Student Self-Assessment as a Learning Tool in Calculus

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Abstract

For many undergraduate students, Calculus I or II may be the first mathematics course they take at the university level. This course provides a foundation for students in solving mathematical problems analytically. Although instructors apply many different assessment methodologies, students generally appear to be unsuspecting of their performance. In support of quantifying the relation between student self-assessment and their performance as well as using assessment to inform teaching, students completed surveys after weekly quizzes. Responses to these surveys reflect an overall understimation of performance. In contrast, pre-semester and mid-semester surveys indicated an overestimation of actual class achievement. The results informed instruction, served as self-feedback for students, and suggest a discrepancy in students’ own expectations as they begin their undergraduate career.

Introduction

At UC Merced, Calculus II serves as an introductory course to meet the program learning outcome (PLO) of “solving mathematical problems using analytical methods.” Asking students to be cognizant of their performance encourages them to be more sophisticated learners. Previous studies suggest wherein people overestimate their knowledge of a given topic has become known as the Dunning-Kruger effect.

Methods

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

- Needs Assessment Survey
  - This survey gathered data regarding students’ past math courses, expectations important to succeed in Calculus II, and grade expectancy.
- Self-Assessment on Weekly Quizzes
  - Weekly self-assessments were administered after each quiz beginning the third week of instruction.
- Mid-Semester Survey
  - The follow-up questionnaire asked students about the effectiveness of group work, minilectures, and self-reflection.

Self-Assessment Survey

Below, we present a sample self-assessment quiz and survey used in this study.

Sketch the curve and find the area it encloses

\[ r = 2\sin(\theta), \quad 0 \leq \theta \leq 2\pi \]

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

<table>
<thead>
<tr>
<th>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>

Needs Assessment Survey Results

The goal of this project was to determine if there was a relationship between student confidence and performance through administering self-assessment surveys. In turn, these results informed my teaching through mini-lectures at the beginning of each discussion section.

Final Grade Distribution

- With the adjusted grade scale of 5%, we report the final grades of students in both sections.

Table 1 Percentages of students in Section 1 and 2 receiving the corresponding letter grade.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Section 1</th>
<th>Section 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30.4%</td>
<td>34.8%</td>
</tr>
<tr>
<td>B</td>
<td>34.8%</td>
<td>34.8%</td>
</tr>
<tr>
<td>C</td>
<td>47.7%</td>
<td>47.7%</td>
</tr>
<tr>
<td>D</td>
<td>4.2%</td>
<td>4.2%</td>
</tr>
<tr>
<td>F</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Conclusion

- Written responses on self assessment surveys indicated that 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 and final grade distribution.
- Students correctly identified their quiz scores within one letter grade.
- Further exploration is warranted to draw conclusions about UC Merced students undertaking their performance in mathematics.

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References