IMPROVING STEM EDUCATION IN GEORGIA’S COLLEGES AND UNIVERSITIES

INSIGHTS FROM FIVE YEARS OF EVALUATION

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USG STEM Initiative
UNDERSTANDING THE CHALLENGE

The need to increase student access and success within STEM in Georgia’s colleges and universities.
STEM Challenges for Georgia

• National Competitiveness in STEM
  • 2012 PCAST report *Engage to Excel*: 1 million more STEM graduates in the next decade to maintain U.S. leadership
  • Less than 40% of all undergraduate students who intend to major in STEM fields actually receive STEM degrees.

• STEM Workforce Opportunities
  • STEM workers report higher earnings than in other fields
    • 8 of top 10 undergraduate majors with highest median salaries in engineering.
    • Other 2 in pharmaceutical sciences and math and computer sciences
  • Georgetown study: 17% STEM job growth vs. 10% non-STEM job growth through 2018
STEM Opportunities


For those with a terminal Bachelor's degree working full-time, full-year.
How Does Georgia Compare?

Source: National Science Foundation, Science and Engineering Indicators 2016
Challenge of Attainment in Georgia

100 Georgia Public 9th Graders

56 Graduate High School

24 Start a 4-year College
13 Start a 2-year College

19 Become Sophomores
6 Become Sophomores

6 Graduate Within Time
3 Graduate Within Time

91% Loss
Key Focuses for Improving Postsecondary Attainment

- **College Readiness**
- **Improve Access and Completion for Underserved Students**
- **Shortening Time to Degree**
- **Restructuring Instructional Delivery**
- **Transforming Remediation**
Broadening Participation in STEM

“The nation's economic prosperity, security, and quality of life depends on the identification and development of our next generation of STEM innovators.”

“Every student in America should be given the opportunity to reach his or her full potential.”

- National Science Board, 2010
STEM ATTAINMENT WITHIN USG

A closer look at enrollment, retention, and graduation over the past five years.
Enrollment in USG STEM Programs

Source: USG Office of Research Policy Analysis
Enrollment in USG STEM Programs

Source: USG Office of Research Policy Analysis
Breakdown of Enrollment by STEM Subject (Largest Enrollment), by Fiscal Year

- Biological and Biomedical Sciences
- Computer and Information Sciences and Support Services
- Engineering
- Engineering Technologies and Engineering-Related Fields
- Physical Sciences
- Mathematics and Statistics
- Health Professions and Related Programs

Source: USG Office of Research Policy Analysis
# STEM Course Success - Science

Percentage of Students that Receive A, B, C in STEM Core Courses

<table>
<thead>
<tr>
<th></th>
<th>Biology</th>
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<th>Chemistry</th>
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<th>Physics</th>
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<tr>
<td></td>
<td>1111</td>
<td>1112</td>
<td>1151</td>
<td>1152</td>
<td>1111</td>
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<tr>
<td>FY 11</td>
<td>68.4%</td>
<td>83.7%</td>
<td>69.7%</td>
<td>74.6%</td>
<td>73.1%</td>
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<tr>
<td>FY 12</td>
<td>67.4%</td>
<td>81.6%</td>
<td>69.4%</td>
<td>73.3%</td>
<td>71.6%</td>
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<tr>
<td>FY 13</td>
<td>71.7%</td>
<td>82.5%</td>
<td>68.3%</td>
<td>75.2%</td>
<td>75.0%</td>
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<tr>
<td>FY 14</td>
<td>70.3%</td>
<td>83.6%</td>
<td>68.6%</td>
<td>78.1%</td>
<td>74.6%</td>
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</table>
## STEM Course Success - Mathematics

### Percentage of Students that Receive A, B, C in STEM Core Courses

<table>
<thead>
<tr>
<th></th>
<th>College Algebra (1111)</th>
<th>Pre-Calculus (1113)</th>
<th>Calculus I</th>
<th>Calculus II</th>
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<tr>
<td><strong>FY 11</strong></td>
<td>56.8%</td>
<td>61.1%</td>
<td>63.8%</td>
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<td><strong>FY 12</strong></td>
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</tbody>
</table>
Retention Rates in STEM

Institutional Retention in a STEM Major for Bachelor’s Seekers that declared a STEM Major Freshman Year

- One-Year Later
- Two-Years Later
Retention Rates in STEM

Institutional Movement into a STEM Major for Bachelor's Seekers that declared a Non-STEM Major Freshman Year
Discussion

- Increasing enrollment in STEM across USG overall, but varying trends based on type of institution
- Despite overall improvements in gateway mathematics courses, progress is still needed
- Challenges in two-year retention rates in STEM suggests need for longer-term approaches
- However, students may still switch to STEM
- Overall, progress in the right direction—issue one of strength of that direction
STEM INITIATIVE HIGHLIGHTS

Selected highlights from the STEM Initiative’s participating institutions.
Current Participating Institutions

- Columbus State University (CSU)
- Georgia College (GCSU)
- Georgia Gwinnett College (GGC)
- Georgia Perimeter College (GPC)
- Georgia State University (GSU)
- University of Georgia (UGA)
- University of West Georgia (UWG)

- Georgia Southern University
  - Scholarship of STEM Teaching and Learning Conference
Columbus State University: STEM Honors Camp

- Two-week camp for high school students throughout GA and AL
- Students live at CSU, engage in lab work and perform experiments
- Participate in activities at Coca-Cola Space & Science Center and Oxbow Meadows Environmental Learning Center
- 23 students in June 2014, 43% from underrepresented groups
- 83% reporting increased enthusiasm for STEM, 83% intend to pursue a STEM degree
Georgia College: STEM Retention Initiative

• Supplemental instruction program - Student instructors attend classes and lead collaborative learning sessions (usually twice weekly) to students

  • **Mathematics:** (computer lab model) students review project proposals and practice presentations before presenting projects to the class

  • **Chemistry:** (studio lab model) SIs mini-lectures on homework problems allow faculty to “flip” the classroom; SIs unpack content, allowing faculty to lead critical-thinking experiences in the classroom

  • **Biology:** (science hybrid lab/lecture model) SIs help with week – SIs connected more with students and developed a broader view of concepts

  • **Biology:** (science lab model) SIs assist instructor with proper lab techniques and interpretation
Georgia Gwinnett College: 4-Year Undergraduate Research Experience

• 4-Year Undergraduate Research Experience (4-yr URE)
  • Requirement for *all students* in School of Science & Technology
  • Focus on undergraduate research and internships

• Structured “Mini-Grant” Program to Support 4-yr URE
  • Course-embedded research projects
  • Individual, small group Undergraduate Research (STEC 4500) projects
  • Course redesigns and innovative instructional strategies

• Service learning course with Gwinnett County Schools
  • Student interns use content knowledge, skills to assist teachers in inquiry-based lessons and projects based on GCS Academic Knowledge Skills (AKS)
  • Plans to post projects, activities as “freeware”
Georgia Perimeter College: MESA Program

- Based on pioneering MESA (Mathematics, Engineering, Science Achievement) program in California for community/access colleges
- Workshops, academic and career advisement and counseling, transfer assistance to 4-year institutions, research/internship opportunities, linkages with student and professional organizations
Georgia State University: Academy for Future Teachers

- Three-week STEM summer program for APS and metro Atlanta high school students
- Focus on attracting talented students into the teaching profession and providing academic and professional preparation
University of Georgia: Project FOCUS

• Places college students with a science background in local schools to improve science awareness among K-8 school children.
• NOT a teacher training course, but a service-learning course: Students provide a much-needed service and learn about themselves in the process.
• 3-hour credit course at UGA
University of West Georgia: UWise Program

- UWise Program (University of West Georgia Institutional STEM Excellence)
  - Summer STEM Scholars Academy – Bridge program for incoming students at UWG
  - UWise Learning Community – Students placed into cohort and take English I, Chemistry I, Precalculus/Calculus, and XIDS course on STEM professions together
- XIDS Offerings: Credit-bearing courses on STEM careers
- Peer-Mentoring and Undergraduate Research
Fifth Annual Scholarship of STEM Teaching and Learning Conference

Thursday, March 3, 2016
7 to 9 p.m. – Poster Session and Reception
Statesboro Holiday Inn

Friday, March 4, 2016
8 a.m. to 4:30 p.m. – Concurrent Sessions
Nessmith-Lane Conference Center at Georgia Southern University
FINDINGS FROM EVALUATION

Highlights from STEM II Evaluation findings, FY2011-FY2015
USG STEM Initiative Logic Model

**Inputs**

- University System of Georgia’s (USG) Board of Regents (BoR)

**STEM Initiative Programs**
- CSU
- GCSU
- GGC
- GPC
- GSU
- UGA
- UWG

**Knowledge Translation Efforts**
- Georgia Southern Conference on STEM

**Activities**

- **Mini-Grant Projects** to investigate, develop, and pilot innovative approaches for STEM instruction and service delivery.
- **Service Learning Courses** to provide opportunities for students to engage P-12 schools to increase interest and understanding of science and mathematics, while providing teaching opportunities for students.
- **Institution-Specific Strategies** to improve postsecondary STEM education through a synergistically applied set of programs:
  - Regional Institute on STEM Teaching and Learning
  - Academy for Future Teachers
  - New Degree Programs
  - 4-Year Undergraduate Research Experience
  - Project MESA
  - UWise
  - UTeach Columbus
  - Scholarship of STEM Learning and Teaching Conference
- **Non-specified Strategies** that contribute to STEM Initiative objectives
  - Supplemental Instruction
  - Peer Tutoring
  - Bridge Programs
  - P-16 Learning Communities
  - STEM Learning Centers

**Outputs**

- **Research Findings** on efficacious instructional and support approaches in STEM
- **Partnerships** between STEM institutions and local area P-12 systems; **new courses or internships** to enable service learning
- **Coherent programs** to realize STEM Initiative objectives that are **synergistic in impact**, **scalable** to other institutions, and **disseminated** for system-wide impact
- **Support, Enrichment, or Enhancement** to augment existing STEM instruction efforts and further STEM Initiative efforts

**Outcomes**

- **Explicit STEM Initiative Objectives**
  - Increase in STEM majors
  - Increase in STEM degrees
  - Increase in P-12 STEM teacher production

- **Implicit STEM Initiative Objectives**
  - Improved quality of STEM instruction
  - Improved service delivery and student support

**Impacts**

- **Set of Best or Promising Practices** for improving USG STEM outcomes
- **Set of Best or Promising Practices** for improving System-wide Impact; Advancement of Complete College Georgia
- **Translation of practices across USG for System-wide Impact**

**Increased Student Success**

**Knowledge Translation**

**Increase in Quantity and Quality of Georgia’s STEM Workforce**
Enrollment in STEM Degree Programs

Actual, Reported Percent Change (Overall Initiative)

- AY2011-2012 to AY 2012-2013: 9.97%
- AY2012-2013 to AY 2013-2014: 26.44%
- AY2013-2014 to AY 2014-2015: -8.86%
- **OVERALL CHANGE**: 26.72%

Adjusted Percent Change (Proportion of Majors)

- **OVERALL CHANGE**: -2.20% to 5.05%
STEM Degree Production

Actual, Reported Percent Change (By Institution)

- **AY2011-2012 to AY 2012-2013**  
  -2.08% to 64.86%

- **AY2012-2013 to AY 2013-2014**  
  4.31% to 60.49%

- **AY2013-2014 to AY 2014-2015**  
  -8.23% to 43.40%

- **OVERALL CHANGE**  
  14.84% to 167.57%

Adjusted Change (Percent Change in STEM Degrees)

- **OVERALL CHANGE**  
  10.07% to 86.52%
FUTURE DIRECTIONS

Some considerations on the future of the STEM Initiative.
Revised STEM Initiative

- Equitability and Opportunity – Need for Greater Participation by USG Institutions

- Specificity – Respect for Institutional Missions and Needs, Focus on Formative Evaluations for Improvement

- Attainment – Furthering the Aims of Complete College Georgia (CCG) through STEM For All Learners

- Knowledge Translation – More Effective Means of Disseminating Promising Practices, Focus on Adapting Rather than Replication
USG Institutional Participation

Georgia Institute of Technology
University of Georgia
Georgia State University
Georgia Southern University
Southern Polytechnic State University
Kennesaw State University
University of West Georgia
Columbus State University
Valdosta State University
Georgia College & State University
Armstrong Atlantic State University
Abraham Baldwin Agricultural College
Augusta State University
Clayton State University
Savannah State University
Macon State College
North Georgia College & State University
Fort Valley State University
Albany State University
Dalton State College
Middle Georgia College
Georgia Southwestern State University
Georgia Gwinnett College
Gainesville State College
Medical College of Georgia
Bainbridge College
Darton College
Coastal Georgia Community College
Thank You!

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the evaluator and do not necessarily reflect the views of the USG or the Board of Regents.