Student Self Assessment as a Learning Tool in Calculus

Mario Banuelos

University of California Merced, Merced, CA

UCSC Assessment Symposium
October 17, 2014
Motivation and Background

For a variety of majors in college, Calculus I or II may be the first mathematics course taken.
For a variety of majors in college, Calculus I or II may be the first mathematics course taken.

At UC Merced, the outcome of having students “solve mathematical problems using analytical methods” is fostered by this course.
Motivation and Background

For a variety of majors in college, Calculus I or II may be the first mathematics course taken.

- At UC Merced, the outcome of having students “solve mathematical problems using analytical methods” is fostered by this course.
- By asking students to be cognizant of their performance,
  - We can encourage these outcomes
  - Students can become more sophisticated learners.
Motivation and Background

Previous studies suggest that students are overconfident in their math skills (Tariq and Durrani (2012), Kruger and Dunning (1999)).
Motivation and Background

- Previous studies suggest students are overconfident in their math skills (Tariq and Durrani (2012), Kruger and Dunning (1999)).

- In this study, 13% of students in Math 22 (Calculus 2) did not receive a passing grade.
Motivation and Background

- Previous studies suggest students are overconfident in their math skills (Tariq and Durrani (2012), Kruger and Dunning (1999)).

- In this study, 13% of students in Math 22 (Calculus 2) did not receive a passing grade.

- The aim of this project was to determine if there was a relationship between student confidence and performance.
Source: www.evaluationforms.org
For the Spring 2014 Semester, two sections of Calculus II (Math 22) were considered. The following components were implemented:
For the Spring 2014 Semester, two sections of Calculus II (Math 22) were considered. The following components were implemented:

- Needs Assessment Survey
For the Spring 2014 Semester, two sections of Calculus II (Math 22) were considered. The following components were implemented:

- Needs Assessment Survey
- Self-Assessment on Weekly Quizzes
For the Spring 2014 Semester, two sections of Calculus II (Math 22) were considered. The following components were implemented:

- Needs Assessment Survey
- Self-Assessment on Weekly Quizzes
- Mid-Semester Survey
Needs Assessment Survey

This survey gathered data regarding students’ past math courses, expectations important to succeed in Calculus II, and grade expectancy.
Needs Assessment Survey

This survey gathered data regarding students’ past math courses, expectations important to succeed in Calculus II, and grade expectancy.

What factors are important to success in this course?
Needs Assessment Survey

This survey gathered data regarding students’ past math courses, expectations important to succeed in Calculus II, and grade expectancy.

What factors are important to success in this course?

- Attending discussion
- Attending lecture
- Completing homework
- Studying for quizzes and tests
Students did not consider reading the textbook as an important part of succeeding in the course.
Textbook

Students did not consider reading the textbook as an important part of succeeding in the course.

- Encouraged textbook reading via introductory lectures
Textbook

Students did not consider reading the textbook as an important part of succeeding in the course.

- Encouraged textbook reading via introductory lectures
- Reminded students that quiz questions came from the textbook.
Grade Expectancy for Section 1 and 2

<table>
<thead>
<tr>
<th>Grade Expected</th>
<th>Percentage of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>45</td>
</tr>
<tr>
<td>B</td>
<td>49</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>
Self Assessment on Weekly Quizzes

The design of the survey focused on two key concepts:
The design of the survey focused on two key concepts:

- The comparison of student self-assessment and actual performance on quizzes.
Self Assessment on Weekly Quizzes

The design of the survey focused on two key concepts:

- The comparison of student self-assessment and actual performance on quizzes.
- Self-reflection on what students did to prepare for the quiz.
**Self Assessment Example**

**Example:** Sketch the curve and find the area it encloses.

\[ r = 2 \sin(\theta) \]

What have you done to prepare for this quiz and what is your comfort level with the material?

<table>
<thead>
<tr>
<th>Quiz Grade Prediction</th>
<th>9 – 10</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5 or lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>I predict to receive a grade of</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
Mid-Semester Survey

This follow-up questionnaire asked students about the effectiveness of group work, mini-lectures, and self-reflection.
Mid-Semester Survey

This follow-up questionnaire asked students about the effectiveness of group work, mini-lectures, and self-reflection.

- 86% of students found short lecture/review helpful in their understanding of the concepts.
Mid-Semester Survey

This follow-up questionnaire asked students about the effectiveness of group work, mini-lectures, and self-reflection.

- 86% of students found short lecture/review helpful in their understanding of the concepts.

- Student grade expectancy did not change dramatically.
Mid-Semester Survey

This follow-up questionnaire asked students about the effectiveness of group work, mini-lectures, and self-reflection.

- 86% of students found short lecture/review helpful in their understanding of the concepts.

- Student grade expectancy did not change dramatically.

- Group work and group learning could be more beneficial.
**Self-Assessment Survey Results**

### Section 1: Mean Quiz and Mean Predictions

![Bar chart showing the mean quiz and mean predictions for Quiz 1 to Quiz 7.](image)

- **Quiz 1**: Mean Quiz = 8.5, Mean Pred = 8.0
- **Quiz 2**: Mean Quiz = 7.0, Mean Pred = 7.0
- **Quiz 3**: Mean Quiz = 9.0, Mean Pred = 8.5
- **Quiz 4**: Mean Quiz = 9.5, Mean Pred = 9.0
- **Quiz 5**: Mean Quiz = 8.5, Mean Pred = 8.0
- **Quiz 6**: Mean Quiz = 9.0, Mean Pred = 8.5
- **Quiz 7**: Mean Quiz = 8.5, Mean Pred = 8.0
Self-Assessment Survey Results

Section 2: Mean Quiz and Mean Predictions

Quiz Score

Quiz Number

Quiz 1  Quiz 2  Quiz 3  Quiz 4  Quiz 5  Quiz 6  Quiz 7

Mean Quiz
Mean Pred

M.Banuelos (UCM)  UCSC Assessment Symposium  October 17, 2014
Results

Most students did not change their study habits during the semester. Students, more often than not, underestimated their quiz scores. Students scored relatively well, but this was not represented in exam scores. Students correctly identified their quiz scores within one letter grade.
Most students did not change their study habits during the semester.
Most students did not change their study habits during the semester.

Students, more often than not, underestimated their quiz scores. Students scored relatively well, but this was not represented in exam scores.
Results

- Most students did not change their study habits during the semester.

- Students, more often than not, underestimated their quiz scores. Students scored relatively well, but this was not represented in exam scores.

- Students correctly identified their quiz scores within one letter grade.
Future Directions

Develop workshops or introduce better studying habits to undergraduate students.

Are these results indicative of students at UC Merced? Further exploration is warranted.

Build statistical models based on data to gain more insight into this phenomenon.
Future Directions

- Develop workshops or introduce better studying habits to undergraduate students.
Future Directions

- Develop workshops or introduce better studying habits to undergraduate students.

- Are these results indicative of students at UC Merced? Further exploration is warranted.
Future Directions

- Develop workshops or introduce better studying habits to undergraduate students.

- Are these results indicative of students at UC Merced? Further exploration is warranted.

- Build statistical models based on data to gain more insight into this phenomenon.
Conclusion

Presented framework of self assessment study, as well as how this influenced instruction.

Results indicate UC Merced students underestimate their performance in Calculus. Are PLOs for course being met? Proposed possible explanations and future studies.
Presented framework of self assessment study, as well as how this influenced instruction.
Conclusion

- Presented framework of self assessment study, as well as how this influenced instruction.

- Results indicate UC Merced students underestimate their performance in Calculus. Are PLOs for course being met?
Conclusion

- Presented framework of self assessment study, as well as how this influenced instruction.

- Results indicate UC Merced students underestimate their performance in Calculus. Are PLOs for course being met?

- Proposed possible explanations and future studies.
Acknowledgements

This study could have not been possible without

- Council of Graduate Schools
- CGS UCM Grant Coordinators
- SATAL
References

Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning
*Pearson*, 32-63.

Comparing College Students’ Self-Assessment of Knowledge in Organic Chemistry to Their Actual Performance
*Journal of Chemical Education* (90) 1096 – 1099.

Kruger, J.; Dunning, J. (1999)
Unskilled and Unaware of It; How Difficulties in Recognizing One’s Own Incompetence Lead to Inflated Self-Assessments

Tariq, V.N; Durrani, N. (2012)
Factors influencing undergraduates’ self-evaluation of numerical competence.
*iJMEST Vol. 43 No. 6*, 337 –356.