

# DESIGNATED STUDENT GRADING<sup>1</sup>

## AS A LEARNING DEVICE<sup>2</sup>

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In the school at which I teach, Rose-Hulman Institute of Technology, an undergraduate engineering, science, and mathematics curriculum is offered to approximately 1300 students. Most faculty teach three courses. Often this consists of two lower-level sections of the same course and one upper-level course. For example, I might have two sections of Calculus II, say with 30 students in each section, and an upper-level elective course or seminar.

One sure way to get students to learn mathematics is to have them *do* mathematics. Of course, thinking in class and doing activities during class time is an obvious route. But doing problems at home, be it straightforward material from the text or extended projects, designed to bring out the creative best in the student, is a must. Accordingly, I assign regular homework, mostly of the traditional type, dare I say routine, from our textbook.

Now in order to get students to do mathematics by working out problems at home, I have found it best to reward them positively with feedback and credits toward success in the course. I use a grading scheme in which the total score (percent score) of homework counts the same as one hourly exam. Thus if we have 4 hourly exams and a comprehensive final exam (worth 2 hourly exams) the students see that the homework counts 1/7 of the total grade. That becomes a serious motivator.

Feedback and credit demand evaluation and recording of the homework. At Rose-Hulman we get a solid upper-class student as a grader for each lower-level course. The professor can give the grader as much help and instruction on evaluation procedures and methods as the professor deems necessary. I have used graders in the past. Since my motivation is primarily to get the students in the course to practice mathematics at home, using a grader is a good idea.

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<sup>1</sup> This paper was written while the author was a faculty member of the Department of Mathematics, Rose-Hulman Institute of Technology, Terre Haute IN 47803 USA.

<sup>2</sup> Essentially from the article "Peer Grading." In *UME Trends*. 1(5): 2, 7. Reprinted in *You're the Professor - What Next? MAA Notes Number 35*. Ed. Betty Anne Case. Washington DC: The Mathematical Association of America.

The feedback offered by the grader is a function of the grader's personality, the time afforded for grading, and the demand for detail from the professor. There are occasional complaints about inconsistencies in grading, even about general harshness, although I almost always back my grader, especially if the grading is consistent. I point out to the student that a specific homework assignment grade does not count that much in the grand scheme of the course. But I always make sure the student is satisfied about his ability to do the mathematics and, of course, I try to address the complaint and get feedback to the grader.

For this winter quarter's Calculus II course I could not locate graders. What was I to do? An idea came to my head based, in part, on my own third grade spelling teacher's, "Pass your papers to the left and now let us begin correcting the papers." and one of the previous quarter's graders who thanked me for the opportunity to review the work. This grader also said he was amazed at the different approaches students took to solve problems and the diversity in the quality of presentation and exposition.

The idea: Why not have the students in my Calculus II class grade the homeworks in my Calculus II class? It was obvious. Here is what I did and what I continue to do now.

I grade the first week's homeworks to see who some of the good students were and to give the class a model on how one could grade - *not* on how *they* should grade. I usually give 10 points per problem, with an occasional problem worth 20 points, and there would be 10-15 problems each night. Thus in a 10 week, 5 meetings per week, class we could accumulate some 3-4,000 homework points. And throughout the course I assign larger problems, e.g. worth 50 or 100 points. I would try to "buy" solutions of extra credit problems<sup>3</sup> with high price tags of 200-300 points per problem and I would assign large, open-ended projects or essays, all of which I would grade. Now you begin to see why I did not wish to grade the routine problems.

On the information sheet I provided for them at our first class meeting on the details of the course, e.g., text, topics, office hours, evaluations, procedures, etc. I write this:

Homeworks are assigned regularly and collected regularly - all are graded. Homeworks will be graded by students in the class. Each student will be responsible for one or more homework assignments during the quarter. Student graders will be informed at the start of class that they will grade that evening. Work must be graded, (a key will be provided) with scores recorded (10 points per problem, unless otherwise stated) and papers alphabetized. Papers must be returned to instructor before the next day's class for distribution to the students.

I do not change my teaching style in any way to accommodate this approach. For instance, if a student asks about a homework problem the day it is due, and we get into it, either partially or with a complete solution, I never discourage students from taking this down and submitting it for homework. Remember the real purpose for homework, and the same goes for classroom, is learning.

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<sup>3</sup>In computing final course grades, I calculate a numerical grade and thence a letter grade, before adding in the extra credit grades. Then I recalculate a numerical grade (actually another column of my spreadsheet holds this information) using the extra credit grade to see if someone moves up - never at the expense of anyone moving down - because of the extra credit. If one does not do extra credit, then one sits tight with the grade assigned.

I produce copies of a class roster, and after selecting the first few grader candidates, I show up in class on the Monday of the second week with a key (indeed a worked out solution to each problem assigned) to the homework that was due that day and a class roster with the grader's name atop the roster. I give the roster and the key to that student and say, "You're on tonight." At the end of class this student is responsible to pick up the papers left at the front desk and return them to me for distribution at the start of the next day's class with the grades recorded on the roster, e.g. 93/100. When I return the graded papers, I also give each student a complete key. This is the same key given to the grader the day before. I continue this process each time I have homework due.

What are the results? The program started well because I selected the "stars" based on organization and correctness of their homework from grading of the homework during the first week. Only one student out of over 75 student graders failed to bring the papers to class the next morning. There were occasional complaints about harshness of the grading. It was obvious that some student graders took it more seriously than others, e.g. grades would come back 83/90, 67/90, 34/90, etc. as opposed to 110/110, 90/110, 100/110, etc. When all students had a chance to grade, I started at the top of the roster. Knowing that I would not be able to complete a second round, I assigned half the class, to one grader and half the class to a second grader. Of course, here there would be some inconsistencies, and students noted that in a later course evaluation.

What did the students think of this homework grading scheme? Of the 60 students in the two sections of Calculus II, not one thought it a bad idea! At the end of the quarter I handed out an evaluation on this approach. I asked, "What did you think of the student grading of homework in this course? What benefits were there for the class? for the grader? What negative aspects were there? How could the process be improved?"

Some immediate responses with my comments are:

- We got homeworks back faster. [Often with only one upper-classman grading, there would be some days on which homework would not come back, e.g., the grader had a series of labs to write up or had a plant trip for an interview.]
- I liked to see how other people worked the problems. [This was a very common response.]
- It helped the person who graded to understand the material better. [We all learn when we have to follow someone else's reasoning. Again this was a very common response.]
- It helped students understand problems they were having trouble with. [Students were forced to figure out what was correct on problems which gave them difficulty.]
- It gave me the feel of a problem as I worked through different approaches. [And there were different approaches, as students bring different experiences and insights to the problem.]
- After working through a homework assignment each student knows that material by heart, allowing him to be an expert in that type of problem. [Is this a delusion

of grandeur or a recognition that plowing through the same material many times to complete the grading makes the student experienced? I think it is the latter.]

- If there was something I wasn't sure about, I could check it with someone else's or the key.
- It was no big thing. [Joe Cool! This actually was a very common response, i.e., it was not perceived to be an inconvenience or burden.]
- Since the same grader did not grade every night, an 'assembly line grading' didn't occur. [Occasionally the use of one grader per course results in a sense of check-off or stale grading.]
- It showed me how sloppy and unorganized some people could be and how structured others could be. [One can hope that the student moves *up* the organization ladder.]

Only one student mentioned that the grading took too long. And while I never polled them as to how long it actually took, several told me that they finished in less than one hour. But I suspect there may have been very careful graders who took more time.

Only one student suggested I provide more rigid standards for grading. I simply said 10 points per problem and be consistent. Of course, we discussed, and they learned, the difference between a significant Calculus error and a lesser arithmetic or copying error and they each set their own standard on these. Some were harsh and others were more forgiving. There was never any sign of vindictive behavior. There was a sense of involvement in the process.

The one "complaint" was that they would like to have more notice on when they would have to grade. They came to class each day wondering where the fickle finger of fate would strike, as I moved about the room to drop the assignment at the desk of the designated grader. I was ready to alter this in the next quarter by giving the designated grader the roster (not the key!) on the same day I assigned the homework, thus informing the grader that the grading needed to be done the following night, allowing for some adjustment to study time and personal scheduling. In fact, I tell the students that if they really are pressed that evening, they may pass and I am prepared to select another student. It has only happened twice and it posed no problem nor did it encourage procrastination. But one student foresaw a problem here and suggested that, "I think it's better to surprise them, for if you give the students forewarning as to when they are going to have to grade, they probably won't do the assignment." Hmmmmmmmm???? And by not doing the assignment, the designated grader loses out on the learning experience and thus may not fully benefit from the grading opportunity. And, of course, not having done battle with the problem set, the designated grader arrives at the task with little to draw upon.

So what are the problems? Occasionally (but rarely) there would be inconsistencies in grading. I tried to address those on an individual basis. One or two students begrudged the time, especially with no warning. One student mentioned that it was good to know who the grader was. (The grader was known by the fact that I would give something – the key and grade sheet – to someone at the start of each class.) This might concern some teachers, but I never heard anything about repercussions. Overall,

the problems seem very small and the benefits are great, from the perspective of the teacher *and* the student.

It is interesting to note that when I had finished the first round of grading, i.e. gone through all the students in one class, I announced that I would have to begin at the beginning and go through the list of graders again. I erred and announced this in both sections. In fact, in one section I had not finished the roster and at the start of class the next morning the one student who had not been asked to grade came up and said, "How come I did not get a chance to grade homeworks? I had realized my error and had prepared for him to do the next day's work. And when I immediately handed him the roster sheet with the homework key for that night, his face lit up. He smiled and said, "Thank you, Dr. Winkel." *He was thanking me for letting him grade* – shades of Huck Finn and the fence whitewashing scene. But we remember the envy we held in grade school for those asked to clean the erasers after class, to take a message for our teacher to another class, or to help the teacher in class? The students were proud to be asked to grade homeworks. And they took pride in the work.

We see that what began as an expedient solution to a problem, actually turned into a good experience for all concerned. While I am not sure how designated grading could be used in each area, I do know that the students who grade like it and believe it helps them learn better. Thus I commend the method to you.