Purdue University

NOMINATION FORM FOR

HELPING STUDENTS LEARN AWARD

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Enhanced Student Learning Using Exam-Point-Recovery Teaching Sessions

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Nominations must be sent electronically to cie@purdue.edu. Nominations must be received no later than 5 pm, Friday, February 2, 2018.

Prof. Melloch has developed a simple and innovative technique that impacts many aspects of student learning and well-being. After each exam, if the students have attended at least 80% of the lectures they have an opportunity to recover points on one problem. The student has 15 minutes to explain, as if she were teaching a classmate, the concept behind the problem on which she is trying to improve her score. If an exam consists of 10 problems, the possible point recovery is small enough so as to not influence the effort students put in preparing for an exam. But, an opportunity to recover up to 10% of the exam points, has the following positive impacts.

1. Active Learning by Teaching

The best way to understand a concept is to figure out how to explain it. The student receives no points if all the student does is rework the problem. The student has to explain the concept behind the problem. This concept, which was a weakness, now becomes a strength. In addition to students learning better when they try to teach a topic, there is a psychological drive to learn the material to regain lost points. Prospect Theory shows that humans exhibit greater sensitivity to losses than to equivalent sized gains [1]. Therefore, most students will put in considerably more effort to learn material to recover lost points on an exam than they do to learn the material for the original exam. Prof. Melloch has observed that some students who had no idea how to work a problem on an exam are experts on the topic when they come in for their teaching session. Some students have told Prof. Melloch that they have started to tutor because of the learning benefits they experienced from figuring out how to teach a concept.

2. An Increased Learning Experience from Exams

An exam should be a learning opportunity not just a method of assessment. Most students do not spend much time reviewing a past exam; to recover their lost points this review is required. Students have commented how useful they have found spending time reviewing their graded exams and the posted solutions, with the intent of being able to teach the topic behind a question.

3. Reduced Exam Anxiety

During an exam, the students know they will have the opportunity to recover all lost points from one problem. If a student is having difficulty with a problem, the student can move on to finish the other problems without becoming anxious.

4. Concepts Learned, not just the steps to get a solution

ECE 31100, Electric and Magnetic Fields, is a course where Prof. Melloch has incorporated this student teaching session concept. ECE 31100 is a mathematically intensive course using vector calculus. All the equations can result in the course being a mathematical abstraction to the students with no understanding of the concepts. It takes considerable effort on the part of students to develop mental models of what these equations actually represent, which is essential in order to do well in the course. In order for the students to be able to teach the concept behind a problem, they have to develop these mental models. In order to teach the material, the students cannot just memorize a procedure, or solution to a particular problem. They have to understand the concept behind the equations.

5. Students become comfortable presenting a technical topic one-on-one

Some students are clearly nervous when they come in for their first teaching session. They become much more comfortable as they gain experience from their one-on-one

teaching sessions. These sessions are good preparation for the students for when they are asked to explain a technical concept during a job interview.

6. Increased Class Attendance

The opportunity to recover lost points is a positive way to greatly improve class attendance. Unless a student has attended at least 80% of the lectures, they are not eligible to recover lost points on an exam. So instead of punishing students for not attending class, the opportunity to recover lost points provides an incentive for class attendance. This attendance policy results in greater than 95% attendance for all lectures.

7. Increased Utilization of Office Hours

Another benefit of the teaching session is students who had not come to office hours before the first exam start coming to office hours after their teaching session. The opportunity to recover lost points is sufficient incentive to schedule their fifteen minute session in the professor's office, after which they feel comfortable dropping in during office hours.

8. Early Opportunity to Counsel Students Having Difficulty

There is the occasional student who comes to their teaching session with little understanding of the course material. This affords an opportunity early in the semester to counsel this student, who might otherwise never come to see the professor, languish, and end up failing the course.

9. Students Feel That a Faculty Member Cares About Them as an Individuals

The three 15 minute sessions during the semester (for a three exam course) result in the faculty member knowing the student. The students feel there is a faculty member who cares about them as an individual. The recent Purdue-Gallup poll showed the importance for

students' life after college from having been actively engaged with a faculty member, and these sessions foster such engagement [2].

Evidence of Student Learning

There has been a significant, and measureable, effect on the students' performance on the exams and the final course GPA because of the additional learning that occurs with the teaching sessions. As in most courses, but especially ECE 31100, students are not ready to learn the material for the next exam unless they know the material covered on the previous exams. There are three exams and a final in ECE 31100. As the course progresses, the material in 31100 becomes conceptually more difficult and requires comprehensive knowledge of all previous material. The result had been that each exam had a lower average than the previous exam, typically by 3 to 5 percentage points. With three exams and a final there was a significant decrease observed in students' understanding of the material as the semester progressed. To prepare for their teaching sessions, the students must go back and learn material they previously did not learn, or had difficulty with. The result has been improved exam performance; there is no longer a decline in exam averages as the semester progresses.

In the following table is student performance in ECE 31100 before the implementation of the exam teaching policy in Fall 2011 and after. The total number of points between the four exams and the homework was 480. The average student total point recovery ranged from 11.9 to 28.8 with an average of 19.1. ***The average GPA went from 2.71 to 3.13 with the incorporation of the point recovery policy.***

Before

Semester	Number of Students	Number who failed	GPA
Fall 2002	64	5	2.70
Spring 2007	93	1	2.81
Fall 2008	75	10	2.53
Fall 2009	37	3	2.72
Fall 2010	62	1	2.78

After

Semester	# of Students	# who failed	Total average points recovered	GPA
Fall 2011	59	2	16.1	3.18
Spring 2012	56	0	28.8	3.25
Fall 2012	58	4	22.1	3.02
Spring 2013	62	2	25.8	3.03
Fall 2013	61	0	18.9	3.10
Spring 2014	57	5	15.2	3.00
Fall 2014	45	3	14.5	2.90
Spring 2015	52	1	13.9	3.30
Fall 2015	53	2	18.9	3.29
Spring 2016	57	1	20.1	3.23
Fall 2016	59	4	11.9	3.15
Spring 2017	28	0	24.6	3.28
Fall 2017	53	2	27.3	3.19

There has been considerable interest in introducing active learning techniques. Presented is a very simple to implement active-learning technique. Any instructor wishing to incorporate this technique into their class can instantly do it. For a class size of 60 students, with three exams during the semester, the investment in instructor time is about 40 hours during the semester. For larger classes, or instructors who do not want to invest this time, teaching assistants could be used.

[1] D. Kahneman and A. Tversky, Econometrica 47: 263-291.
[2] http://www.gallup.com/poll/168848/life-college-matters-life-college.aspx