ASSESSING THE IMPACT OF PEER GRADING DURING FORMATIVE ASSESSMENT ACTIVITIES

William Tarimo
Connecticut College
November 11-13, 2019
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Goals & Summary

Can we improve on in-class formative assessment, student engagement, student learning, and simplify grading of student answers through peer review?

- We present on our initial experience and assessment of the impact of incorporating peer grading or peer review during formative assessment activities in the classroom.
  - allowing students to review or grade their peers’ answers to formative assessment questions by providing their assessment of correctness and feedback comments.
  - Using a web-based online Peer Review functionality built on a clicker-style assessment tool.
Literature Review & Motivation

Implementing a feasible and practical Peer Review practice in the classroom creates the opportunities for these demonstrated BENEFITS:

- Collaborative and cooperative learning activities in the pedagogy - compared to competitive and individualistic activities [7, 8, 14]
- Peer Instruction (PI) - learning from each other [2, 3]
- A social constructivist classroom - co-construction of knowledge and mutual engagement of participants in fun, social, engaging environment
- Active problem-based learning with immediate feedback [1, 6]
- Think-Pair-Share methodology [5]
In this work

- We looked for the impact of using peer review by looking for agreement between overall student peer grading on specific answers and the actual instructor grading.
- In addition, we also looked to see whether overall number of peer reviews given by each student and their accuracy or performance (relative to instructor grading) in peer reviewing correlate with overall course performance.
Discovery Teaching: Questions & Peer Review tools

This study was facilitated by using a tool called Peer Review, which is an added extension to the clicker-style assessment functionality (named Questions) in the Discovery Teaching platform.

- Discovery Teaching is a web application with several tools designed to support interactive and evidence-based teaching and learning in the higher education classroom
- The platform and its several tools have been used in several prior studies [9], [10], [11], [12], [12], [14].
Discovery Teaching

An in-class web-based platform with tools to support different aspects of interactive teaching and learning for activities such as:

- **Feedback**: polling of feedback from students,
- **Questions, GroupWork**: individual and collaborative assessment,
- **Forum**: discussion forums,
- **Stats** - Records on performance & participation: detection as well as interventions of students at risk of falling behind based on the learning evidence from performance and participation data collected throughout the platform.

Accessible at: [discoveryteaching.com](http://discoveryteaching.com)
Questions: A clicker-style assessment tool

- **Functions and Methods**
  What is one way they are similar?
  What is one way they are different?
  
  Responses: 106, ✓ 3/10: 2%

- **islower**
  Give an example of a call using islower which will return True
  and an example which will return False.
  
  Responses: 117

- **Splitting with separators**
  Write a Python expression to split the string s into a list, using commas as the separator, and try it on the example
  
  s="1,2,3,4,5,4,3,2,1" to see that it works.
  
  Responses: 116

- **What is the body of your count as better function?**
  
  Responses: 123

- **Can you evaluate all of the expressions in part I of the notebook?**
  
  Responses: 132

- **Can you run jupyter notebook and see the notebook page?**
  
  Responses: 137

- **Did you install Jupyter?**
  
  Responses: 143
Peer Review: Allows students to review/grade their peers’ answers in Questions

Question: What are the two parts/cases of any recursive function?

<table>
<thead>
<tr>
<th>Response</th>
<th>Rating</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case and recursive case (calls smaller and smaller versions of itself)</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>A statement that lets you know when the task is finished, and another statement that performs a function until the final goal is achieved.</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>General case and base case</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>BASE CASE AND RECURSIVE CASE</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Base Case Recursive Case</td>
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<td>2.0</td>
</tr>
<tr>
<td>Base Case and recursive case</td>
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<td>2.0</td>
</tr>
<tr>
<td>if statement and then calling the function</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>base case and recursive function</td>
<td>4</td>
<td>2.0</td>
</tr>
</tbody>
</table>
THE STUDY
Usage data from 2 Spring 2019 courses

The Courses: Two Flipped undergraduate Computer Science courses

- (Course 1) - 15 STUDENTS: CS1 course - introductory programming and problem solving using the Python programming language.
- (Course 2) - 24 STUDENTS: an intermediate elective course teaching website and web-based application development.

Data collected:

- Overall QUALITY of students peer reviews - compared to instructor grading
- The COUNT of peer reviews for each student during the semester
- The PERFORMANCE/ACCURACY of each student as a peer reviewer - compared to instructor grading
- End-of-semester student course grades
RESULTS
Results: Quality of student peer reviews

- A statistically significant, positive correlation between overall student peer grading and instructor grading. The correlation coefficients are 0.7265 and 0.7563 in Course 1 and Course 2, respectively - (p-value < 0.0001).
- This suggests that students peer review summaries:
  - Can be a good approximation of the actual (instructor) grading of individual answers.
  - Can be a reliable prediction or estimate of the correctness of answers.
  - Can be an estimate of students' mastery and learning outcomes.
- Doing peer reviews is an effective alternative way of sourcing the grading step from the students themselves. Eliminating the need for instructor to do the actual grading of answers.
Results: Accuracy in reviewing & course performance

- On individual student accuracy as peer graders:
  - There was a suggestion of positive correlation with course grades (a measure of learning outcomes), however, not statistically significant.
  - Indicating that our recorded accuracy in peer grading was not a good predictor of final course grades.
  - Possible explanations:
    - The final course grade earned at the end of the semester was comprised of cumulative grades from multiple assignments types throughout the semester
    - Students completed varying amounts of peer reviews throughout the semester
Results: Number of reviews & course performance

- On the total number of peer reviews completed for each student throughout the semester:
  - There was a statistically significant positive correlation between this count and course grade. With correlations of 0.6168 (p-value 0.018), and 0.6497 (p-value 0.004), in Course 1 and Course 2, resp.

- This suggests that:
  - the more answers a student reviews the better the learning outcomes
  - Peer Review activities can engage students at a higher level of self-assessment and learning
  - there is positive relationship between engagement, drive, and overall participation in formative assessment activities and learning outcomes in a course [9].
REFERENCES


References


