Georgia Gwinnett College
School of Science & Technology

Building and Sustaining a Four-Year Undergraduate Research and Creative Activities Experience (4YURCE)
GGC STEM Initiative Team

Judy Awong-Taylor, Biology
Thomas Mundie, Dean SST

Allison D’Costa, Biology
Clay Runck, Biology
David Pursell, Chemistry
Tirza Leader, Psychology
Aims of This Session

- Provide some background
- Describe our 4YURCE program
- Show some preliminary results
- Describe successes & challenges
About GGC & the School of Science & Technology

- Public 4-year liberal arts college with a teaching mission
- 28% of GGC students major in STEM programs

STEM Students:
- 33.3% Black or African-American, 31% White, 16.3% Hispanic, 14% Asian
- 55.2% male/44.7% female

SST Faculty:
- 184 FT and 130 PT faculty
- 14 full, 56 associate, 92 assistant, 22 instructor
Dean’s Vision: 4-Year Undergraduate Research Experience Initiative

All students in all SST academic majors participate in research and creative activities all 4 years of their undergraduate career.
Gap Analysis

Undergraduates typically engage in research in their junior or senior years as part of a traditional apprentice-style model.

What knowledge, skills and/or dispositions are **STUDENTS** likely to build if we bridge this gap?

What knowledge, skills and/or dispositions are **FACULTY** likely to build if we bridge this gap?

*All* undergraduates participate in research and creative activities *all 4 years* of their undergraduate career.
### GAP Analysis for Students

#### GAP Statement:

STEM Majors are not given the opportunity to participate in research and creative experiences in all 4 years.

#### How do we fix this?

<table>
<thead>
<tr>
<th>Fix</th>
<th>Low Cost</th>
<th>Low Time</th>
<th>Modest Cost</th>
<th>Modest Time</th>
<th>High Cost</th>
<th>High Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>students analyze “old” data from papers</td>
<td>Low Cost</td>
<td>Low Time</td>
<td>Modest Cost</td>
<td>Modest Time</td>
<td>High Cost</td>
<td>High Time</td>
</tr>
<tr>
<td>students engage in research “skills” in class</td>
<td>Low Cost</td>
<td>Low Time</td>
<td>Modest Cost</td>
<td>Modest Time</td>
<td>High Cost</td>
<td>High Time</td>
</tr>
<tr>
<td>Develop/offer experimental methods courses</td>
<td>Low Cost</td>
<td>Low Time</td>
<td>Modest Cost</td>
<td>Modest Time</td>
<td>High Cost</td>
<td>High Time</td>
</tr>
<tr>
<td>Embed research in courses so students get experience multiple times</td>
<td>High Cost</td>
<td>High Time</td>
<td>Modest Cost</td>
<td>Modest Time</td>
<td>High Cost</td>
<td>High Time</td>
</tr>
<tr>
<td>Build More research labs/ Hire research faculty to work with students</td>
<td>High Cost</td>
<td>High Time</td>
<td>Modest Cost</td>
<td>Modest Time</td>
<td>High Cost</td>
<td>High Time</td>
</tr>
</tbody>
</table>

---

If Not Fixed:
- Lack Problem Solving
- Lose Interest in STEM
- Low RPG Rates
- Lack Critical Thinking Skills

If Fixed:
- Build Resume
- Better Workforce
- Can Problem Solve
- Conference Presentations
- Gain Research Confidence
- Complete Independent Research
Undergraduates typically engage in research in their junior or senior years as part of a traditional apprentice-style model. All undergraduates participate in research and creative activities all 4 years of their undergraduate career.

What knowledge, skills and/or dispositions are **STUDENTS** likely to build if we bridge this gap?

What knowledge, skills and/or dispositions are **FACULTY** likely to build if we bridge this gap?
GAP Analysis for Faculty

GAP Statement: STEM Majors are not given the opportunity to participate in research and creative experiences in all 4 years.

How do we fix this?

- Add Research Skills to labs: Low Cost $, Low Time
- Change Curriculum & Research Experience: Low Cost $, High Time
- Integrate Teaching & Research; SOTL: Modest Cost $, Modest Time
- Internal SEED Funding: High Cost $, Low Time
- Build Infrastructure (Labs, Faculty, Admin): High Cost $, High Time
Low Cost-High Time

• **Low Cost**- Started with an SST Faculty Committee
• **High Time**- Tasked with developing a model that allows all students to be exposed to research
Low Cost-High Time

- “Research & Creative Experiences”
  - Research skills and competencies through research experiences that are novel to them
  - Repeated, scaffolded exposures build problem solving & critical thinking skills
  - Build confidence for faculty mentored research
  - Graduate with STEM skills and competencies
Low Cost-High Time

• Designed a flowchart or sequence of courses
  – Developed by the Disciplines
  – All SST students would take
  – Incorporate all four years
  – Courses that are amenable to research modules
Biology: General Biology

Senior
- STEC 4500 Research
- BIOL 4800 Internship
- BIOL 4570 Experimental Methods
- BIOL 4560 Research Methods in Biology

Junior
- BIOL 3500K Ecology

Sophomore
- BIOL 3400K Cell Biology
- CHEM 2212K Organic Chemistry II

Freshman
- BIOL 1107K & BIOL 1108K Principles of Biology I & II
- CHEM 1211K & CHEM 1212K Principles of Chemistry I & II
Modest Cost-Modest Time

• Opportunity arose to apply for external funds (USG STEM Initiative)
• Developed a mini-grant program to incentivize faculty
• Allowed us to make this happen faster
• Encouraged faculty to be innovative and creative
Mini-Grant Program

Three Categories of Mini-Grants:

1. Course-embedded research projects that promote the 4-YURCE model (*Priority*)
2. Development, implementation, and research of innovative instructional strategies that pertain to the Scholarship of Teaching and Learning (SoTL)
3. Individual or small group Undergraduate Research Projects aligned with the 4-yr URE model
Mini-Grant Program – Project Types

1. **Pilot Projects** (involve one section to test an idea; one semester; funds used for supplies)
2. **Small Scale Projects** (involve 2-3 sections; 1-2 faculty; 1-2 semesters; funds for supplies & equipment; course release)
3. **Large Scale Projects** (involve multiple sections; 2 or more faculty; 2-3 semesters; etc.)
4. **Collaboration**: strongly encouraged within disciplines & between schools
<table>
<thead>
<tr>
<th>SST’s 4-YURCE Model - Impact to date...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Proposals submitted</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Mini-grants funded</strong></td>
</tr>
<tr>
<td><strong>Course Embedded Research Projects</strong></td>
</tr>
<tr>
<td><strong>SoTL Projects</strong></td>
</tr>
<tr>
<td><strong>Undergraduate Research</strong></td>
</tr>
<tr>
<td><strong>Special projects</strong></td>
</tr>
</tbody>
</table>
## SST’s 4-YURCE Model - Impact to date...

<table>
<thead>
<tr>
<th></th>
<th>FY 2012</th>
<th>FY 2013</th>
<th>FY 2014</th>
<th>FY 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of courses impacted</td>
<td>17</td>
<td>29</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Freshmen level</td>
<td>6</td>
<td>13</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Sophomore level</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Junior level</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Senior level</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Number of faculty</td>
<td>118</td>
<td>212</td>
<td>112</td>
<td>79</td>
</tr>
<tr>
<td>participating in Fiscal Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Students Impacted</td>
<td>2,001</td>
<td>2,407*</td>
<td>3,232*</td>
<td>3,435*</td>
</tr>
<tr>
<td>*Unduplicated head count</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of STEM sections</td>
<td>106</td>
<td>261</td>
<td>198</td>
<td></td>
</tr>
</tbody>
</table>
## SST’s 4-YURCE Model - Impact to date...

<table>
<thead>
<tr>
<th>Dissemination</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM Initiative Presentations</td>
<td>4</td>
<td>2</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Faculty Presentations</td>
<td>40</td>
<td>56</td>
<td>64</td>
<td>TBA</td>
</tr>
<tr>
<td>Student Presentations</td>
<td>32</td>
<td>37</td>
<td>25</td>
<td>TBA</td>
</tr>
<tr>
<td>Published Manuscripts</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>TBA</td>
</tr>
</tbody>
</table>

- **Faculty Presentations**
  - Engagement with Students
- **Professional Development**
SST’s 4-YURCE Model
Program Assessment

Four Components:

1. Student attitudinal surveys
2. Course content assessment
3. Faculty Attitudinal Survey
4. Student Performance Data
• Significant increases in 27 of 28 questions asked.

• Greatest increases observed with the following questions:
  – I am comfortable talking about science with other students (31% increase),
  – As a result of my research experience I am more likely to choose a career in a STEM field (30% increase)
  – I understand the variety of scientific career paths in STEM (28% increase).
SST’s 4-YURCE Model
Program Assessment

Four Components:

- 1. Student attitudinal surveys
- 2. Course content assessment
- 3. Faculty Attitudinal Survey
- 4. Student Performance Data
SST’s 4-YURCE Model
Faculty Assessment Survey

• To determine if faculty attitudes change over time
• Administered annually since spring 2012
• Survey data included:
  – faculty demographics,
  – awareness of SST STEM Initiatives,
  – STEM-related scholarship,
  – discipline perspectives on STEM
SST’s 4-Year URCE Model

Faculty Assessment Data

• Faculty have developed a better understanding of the initiative
  – Participating in more initiatives
  – Collaborating more with other faculty
  – Changing their teaching

• Faculty concerns
  – Implementing the initiative into their work schedule
  – Value in research and promotion
• Following has caused faculty to make changes to course design:
  – STEM mini-grant program – 95%
  – STEM initiative counting for promotion – 79%
  – SOTL Workshops & STEM Symposium – 98%
Have you seen an increase in student engagement?

• 85% Yes!
• Most definitely. Students used to think that research was beyond their abilities and that it was far away from a reality. Now I hear even more students asking for research opportunities with confidence. They do not see research as a hurdle to prevent their aspirations from happening, but as a step towards their career.
• Yes!! Students often claim to enjoy coming to class and learning and complain that their NON-SCIENCE courses are often lecture-based only.
SST’s 4-YURCE Model
Program Assessment

Four Components:

- 1. Student attitudinal surveys
- 2. Course content assessment
- 3. Faculty Attitudinal Survey
- 4. Student Performance Data
Retention & Performance Data

• Overall GPA Fall 11 cohort: an annual increase from 2.68 (fall 2011) to 2.87 (fall 2012) to 2.96 (fall 2013).

• Average STEM retention rate:

<table>
<thead>
<tr>
<th>Cohort</th>
<th>STEM Retention All</th>
<th>STEM Retention Underserved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>88%</td>
<td>91%</td>
</tr>
<tr>
<td>2012</td>
<td>83%</td>
<td>85%</td>
</tr>
<tr>
<td>2013</td>
<td>79%</td>
<td>79%</td>
</tr>
<tr>
<td>2014</td>
<td>86%</td>
<td>83%</td>
</tr>
</tbody>
</table>
FT FR Retention Data

First-time, Full-time Freshmen Retention

% of Students Retained

- SST
- GGC

2010: 75.50%
2011: 72.70%
2012: 67.74%
2013: 63.34%
2014: 74.62%
2015: 71.57%
2016: 67.98%
2017: 66.51%

Years:

Georgia Gwinnett College
STEM Enrollment Data

% Increase in Student Enrollment Since 2010

- SST
- GGC

<table>
<thead>
<tr>
<th>Year</th>
<th>SST</th>
<th>GGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2011</td>
<td>50%</td>
<td>44%</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Fall 2013</td>
<td>97%</td>
<td>81%</td>
</tr>
<tr>
<td>Fall 2014</td>
<td>100%</td>
<td>101%</td>
</tr>
<tr>
<td>Fall 2015</td>
<td>130%</td>
<td>113%</td>
</tr>
</tbody>
</table>
STEM Degrees Awarded

% Increase in Degrees Awarded Since Fall 2010

- **SST**
  - Fall 2011: 69%
  - Fall 2012: 116%
  - Fall 2013: 142%
  - Fall 2014: 151%
  - Fall 2015: 178%

- **GGC**
  - Fall 2011: 69%
  - Fall 2012: 116%
  - Fall 2013: 142%
  - Fall 2014: 151%
  - Fall 2015: 160%
ABC/DWF Rates

DWF Rates for Introductory STEM Courses

% of students who received D, W or F

- BIOL 1107K
- BIOL 1108K
- CHEM 1211K
- CHEM 1212K
- MATH 1111
- MATH 1113

Terms:
- Fall 11
- Spring 12
- Fall 12
- Spring 13
- Fall 13
- Spring 14
- Fall 14
- Spring 15
Successes

- Faculty are incentivized and energized
- Collaboration among faculty
- Innovative and creative ideas and projects
- Faculty led and driven
- Work counts as scholarship
- Scholarly products
- Administrative commitment to sustainability
Challenges

• Assessment
• Time commitment
• Faculty leadership, coordination/integration in multi-section courses
• Faculty knowledge, skills, and ability to embed research experiences in courses
• Concerns about loss of content from “cook-book” labs
Parting Words About the STEM Initiative from SST Faculty Survey

• I think the STEM initiative has been exceptionally valuable for the GGC faculty. Faculty are energized to think about reforming their classroom and lab exercises and have felt encouraged to think about their teaching differently. Faculty feel supported in their endeavors with the mini-grants and this support helps them change and revise their teaching. An energized and excited about teaching faculty directly benefits the students.