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Distinguished Teacher-Scholar
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November Focus
- Instructional strategies that improve retention and academic performance among underrepresented groups

Instructional Strategies: Inside the Classroom and Out
- Chemistry 101 (Introductory Chemistry)
- Chemistry Merit Program for Emerging Scholars
- Undergraduate research and faculty/graduate student mentoring

Understand Your Audience: Chemistry 101 vs. 102
- Average Math ACT
  - Chemistry 101 students = 26
  - Chemistry 102 students = 31
- Average Chemistry Placement
  - Chemistry 101 students = 9
  - Chemistry 102 students = 19
Understand Your Audience: Chemistry 101 (Fall 2013)

<table>
<thead>
<tr>
<th>Major</th>
<th>Percent of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undeclared</td>
<td>208/659 = 31.6%</td>
</tr>
<tr>
<td>ACES</td>
<td>181/659 = 27.5%</td>
</tr>
<tr>
<td>Biology</td>
<td>77/659 = 11.7%</td>
</tr>
<tr>
<td>Applied Health Sciences (Community Health/Kinesiology/SHS)</td>
<td>98/659 = 14.9%</td>
</tr>
<tr>
<td>Engineering</td>
<td>32/659 = 4.9%</td>
</tr>
<tr>
<td>Chem/Biochem/Chemical Engineering</td>
<td>12/659 = 1.8%</td>
</tr>
<tr>
<td>Psychology</td>
<td>26/659 = 3.9%</td>
</tr>
<tr>
<td>Other</td>
<td>25/659 = 3.8%</td>
</tr>
</tbody>
</table>

- Largest percentage of underrepresented students in our department's courses (40% minorities; 66% female)
- High risk for dropping out of STEM majors
- ACT scores of my minority students are lower than their counterparts (~24 Math ACT)
- 34% of my students are first-generation students
- 91% of my students are incoming freshman

Instructional Strategies
- Course format strategies
- Online strategies
- Mentoring strategies

Course Format Strategies
- Lecture
- i-Clickers
- Real-world and personalized examples and analogies
**Course Format Strategies**

- Lab
- All experiments and activities are collaboration-based.
- Lots of writing! Explanations, drawings, show all work!

**Course Format Strategies**

- Discussion
- Discussions are collaboration based.
- Students work together on problems in groups.
- TA facilitates.

**Frequent Assessments!**

**Online Strategies**

- Algorithm-based homework is online
- Pre-lecture assignments
- Monday Morning Message
- Video hints and tutorials
- StudyCloud
Mentoring Strategies

- Studies show that undergraduate students who are mentored tend to have higher GPAs, higher retention rates, and more units completed per semester as compared to their un-mentored colleagues.


Mentoring Strategies

- One-on-one mentoring as much as possible!

Mentoring Strategies

- Train TAs to be mentors

Mentoring Strategies

- Incorporate opportunities for peer mentoring.
  - Lab and discussion
  - Online homework

**Mentoring Strategies**
- Utilize email frequently
- Exams
- Email individual students and advisors for students at risk

**Worth the Effort**
- Analysis shows:
  - Students that place into and participate in Introductory Chemistry before enrolling in our mainstream General Chemistry I course earn **at least one full letter grade higher** versus those that place into Introductory Chemistry and do not participate.

**Merit Program for Emerging Scholars: Background**
- Dr. Uri Treisman’s collaborative learning model
- Students work in groups
  - Challenging worksheet or activity
  - TA facilitates
  - Few Immediate Direct Answers
- Goal – improve retention through:
  - Improving academic performance
  - Increasing confidence and self-identity
  - Establishing academic peer groups
  - Mentoring

**How Merit “Fits In”**
- Merit students attend same labs and lectures and take the same exams
- Merit workshops replace regular recitation sections (in most cases)
- Extra 2-3 hours a week = Chem 199 credit
- Additional advising from Merit Director and TAs
Instructional Benefits of the Merit Model

- Students model how to think about problems
- Students are required to be active participants in their own education
- TA can interact with the students and question them further
- Students become more confident around TA (and many times the professor for course)
- TA gets to know students more quickly

Recruiting Students

- Undeclared students (DGS)
- Any major that requires at least one year of general chemistry, calculus, or biology.
- Target underrepresented groups
  - Minorities
  - Students from Small Rural High Schools

Recruiting Students

- Initial selection based on:
  - Competitive ACT/SAT scores
  - 24 Math ACT (1060 SAT)
  - Avg. STEM major = 30 ACT (1310 SAT)
  - Meet during summer registration
- Also:
  - Advisor referrals
  - Word of mouth

Some Evaluation Data Results

- Retention in the chemical sciences
- Academic performance
- STEM degree completion
- Qualitative feedback
Retention

<table>
<thead>
<tr>
<th></th>
<th>Merit</th>
<th>Non-Merit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>Students</td>
<td>BS in Chem or ChemE</td>
</tr>
<tr>
<td>Overall</td>
<td>642</td>
<td>229</td>
</tr>
<tr>
<td>Asian</td>
<td>61</td>
<td>32</td>
</tr>
<tr>
<td>White</td>
<td>230</td>
<td>141</td>
</tr>
<tr>
<td>African American</td>
<td>77</td>
<td>38</td>
</tr>
<tr>
<td>Hispanic American</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td>Male</td>
<td>210</td>
<td>110</td>
</tr>
<tr>
<td>Female</td>
<td>232</td>
<td>111</td>
</tr>
<tr>
<td>Small HS</td>
<td>84</td>
<td>38</td>
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</table>

Academic Performance: Chemistry 102 (Fall 2013)

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>All Students (1374)</th>
<th>Merit URM (46)</th>
<th>Non-Merit URM (194)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>224</td>
<td>16.20%</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>405</td>
<td>30.48%</td>
<td>17</td>
</tr>
<tr>
<td>C</td>
<td>453</td>
<td>33.90%</td>
<td>19</td>
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<tr>
<td>D</td>
<td>137</td>
<td>12.10%</td>
<td>7</td>
</tr>
<tr>
<td>F</td>
<td>54</td>
<td>4.05%</td>
<td>2</td>
</tr>
<tr>
<td>NC</td>
<td>1</td>
<td>0.07%</td>
<td>0</td>
</tr>
<tr>
<td>ABS</td>
<td>5</td>
<td>0.36%</td>
<td>0</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>0.07%</td>
<td>0</td>
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</tbody>
</table>

| Course GPA | 2.44 | 2.81 | 1.82 |
| Math ACT   | 31.42 | 27.76 | 26.23 |
| Comp. ACT  | 25.00 | 27.41 | 27.38 |

Academic Performance: Chemistry 232 (Fall 2013)

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>All Students (736)</th>
<th>Merit URM (22)</th>
<th>Non-Merit URM (77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>150</td>
<td>22.15%</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>216</td>
<td>37.23%</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>208</td>
<td>27.86%</td>
<td>3</td>
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<tr>
<td>D</td>
<td>75</td>
<td>9.51%</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>2.02%</td>
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<tr>
<td>NC</td>
<td>0</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>CR</td>
<td>1</td>
<td>0.14%</td>
<td>0</td>
</tr>
<tr>
<td>ABS</td>
<td>2</td>
<td>0.27%</td>
<td>0</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>0.14%</td>
<td>0</td>
</tr>
</tbody>
</table>

| Course GPA | 2.67 | 2.86 | 2.25 |
| Math ACT   | 32.34 | 27.32 | 27.41 |
| Comp. ACT  | 28.30 | 26.38 | 27.00 |

STEM Degree Completion (Undeclared Majors)

- To date, **48%** of our Merit undeclared students have graduated with a STEM degree as opposed to only **33.5%** of our Non-Merit comparison group, indicating that the Merit Program is effective at both retaining and recruiting students into STEM fields.
**Students’ Personal Learning**

**Student Feedback**

- “I like working in groups as others’ ideas help me to learn and see other approaches to different problems, as well as not having the answers just given to me.”
- “It has really helped by providing a more challenging atmosphere in learning so the tests do not seem as hard.”
- “The small groups allow discussion on problems where everybody can participate; this participation is integral to learning and allows our brains to actually process the information in a way that it sticks.”

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**Undergraduate Research**

- Participation in undergraduate research improves retention in the STEM fields.

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**Undergraduate Research**

- Based on student feedback from a department-wide chemistry climate survey, revamped the undergraduate research process to make it easier for students to find faculty research groups.
- Secured funding

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Undergraduate Research

- Interviewed students (all underrepresented) indicated that the experience and faculty mentoring has led to increased confidence, applicability of coursework, and enjoyment of the major.

Key Points

- Try to understand your audience.
- What works? Can this be adapted to your department, program, classroom, personal style?
- Evaluate
- What else? What is your “take home” message?

Assignment

- What are some strategies you would like to implement in your courses, programs, or department? Develop a game plan for implementation.