**Community and Collaboration: STEM Reform at Brown**

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**Community Building**

- **Engage**
  - New faculty early in reform
  - Senior faculty become department chairs

- **Progress**
  - New faculty become senior faculty

- **Lead**
  - Community of chairs engaged in reform

- **Build**
  - Collaborative problem solving sessions added to one introductory course per department
  - Course instructors collaborated weekly

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**Departmental Collaboration**

- Three departments involved in Spring 2014:
  1. Chemistry
  2. Physics
  3. Applied Math
- Department Chairs and course instructors attended Bi-weekly AAU Meetings to share experiences and ideas
  - Avoided “reinventing the wheel”
  - Spread what worked quickly

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**In-Course Collaboration**

- Collaborative problem solving sessions added to one introductory course per department
  - Problem sets followed lecture and homework
  - Students worked in teams of three
  - Sessions observed by grant staff
  - Student voice captured in feedback
- Student feedback overwhelmingly positive
  - “[The session facilitators] were enthusiastic and helpful. They made me look forward to doing physics at 8:30 [AM] every Friday”
  - “Working through problems with other students helped me reinforce my understanding of concepts presented in the class. I would strongly encourage that these [sessions] continued to be offered, because they really helped me to learn and retain the course material.”

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**Weekly Course Instructor Meetings**

- Evaluation of Reform Efforts
  - Lecture content
  - Homework
  - Exams
  - Problem sets
  - Team formation
  - Session facilitation

- Fully Integrated Problem Solving Sessions

- Student Buy-In and Feedback

- Communication of Reform Effort to Students

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**Physics Outcomes**

- Compared problem solving session attendance and exam scores

<table>
<thead>
<tr>
<th># Sessions Attended</th>
<th>Midterm 1 Score</th>
<th>Midterm 2 Score</th>
<th>Final Exam Score</th>
<th>Total Exam Average*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>84%</td>
<td>54%</td>
<td>67%</td>
<td>68%</td>
</tr>
<tr>
<td>1 - 3</td>
<td>81%</td>
<td>74%</td>
<td>67%</td>
<td>78%</td>
</tr>
<tr>
<td>4 - 7</td>
<td>84%</td>
<td>72%</td>
<td>70%</td>
<td>74%</td>
</tr>
<tr>
<td>8</td>
<td>85%</td>
<td>78%</td>
<td>76%</td>
<td>79%</td>
</tr>
</tbody>
</table>

* Scores were significantly higher (p < 0.05) than those of students who did not attend any sessions.

**Chemistry Outcomes**

- Compared problem solving session attendance and exam scores

<table>
<thead>
<tr>
<th>Attended Sessions</th>
<th>Mid 1 Score</th>
<th>Mid 2 Score</th>
<th>Mid 3 Score</th>
<th>Final Exam Score</th>
<th>Total Exam Average†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>71%</td>
<td>82%*</td>
<td>73%</td>
<td>71%*</td>
<td>74%</td>
</tr>
<tr>
<td>No</td>
<td>71%</td>
<td>78%</td>
<td>68%</td>
<td>64%</td>
<td>69%</td>
</tr>
</tbody>
</table>

* Scores were significantly higher (p < 0.05) than those of students who did not attend any sessions.

**Future Collaboration: Engineering**

- Change the spirit of “Introduction to Engineering” to “Introduction to Engineering Design”
  - Emphasis on collaborative problem solving in Brown Design Workshop
  - Recruit peer mentors to build student community
  - Provide more feedback to students earlier
  - Create excitement around engineering design
- Expand into sophomore, junior, and senior capstone design courses
  - A curriculum that emphasizes collaboration and community

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