**Abstract**
This pilot study examined the impact of the “flipped classroom” pedagogical method on the rate of student success in General Chemistry II during Fall 2013. Results show encouraging improvement in student performance with this nontraditional teaching method.

**Background Information**
Significant improvement in student success rates have been reported in courses where the teaching approach has been shifted from the traditional lecture format to a flipped classroom format.

In a study carried out at San Jose State University, students in the section of an “Engineering Electronics and Circuits” course that was flipped scored 10 to 11 points higher in midterm exams than students in the non-flipped sections.

For one week, students in one of two sections of a physics course offered at Vanderbilt University were taught using the flipped classroom approach while traditional lecture was used in the other section. At the end of the experimental week, a multiple-choice test was administered to both sections. The average score in the flipped classroom section was 33% higher than the corresponding to the control classroom. Prior to the experimental week, no significant difference in student performance between the two sections was observed.

**Method**

**Setting**
In Fall 2013, three sections of General Chemistry II were offered, each taught by a different instructor. Two sections followed the traditional lecture format and the third section was redesigned based on the “flipped classroom” method. Class meetings in the “flipped” class took place three times a week for 50 minutes, in a classroom designed for the traditional lecture format.

**Participants**
The group of participants consisted of 84 students from 17 different majors and class statuses ranging from freshman to graduate. The class was divided into 16 teams of 5-6 members. The criterion used to form the teams was to have heterogeneous groups in terms of gender, majors, and class status.

**Results**
Results from the American Chemical Society (ACS) comprehensive standardized final exam were used to compare students’ performance and success rates among the three sections. As displayed in the bar graph below, on average, students in the flipped classroom section scored 4 points (out of 70) higher than those in the traditional lecture sections, which in terms of national percentile rankings represents a 14% difference. The data in Table 1 shows that such a relatively small difference translated into encouragingly higher student success rates. General Chemistry II is a challenging course with ABC rates typically falling in the 65-70% range. Markedly, over 85% succeeded in the redesigned course, allowing students to progress in their science curricula.

**Table 1. Comparison of Student Success Rate by Type of Instruction**

<table>
<thead>
<tr>
<th>Type of Instruction</th>
<th>Percentage of Students with a Course Grade of C or Higher*</th>
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<tbody>
<tr>
<td>Flipped Classroom</td>
<td>86%</td>
</tr>
<tr>
<td>Traditional Lecture</td>
<td>72%</td>
</tr>
<tr>
<td>Traditional Lecture</td>
<td>61%</td>
</tr>
</tbody>
</table>

*The same grading scale was used across all sections.

**References**
(2) ACS Division of Chemical Education Examination Institutes National Norms: http://chemexams.chem.iastate.edu/nationalnorms/g10t0.html (accessed March 12, 2014)

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