Recruiting and Supporting Physics (and other STEM) Majors

Brian Thoms and Dabney Dixon
Georgia State University
GSU Student Body

* Over 50,000 students (20k Assoc., 24k Bach., 8k Graduate)
* 14th most diverse university in the nation
* #1 in Georgia in undergraduate and graduate degrees conferred to students of color
* More than 1,500 international students
* Asian = 13%; Black = 38%; Hispanic = 8%
* White = 37%; Multiracial = 5%; Other/NR = 7%
Growth of Physics Degrees

Physics BS Degrees

0 5 10 15 20 25
Initial Efforts to Increase Physics Majors

- Try to Follow SPIN-UP Report
- Program changes to streamline, eliminate conflicts, add flexibility
- Improved departmental advisement
- Peer interactions - Vitality of SPS chapter
Recent Efforts to Increase Physics Majors

1. Gateway to Physics course
   identity formation

2. Principles of Physics
   foundational understanding

3. Advanced Physics Lab
   career skills development

4. Research Project
   Course-based Undergrad Research Experience
Recent Efforts to Increase Physics Majors

- **Gateway to Physics course (identity formation)**
  - For Incoming Freshman Physics Majors
  - Discusses Careers in Physics (including teaching)
  - Exposure to Research Topics
    - Students learn that they will engage in research and that they will be prepared to be successful in it
  - Connections of Physics to Modern Technology
Recent Efforts to Increase Physics Majors

- Principles of Physics (foundational understanding)
- Redesign three hour traditional laboratory
- Undergraduate Learning Assistants lead tutorials (1 hr)
  - LAs take course in physics pedagogy
  - LAs practice tutorials and good teaching is modeled for them
- Inquiry-based experiments led by GTAs (2 hr)
  - Experiments emphasize conceptual understanding
Recent Efforts to Increase Physics Majors

- Advanced Physics Lab (career skills development)
  - Nature of Science
  - Experimental Design
  - Scientific Writing
  - Scientific Ethics
  - Data Analysis & Computer Skills
  - Emphasis on Skills
    - What is expected by employers & graduate schools
Recent Efforts to Increase Physics Majors

- Research Project (CURE)
  - Authentic Research
    - Integrated into a research group
    - Project contributes to group efforts
    - Potentially publishable
  - Scientific Writing
    - Research proposal
    - Peer Review
Growth of Physics Degrees

Physics BS Degrees

- 1995
- 2000
- 2005
- 2010
- 2015
- 2020

0
5
10
15
20
25
Growth of Physics Majors

Physics BS Majors

Fall 2005 to Fall 2016: Increase in the number of Physics BS Majors
URM Degrees in Physics Increased from 17% to 30% of total
Female Degrees in Physics Decreased from 24% to 17% of total
Physics teachers now constitute 18% of total Physics BS degrees

3 of 14 teachers were URM
3 of 14 teachers were female
Personalized Interactions Before Enrollment
Portal to Guide Students

Which resources matter most to you?

- Select any of our student services that interest you, and we’ll add appropriate information to your path.

A Few Recommendations:

- **Child Care**
  - On campus and nearby child care options to help while you are in class.

- **First Generation to Attend College**
  - Resources to help new students learn the ropes and lingo of college.

- **Commuting Services**
  - Learn the different ways you can get to and from campus.

- **Student Technologies**
  - Get help with all apps, gadgets, and sites that can enhance your campus experience.

All Student Services:

- **Tutoring & Academic Support**
  - A great resource for help outside the classroom for your work inside the classroom.

- **Housing Services**
  - Resources to help you find a place to stay near campus.

- **Career Guidance**
  - Helping you find the right career path and prepare you for the job market. It’s never too early to start!

- **Disability Services**
  - Providing support and equipment to qualified students with physical, mental, or educational needs.
Nudges on Smart Devices

201,000 knowledge-based texts sent in first 3 months
### Academic Program Map: BS in Physics

#### Year 1

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Hours</th>
<th>Term 2</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1211K</td>
<td>4</td>
<td>CHEM 1212K</td>
<td>4</td>
</tr>
<tr>
<td>GSU 1010</td>
<td>1</td>
<td>MATH 2211</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1112</td>
<td>3</td>
<td>Area C Elective</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 1101</td>
<td>3</td>
<td>ENGL 1102</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 1000</td>
<td>2</td>
<td>Area B Elective</td>
<td>2</td>
</tr>
<tr>
<td>Total Hours</td>
<td>13</td>
<td>Total Hours</td>
<td>16</td>
</tr>
</tbody>
</table>

#### Year 2

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Hours</th>
<th>Term 2</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 2211K</td>
<td>4</td>
<td>PHYS 2212K</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2212</td>
<td>4</td>
<td>MATH 2215</td>
<td>4</td>
</tr>
<tr>
<td>HIST 2110</td>
<td>3</td>
<td>POLS 1101</td>
<td>3</td>
</tr>
<tr>
<td>Area E Elective</td>
<td>3</td>
<td>Area E Elective</td>
<td>3</td>
</tr>
<tr>
<td>Total Hours</td>
<td>17</td>
<td>Total Hours</td>
<td>16</td>
</tr>
</tbody>
</table>

#### Year 3

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Hours</th>
<th>Term 2</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 3260</td>
<td>3</td>
<td>PHYS 3850</td>
<td>3</td>
</tr>
<tr>
<td>*PHYS 3300</td>
<td>3</td>
<td>*PHYS 4900</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 3401</td>
<td>4</td>
<td>Concentration</td>
<td>3</td>
</tr>
<tr>
<td>Concentration</td>
<td>3</td>
<td>Concentration</td>
<td>3</td>
</tr>
<tr>
<td>Area H Elective</td>
<td>3</td>
<td>Area H Elective</td>
<td>4</td>
</tr>
<tr>
<td>Total Hours</td>
<td>16</td>
<td>Total Hours</td>
<td>16</td>
</tr>
</tbody>
</table>

#### Year 4

<table>
<thead>
<tr>
<th>Term 1</th>
<th>Hours</th>
<th>Term 2</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration</td>
<td>3</td>
<td>PHYS 4600</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 4700</td>
<td>4</td>
<td>Concentration</td>
<td>3</td>
</tr>
<tr>
<td>Concentration</td>
<td>3</td>
<td>Concentration</td>
<td>3</td>
</tr>
<tr>
<td>Total Hours</td>
<td>14</td>
<td>Total Hours</td>
<td>14</td>
</tr>
</tbody>
</table>
Freshman Learning Communities and MetaMajors

- Freshman Learning Communities (FLC) organize the freshman class into cohorts of 25 students arranged by common academic interests, otherwise known as “meta majors.”
- Students travel through their classes together, building friendships, study partners and support along the way.
- Almost 80% of the freshman class are in FLCs.
- Requiring all students to choose a meta-major puts students on a path to degree that allows for flexibility in future specialization while ensuring their early course credits will count towards their final majors.
- Block schedules are pre-populated course timetables including courses relevant to the student’s first year of study.
- A one-credit-hour course provides them with essential information and survival skills to help them navigate the logistical, academic and social demands of the university.

MetaMajors Reduce Major Changes

MAJOR CHANGES IN 2013: 2,718
MAJOR CHANGES IN 2015: 1,853
2-YEAR CHANGE: -32%
Supplemental Instruction

SI students were those who attended 5 or more SI sessions during the semester.
Acknowledgments
Backup Slides
# GSU STEM Graduates AY 2014-2015: African Americans

<table>
<thead>
<tr>
<th>Major</th>
<th>Number</th>
<th>% of All Graduates in the Major</th>
<th>Cohort % Women</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Sciences</td>
<td>21</td>
<td>22</td>
<td>52</td>
<td>4</td>
</tr>
<tr>
<td>Biological and Biomedical Sciences</td>
<td>123</td>
<td>37</td>
<td>76</td>
<td>1</td>
</tr>
<tr>
<td>Computer and Information Sciences and Support Services</td>
<td>98</td>
<td>31</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics and Statistics</td>
<td>13</td>
<td>32</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>Allied Health</td>
<td>12</td>
<td>46</td>
<td>75</td>
<td>13</td>
</tr>
</tbody>
</table>

[http://diverseeducation.com/top100/BachelorsDegreeProducers2016.php](http://diverseeducation.com/top100/BachelorsDegreeProducers2016.php)
GSU Percent of Bachelor’s Degrees Earned by Women, by Major

Percent

Year


Biology
Chemistry
Computer Science
Math & Stats
Earth Sciences
Physics

Five year rolling averages

Data from WebCaspar
U.S. Percent of Bachelor’s Degrees Earned by African Americans, by Major

© 2015, American Physical Society and WebCaspar
GSU, Number of STEM Graduates and Non-Stem Graduates

- **Did not Graduate**
- **Grad Non-STEM**
- **Grad STEM**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
</tr>
</tbody>
</table>