

Student Self-Assessment: A Method to Improve Students' Engagement

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Abstract

This study examined student self-assessment as a course activity to enhance learning. Over 350 engineering economics students from three cohorts of nine (9) sessions participated in the study. After submitting their homework to the professor, students graded a copy of their own work using the homework answer keys. Students' self-assigned grades were compared with corresponding grades assigned by the Teaching Assistant (TA). A questionnaire was administered at the end of the semester to collect additional data on students' perception on the self-assessment exercise. The result of the study suggests a positive correlation between the Teaching Assistant (TA) grades and the students self-assigned grades. Results also show that the average grade assigned by the TA was consistently higher than the average grade assigned by the students. Even though the students' acknowledged self-assessment helps them engage in the course and potentially improve their grades, the results indicate that they will only do that with an incentive.

Introduction

Involving students through classroom activities is critical for student engagement and understanding. For math-based courses as in most engineering courses, it is imperative that students practice their understanding of the concept through examples and peer discussions. For example, in a typical engineering economics class, the instructor will assign a problem requiring students to draw cash flow diagrams and determine cash flow equivalencies. Students may be put in groups to discuss the problem as the instructor walks around in the classroom to check on students. The Covid-19 pandemic however removed such face-to-face classroom discussions among students and instructors. During the pandemic, methods such as flipped classroom, online breakout sessions, peer assessment and self-assessment were used to engage students. In the context of this study, students also engaged in self-assessment (self-grading). This study reports initial results of students' self-assessment in an engineering economics class. It should be noted here that self-assessment is a general tool that can be implemented in any course.

Self-assessment, as in letting students assess their own work, is one of the most interesting assessment topics in literature both in secondary and in higher education. The complexity of the topics ranging from what constitutes self-assessment, why do self-assessment and how to use self-assessment results are some of the reasons why this topic is interesting and getting attention in the literature. The interest in self-assessment is due to many reasons. Boud [1], Dochy, Segers and Sluijsmans [2], and Sluijsmans, Moerkerke and Dochy [3] suggested that the reason for this greater interest may include the desire to encourage greater student involvement in their own learning process by making the process more democratic. They also further suggested that increased democratization will improve the relationships between students and professors that will help the students in the quest for autonomy and self-regulation in the learning space.

According to Andrade [4], "the meaning of the term *self-assessment* has been used to describe a diverse range of activities, such as assigning a happy or sad face to a story just told, estimating the number of correct answers on a math test, graphing scores for dart throwing, indicating

understanding (or the lack thereof) of a science concept, using a rubric to identify strengths and weaknesses in one's persuasive essay, writing reflective journal entries, and so on” .

So, what is self-assessment? Two key definitions of self-assessment that guided this study were those of Brown and Harris [5] and Panadero et. al [6]. Brown and Harris [5] defined self-assessment as a “descriptive and evaluative act carried out by the student concerning his or her own work and academic abilities”. Panadero et. al [6] went a step further to include the mechanisms and techniques involved in performing the self-assessment work. They defined self-assessment as a “wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products”.

As implicit as they may be, Andrade [7] points out some of the key missing elements of the two definitions above by suggesting that the purpose and rationale for conducting self-assessment needs to be well articulated in the definitions. Andrade [7], then suggested that “self-assessment is feedback, and that the purpose of feedback is to inform adjustments to processes and products that deepen learning and enhance performance; hence the purpose of self-assessment is to generate feedback that promotes learning and improvements in performance” .

Andrade’s [7] suggestion is heeded by several authors including Paris and Cunningham [8], Paris and Paris [9], Black and William [10], and Taras [11] who argue that self-assessment helps students in such areas as monitoring and regulating learning activities. For a class that uses activity-based learning, including classroom teamwork-discussions to engage students to improve student performance, Andrade’s [7] rationale for incorporating self-assessment to promote learning and potentially improve student performance was adopted for this study.

Study Objectives

The purpose of the study was to examine the use of student self-assessment as a tool to enhance students learning experience. Specifically, the study was designed to explore the following research objectives:

1. To measure students’ ability to effectively assess themselves.

Grading students’ homework is one of the key elements of any academic course work. The question is, can the professor use the students to assess their own work as part of the grading scheme? Tejeiro et al [12] concluded in their study of 122 students who were asked to self-assess themselves that students' self-assigned marks tended to be higher than marks given by professors for students who were told their marks will count towards their final grade. Tejeiro et al [12] also concluded that although students' and professor's assessments tend to be highly similar when self-assessment did not count toward final grades, in both groups, poorer students gave themselves higher grades than the grades given by the professors.

Even though measuring the students grading abilities was the main concern of this study, the key assumption here was that if the students could properly assess themselves, they can fill the knowledge gaps in key concepts that they are being assessed on. And this will get them more engaged and help them in their overall performance.

2. To measure students' perception on how self-assessment supports their study.

The definition of the term self-assessment is very broad in literature. Several authors including Andrade and Boulay [13], Goodrich [14], Gregory et al. [15], Hanrahan and Isaacs [16], Paris and Paris [9] and Tan [17] refer to self-assessment as a formative assessment process that allows the students to reflect and judge the quality of their work to identify their strengths and weaknesses as a basis for improvement. Andrade and Du [17] specifically defines the process that involves the students judging their own work including assignment of a mark (termed self-grading) as self-evaluation. For this study, the term self-assessment is used to describe all the activities including students assessing their work, assigning grades, and reflecting on the whole exercise on how it affects their academic work.

Methodology

An engineering economics course was used as a case study. Over 350 engineering economics students from three cohorts participated in the study. The cohorts were from 3 class sections each of Spring 2021, Fall 2021 and Spring 2022. All groups self-assessed (graded) seven of the eight assigned homework assignments in the class. Students were required to scan their finished assignments and save the scans as pdf files that they uploaded on the course Learning Management Software (LMS) site for grading. After the submission deadline, solution keys for the assignments were released to the students for them to grade their work and assign a grade based on the grading rubrics. Students then resubmitted the work as a graded assignment with self-assigned scores. Once submitted, a TA graded their assignments and entered both grades (their self-assigned grades and the TA assigned grades) in the class grade book. To eliminate any potential grading biases, students were told that the grades they award themselves will not count towards their course grades and that only the TA assigned grade will be used to calculate the homework grade. As an incentive, however, every self-assessment work was a dedicated homework assignment with well-defined points.

In addition to self-grading their work, students were asked to respond to a questionnaire that asked them specific questions about the self-assessment exercise. The questionnaire part of the study occurred at the end of the semester. To increase the response rate, responding to the questionnaire was considered a homework assignment. As an incentive, the self-assessment exercise was considered additional homework and was assigned a 5% weight in the final grade calculation. This was noted in the syllabus as a graded activity and was presented to the students on the first day of class in the semester.

The study included two data sets to address the two research objectives. Students' ability to effectively assess themselves, addressed in research objective one, is the focus of the first data set. The second data set concentrates on students' perception of the self-assessment process as presented in research objective two.

Both descriptive and inferential statistics were utilized to address the first research objective. First, the mean, median and standard deviation of each score (TA and students) were calculated. Next, Pearson's r correlation coefficient was utilized to know if there were any relationships

between the student self-assigned grades and the marks given by the TA. Further, means in TA grades and student's grades were compared with the Student's T statistics in a hypothesis test.

To address the second objective of the research, the mean scores for all subscales in the questionnaire administered in the study were calculated for each group.

Results

After reviewing the first data set for issues such as consistency and completeness including dealing with missing data, two semesters of six (6) class sessions representing 165 students were analyzed. Across all the six class sections, three homework assignments with less missing data and representing the core topics of the course were used. They were homework 2 (Engineering costs estimation), homework 3 (Time value of money) and homework 4 (Equivalence for uniform and non-uniform repeated cash flows). This pertains to the self-grading data. Since data completeness such as missing data did not affect the analysis objective of the questionnaire data, all 300 responses were used to analyze the questionnaire data.

The first research objective examined students' abilities to self-grade their work. Table 1 shows means, and standard deviations of marks assigned by the TA and the Students for three of the students' homework that were analyzed for this study. In all three homework assignments, the TA gave higher mean scores than the mean scores that students awarded themselves (please see Table 1). (M = 32.43, SD=2.63 for TA; M = 31.30, SD=3.78 for Student for homework 2), (M = 34.95, SD=3.52 for TA; M = 34.38, SD=4.49 for Student for homework 3) and (M = 55.25, SD=6.54 for TA; M = 53.06, SD=7.09 for Student for homework 4).

Table 1. Differences between Students' grades and TA's grades

Homework	Grader	Number	Mean	Std. Dev.
2	TA	165	32.43	2.63
	Student	165	31.30	3.78
3	TA	165	34.95	3.52
	Student	165	34.38	4.49
4	TA	162	55.59	4.91
	Student	162	53.15	6.99

We did a correlation analysis to examine the correlation between TA and student self-scores. Pearson correlation coefficient showed a strong positive relationship between self-grading and the TA grades for all the three-homework assessed (table 2). The t test also suggests that the difference in grade between the TA and the Students is statistically significant ($t = 6.120$, $p = 0.0000$ for Homework 2, $t = 3.261$, $p = 0.0013$ for Homework 3, and $t = 7.45$, $p = 0.0000$ for Homework 4).

Table 2. Relationship between self-grading and TA grades

	Homework 2	Homework 3	Homework 4
Pearson Coefficient (r)	0.7826	0.8735	0.8105
N	164	164	162
T-statistic	6.120	3.261	7.451
<i>p-value</i>	0.0000	0.0013	0.0000

The second research objective examined students' overall perception of self-assessment exercise and how it relates to class engagement and potential performance. Across all the cohorts, the results on student perception on self- assessment were consistent. The items with the highest ranked means include doing self-assessment to improve on future assignments (5.75/7), using self-assessment to avoid mistakes made in previous assignments (5.71/7), and understanding the connection between course materials (5.30/7). The least ranked item is the willingness to do self-assessment without any incentive (3.97/7).

Discussion

Is there a relationship between TA's grades and Student grade? The result of the study suggests a high positive correlation exists between student's and TA's scores. This finding is consistent with previous findings as reported by Tejeiro et al [12].

The literature reports that correlations between self-grading and the professor's marks in other studies with wide samples stand around $r = .20$, Andrade and Du [18]. In their discussion, the authors concluded that students tend to underrate themselves when judging their own work. The results of our study show otherwise. The Pearson correlations show a strong positive correlation of 0.78, 0.87 and 0.81 for all the three homework assignments. This significant ambiguity may be due to several factors. One such factor may be due to the type of material being assessed. The assessment materials for this study were based on an engineering class homework assignment. All the three assignments assessed were math based with distinct answers with no room for subjectivity. This may be the difference as most of the reference materials on this area of study are in education and education psychology where the assessment material may give room for subjectivity. Such a difference can cause a shift in the numbers as we see in the results.

On the issue of who awards higher marks, the professor, or the student, our results are consistent with previous studies. Though [12], [19], [20], and [21] concluded that students tend to overestimate their marks and hence reward themselves with high marks than the professor, we found out that, across the three assignments, the TA's average marks were higher than that of the students' average grades. This finding is consistent with those reported by [11], [18], and [21].

The second research objective's results show students' overall perception of self-assessment exercises and their connection with class engagement and potential performance. Across all cohorts, students consistently acknowledged the value of self-assessment in improving their future assignments, with a mean score of 5.75 out of 7. This demonstrates that students recognize the role

self-assessment can play in fostering a deeper understanding of course material and enhancing their academic performance.

Similarly, with a mean score of 5.71 out of 7 for using self-assessment to avoid mistakes made in previous assignments, students view the self-assessment process as an opportunity for self-reflection and growth, enabling them to identify areas for improvement and avoid repeating past errors. Consequently, self-assessment exercises can promote the development of problem-solving abilities among students.

However, the least ranked item, with a mean score of 3.97 out of 7, was the willingness to engage in self-assessment without any incentive. This finding shows the importance of incorporating appropriate rewards to motivate students to participate in self-assessment.

Conclusion

In conclusion, the results from this study demonstrate that students possess the ability to effectively grade their own work, suggesting that self-assessment can be a valuable tool in the learning process. Moreover, our findings indicate that engaging students in self-grading activities enhance students' learning experiences and contribute to understanding of the subject matter.

However, an essential aspect that emerged from the study is the role of reward in promoting student participation in self-grading activities. The results indicate that without proper rewards or recognition, students may be less inclined to engage in self-assessment. Instructors should consider implementing strategies to incentivize self-assessment, such as offering extra credit or incorporating self-assessment results into the overall grading scheme as used in this study.

As we continue to work on this topic, the following future works are in the pipeline: 1) investigate how different teaching approaches affect self-assessment accuracy, 2) investigate the effect of self-assessment on overall performance, and 3) analyze how different groups of students (such as poor and good students) assess themselves.

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