Matter & Interactions: Testing a New Physics Curriculum at Georgia Tech

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Project overview

• Preparing students for 21st century science and engineering
  – Update course content (typical intro physics course: 19th century concepts)
  – Introduce students to important skills in modern sci./eng.

• Impact of university intro physics curriculum reform
  – Potential to affect large numbers of students
  – Nationwide (NC State, Purdue)
Matter & Interactions
(R. Chabay & B. Sherwood, Wiley, 2006)

• Innovative introductory calculus-based physics curriculum
• Modern content
  – Fundamental principles
  – Atoms and structure of matter
  – Relativity and quantum physics
  – Macro/micro connections
• Modern tools/techniques
  – Computer modeling
<table>
<thead>
<tr>
<th>Semester</th>
<th>M&amp;I mechanics</th>
<th>M&amp;I EM</th>
<th>Faculty w/M&amp;I experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 06</td>
<td>1 section, 40 students</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Fall 06</td>
<td>1 section, 120 students</td>
<td>1 section, 45 students</td>
<td>1</td>
</tr>
<tr>
<td>Spring 07</td>
<td>2 sections, 200 students total</td>
<td>1 section, 150 students</td>
<td>2</td>
</tr>
<tr>
<td>Summer 07</td>
<td>None</td>
<td>1 section, 150 students</td>
<td>3</td>
</tr>
<tr>
<td>Fall 07</td>
<td>1 section, 150 students</td>
<td>2 sections, 300 students total</td>
<td>4</td>
</tr>
<tr>
<td>Spring 08</td>
<td>2 sections, 300 students total</td>
<td>2 sections, 300 students total</td>
<td>4</td>
</tr>
<tr>
<td>Summer 08</td>
<td>1 section, 180 students</td>
<td>1 section, 180 students</td>
<td>4</td>
</tr>
<tr>
<td>Fall 08</td>
<td>2 sections, 300 students total</td>
<td>3 sections, 450 students total</td>
<td>5</td>
</tr>
</tbody>
</table>
• Energy concept assessment, Spring 07 M&I sections (193 students)

pre avg = 11.1 (33.5%) ↓

post avg = 18.4 (55.8%)
- Brief E&M Assessment: various sections from Fall 06 to Fall 07
Assessment and Dissemination

- E&M Assessment results
  - Currently compiling results of comparative measures of M&I vs. traditional curriculum at 4 large institutions (GT, Purdue, NC State, Carnegie Mellon)
  - Will be submitted for publication in Phys. Rev. ST: Research in Physics Education
Assessment and Dissemination

• Mechanics
  – M&I weaker than trad. course on Force Concept Inventory
  – Spring 08: “talk-aloud” protocol study
    • M&I and traditional students work FCI problems while verbalizing their reasoning for their answers
    • Data analysis ongoing