and pedagogy for 2012 Summer Bridge, particularly for those with least gains in 2011 Summer Bridge
  - Create informal, safe environment for faculty development
- STEM Communication in XIDS linked to motivation for UTeach enrollment



## Next Steps for 2012-2013

- Double length of Summer Bridge Program from 2 to 4 weeks
- Summer Bridge: 2 credit-bearing courses (Areas B and C)
  - Writing-intensive STEM connection
  - Education faculty will co-teach with Science and Math faculty
  - Strengthened coordination of XIDS content
- Continue with structured peer-mentoring in Fall and Spring



# Acknowledgements

Board of Regents of the University System of Georgia STEM 2 Initiative

## COSM Faculty Collaborators

**Biology** (Heidi Banford and Nancy Pencoe)

**Chemistry** (Sharmistha Basu-Dutt, Anne Gaquere, Victoria Geisler)

**Computer Science** (Michael Orsega, Duane Yoder)

**Geosciences** (Brad Deline, Karen Tefend)

**Mathematics** (Ayona Chatterjee, David Leach, Scott Sykes, Mohammad Yazdani)

**Physics** (Ajith de Silva, Javier Hasbun)

## COE Faculty Collaborators

Judy Cox, Jill Drake, Gail Marshall, Thomas Thrasher