The Department of Mathematics has sought to significantly improve student success rates in Math 101 & 103 through the implementation of Active Learning Mathematics. We are now experiencing greatly improved student outcomes.

Other changes to courses also had positive impacts on student success. Overall, we found higher student passing rates if their class met in Brace (where classrooms have been renovated to support active learning), if their instructor participated in a new pedagogy course, and if their course had a learning assistant assigned to support student engagement and learning.

### Active Learning Mathematics

**Goals:**
- Teaching methods & classroom norms: engage students in sense-making activities
- Students develop habits of mind of mathematical thinkers: solve problems, conjecture, experiment, explore, create, communicate reasoning

**Strategies:**
- Cooperative learning (group work)
- In-class worksheets to direct focus of group work to meet math objectives
- Team quizzes

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**Fall Success Rates**

<table>
<thead>
<tr>
<th>Year</th>
<th>2007 2008 2009 2010 2011 07-13 Ave</th>
<th>2012 2013 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>63% 61% 60% 68% 68%</td>
<td>64% 65% 70%</td>
</tr>
<tr>
<td>103</td>
<td>66% 65% 68% 65% 70%</td>
<td>66.8% 77%</td>
</tr>
</tbody>
</table>

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**First Year Mathematics Task Force**

**Goals:**
- Faculty support for high-quality GTA instruction
- Maintain high standards for learning

**Strategies:**
- Faculty mentor GTAs
- Faculty review syllabus & exams for rigor, content

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**Graduate Teaching Assistant Training**

**Goals:**
- Teach GTAs elements of effective instruction
- Gain buy-in for Active Learning philosophy

**Strategies:**
- Pre-semester training workshop
- Year-long course for first-time GTAs
- Mentoring

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**Early Formative Assessment**

**Goals:**
- Engage students at start of course
- Provide students opportunity to demonstrate mastery of prerequisite knowledge

**Strategies:**
- Prerequisite Mastery Activity
- material in “B” high school Algebra 2 student know & be able to do

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**Learning Environment**

**Goal:**
- Make group work easy and natural for students

**Strategies:**
- Classroom tables/chairs for group work
- Classroom whiteboard
- Classroom document camera
- Class worksheets to direct focus of group work to mastery of prerequisite knowledge
- Common lesson plans
- Weekly coordination

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**Learning Assistants**

**Goal:**
- Support group work & student engagement

**Strategies:**
- Hire undergraduates to assist with course instruction
- Recruit from majors, "A" students can support larger class sizes

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**External Support & Connections:**

- Grant from Association of Public & Land-grant Universities
- Grant from Mathematical Association of America
- Mathematics Teacher Education Partnership
- Ongoing collaboration with University of Colorado Boulder, Auburn University, University of West Virginia, University of Nebraska at Omaha

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**Data Collection:**

- Instructor survey & interviews
- Student attitude survey pre/post
- Student exam & course grades
- Student attitude survey pre/post

**Future Goals:**

- Extend precalculus efforts to calculus I & II
- Wide dissemination of Active Learning Mathematics

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**Results**

The Prerequisite Mastery Activity was a strong predictor of student success. Students who passed the Prerequisite Mastery Activity passed both Exam 1 (upper left graph) and ultimately all the Exams (upper right graph) at statistically significantly higher rates than those who did not pass.