General Chemistry I: A Course Redesign Experience

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Why Redesign General Chemistry?

• CHEM 121 required for >20 degree programs at UNM
• Historical DFW for CHEM 121 and CHEM 122 between 20 and 50%
• Students persisting in STEM have As and Bs in CHEM 121*
• UNM has a high % of under-represented minorities and first generation students

* STEM GATEWAY PROGRAM DATA
Major Themes of the Redesign

The Learning Strategies Triangle
(modified from Fink, 2003)

Interactive Learning
- Doing, discussing (in-class exercises, clickers)
- Experiential, inquiry, problem solving
- Actual, simulated
- Usually Social (peer learning facilitators)

Reflective Learning
- Minute papers, free-writing, portfolios, journals
- Synthesis of main ideas (homework)
- Metacognition (muddy points)
- About the subject and/or learning process
- Usually solitary

Aquiring Information & Ideas
- Reading primary texts and textbooks (+ reading quiz)
- Listening to lecture
- Accessing information/ideas in class, out of class, online

Before Class
In Class
After Class
Getting started:

• Identify key areas of difficulty (concept inventory data)
• Develop course materials to target these areas
• Promote use of active-learning techniques with new instructors.
• Implement in Fall 2013 and assess
  – 4 sections taught using full redesign
  – 2 sections taught with elements of redesign
  – Instructors from all 6 sections participated in regular meetings and discussion.
Assessment: How Our Students Perform Now:

<table>
<thead>
<tr>
<th>Pre</th>
<th>Post</th>
<th>Gains</th>
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</thead>
<tbody>
<tr>
<td>Fall12: 40.30</td>
<td>Fall13: 49.36</td>
<td>Gains: 12.29</td>
</tr>
<tr>
<td>Fall12: 41.68</td>
<td>Fall13: 44.92</td>
<td>Gains: 5.67</td>
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### How Our Students Perform Now:

<table>
<thead>
<tr>
<th></th>
<th>Chem121 Final Exam</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>64.16</th>
<th>64.21</th>
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<tr>
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<td>64.03</td>
<td>64.28</td>
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<tr>
<td></td>
<td>Mean</td>
<td>57.95</td>
<td>60.93</td>
<td>69.56</td>
<td>65.03</td>
<td>65.68</td>
<td>66.08</td>
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<tr>
<td>Final</td>
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How Our Students Perform Now:

- Pre-Reformed (3 semesters)
- Fall 2013

<table>
<thead>
<tr>
<th>Grade</th>
<th>Pre-Reformed</th>
<th>Fall 2013</th>
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<tbody>
<tr>
<td>A</td>
<td>27.4</td>
<td>28.6</td>
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<tr>
<td>B</td>
<td>30.4</td>
<td>27.1</td>
</tr>
<tr>
<td>C</td>
<td>19.4</td>
<td>16.3</td>
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<tr>
<td>D</td>
<td>7.0</td>
<td>9.8</td>
</tr>
<tr>
<td>F</td>
<td>5.7</td>
<td>5.6</td>
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<tr>
<td>W</td>
<td>10.1</td>
<td>12.6</td>
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<tr>
<td>ABC</td>
<td>77.2</td>
<td>71.9</td>
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<tr>
<td>DWF</td>
<td>22.8</td>
<td>27.9</td>
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</tbody>
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Evaluating the redesign: instructors’ perspective

• Learning curve
• Attendance
• Engagement
• Achievement
• Classroom environment
Next Steps or Future Work

• Do active learning strategies of this reformed approach adequately prepare students to be successful in the next science courses?

• Does the reformed approach benefit a special group of students?

• How to extend the scope:
  – helping faculty new to active-learning to implement it
  – Sharing our experience in other courses and or disciplines
Acknowledgements

• The STEM Gateway Program
• Dr. Gary Smith
• Dr. Stephen Cabaniss
Questions? (for NMHEAR)

• Our specific course redesign questions
  - how best to close the assessment loop?
  - how to extend the impact (including new instructors)?
  - what constitutes active learning?

• Also – if you are an instructor what are you currently doing in your classes along these lines, if administrator, what is being done at your institution
• What are your goals for your class/institution with respect to active learning?
• What are your questions for us about your specific class/institution?