Grading in the Sciences (Elective Seminar)

“On homework assignments and exams, I do not look for a regurgitation of what was taught in lecture or that the correct formula could be found in the text. Rather, I am more interested in the thought process and logic that the student applies to solve problems.”

~ Professor Donald L. Feke, Chemical Engineering

Seminar Description

Experienced faculty from biology and physics offer their best strategies for grading homework, exams, and lab reports, so that students have positive, yet, critical feedback on what they have done well and what they still need to work on for the next graded assignment.

Seminar Objectives

- To practice grading techniques in the context of science and engineering teaching assistant roles.
- To understand how to provide developmental feedback on graded materials.
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Planning for Evaluation and Grading

Many professors claim they love to teach but are uncomfortable with grading; they dislike criticizing students’ work or delivering the bad news of a low grade. It may help to rethink what grading is all about. Done badly, grading is a way to distinguish those who succeed from those who fail and to wash one’s hands of the results. However, done well, grading is a way to honestly assess students’ progress and help them learn to judge their own work with accuracy and discernment. Evaluation of work can also help an instructor decide whether to change approaches or to alter the course’s pace.

Evaluation is the act of assessing progress or measuring achievement against certain norms or standards. For instance, you may evaluate the effectiveness of students’ reading by quizzing them on the text. Grading is a more formalized expression of that evaluation, assigning numbers or letters to the work students have done.

The following recommendations will help you assess your students fairly and accurately:

Build evaluation into the course

• Do not grade as if it is a tacked-on final process. Doing so can give students the impression that you think one way in the classroom and a completely different way when grading. When you plan your course, build in different types of evaluation as you go along, both graded and non-graded. Acquaint students with receiving non-graded assessments that help them evaluate according to set criteria while leaving room for subsequent improvement.

• Construct assignments that require students to demonstrate what you are trying to teach. Make sure that the nature of your homework, project, or exam actually requires demonstration of the skills you consider most important.

• Consider, too, how valid and reliable your assignments are. As described in Teaching at Carolina: A Handbook for Instructors (1991), the validity of an assignment is measured by how well it samples the range of knowledge, skills, and abilities students are supposed to acquire in the period being tested. An exam that focuses on one week’s worth of material out of five is not a valid assessment of those five weeks, even if it produces a reasonable distribution of grades; it neglects eighty percent of the subject matter students worked on.

• Measure the reliability of an assignment by how consistently the results of the graded homework, tests, and papers distinguish students who are performing at different levels. If everyone gets A’s, you do not have a reliable indication of what students have
really mastered. Similarly, if a question is vague or subjective enough that two people can give wildly different grades to the same answer, the question is not reliable.

- Write your tests and assignments early to ensure reliability and validity. Writing a good test or assignment takes time and thought, while a hastily written test or assignment can cause problems.

**Distribute evaluated assignments throughout the semester**

Many courses feature just a few large graded elements: a midterm exam, a final exam, and perhaps a paper. This approach may sound attractive at the beginning of the semester, as you imagine only having to grade a few times. However, if you do not have a formally evaluated assignment before the middle of the term, you make it difficult for students to assess their own progress and for you to know how well students understand what you are trying to teach them. Discovering halfway through the semester that half of the class does not understand the concepts will not leave you much time to find out why. Consider the following approach to evaluated assignments:

- Schedule frequent measurements of students’ understanding. These do not have to be elaborate graded assignments: you can use quizzes, class participation exercises, or brief response papers to find out how students are handling the material. A physics class, for example, can use problem sets or pop quizzes to test students’ ability to apply the appropriate mathematical principles for determining angular momentum. Just make certain that students work with the material as early and as often as possible.

**Clarify your grading criteria for the class**

- Make it clear to students how you evaluate work, and how that evaluation fits your larger course goals. If you have a grading rubric, distribute it and discuss it. Do practice grading of sample papers or problems. By putting the students in the position of grading work according to the standards you explain, you help them more fully understand those standards and apply them to their own work.

- Test your exams or assignments before giving them to students. By the time you have constructed an assignment, you may be very familiar with it and, therefore, unable to spot poorly worded questions or unevenly weighted sections. Work the problems yourself, and if possible, ask fellow TAs to review tests or assignments. Ask how a reasonable student would interpret what you have written. Are the instructions clear and complete? Can the assignment be completed in the time frame given? Are any sections more difficult than others, and if so, are they weighted accordingly? If you have given a choice of questions, is one distinctly more difficult than the rest? Is it possible to
give a reasonable answer to a question which is not the answer you had in mind? Never give an assignment to which you have not thought through a valid response.

- Ensure that each assignment, quiz, test, or paper has clear instructions, deadlines, time limitations, and point breakdowns, as well as criteria for completion. If you have format requirements, such as using pencil or pen, writing in bluebooks, or following certain style guides or procedures, relay that information in the instructions, and indicate how much weight you will give those elements when grading.

**Keep accurate records throughout the term**

Students should be able to assess their overall grades as they go along, and so should you—neither of you should be surprised by a grade near the end. Each time you grade an assignment, reassess overall grades. Also, encourage students to take responsibility for monitoring their grades rather than relying on you.

**Make the evaluation process a part of the learning process**

Once an assignment is completed and graded, you should not consider it finished. Otherwise, the student will glance quickly at the bottom line grade to make sure it is satisfactory, then stuff it in a folder or backpack and forget about it. That’s not what you want them to do with the material! Instead, take the opportunity when returning assignments to review how students performed and make explicit connections with work being done in the rest of the course. Ask students who did well to demonstrate or read aloud excerpts from their work; go over common problems as a group to help students understand what went wrong.

Some instructors use grades to shock students; they construct exams that push the students to take what has been learned so far in the course and move to the next level, but they do not prepare students for this step before the exam. This strategy is usually counterproductive. Students are certainly shocked, but they are not necessarily motivated to learn. Instead, construct assignments that require students to build on what they have learned, while also demonstrating their command of the material.
Determining Grading Criteria

Grading Policy of Case Western Reserve University

The *General Bulletin* provides a full explanation of the university’s grading policy. The following definitions are given to letter grades A-F:

- A: Excellent
- B: Good
- C: Fair
- D: Passing
- F: Failure

There are other grades indicating incompletes, repeats, or the pass/no pass option, but for the most part these are the five grades with which you will work. You should take these definitions seriously. Many students entering your classes will have made easy A’s in high school and will expect to do the same in college; you should explain to them that an A represents truly excellent work and not just satisfactory completion of the basic elements of the assignment.

**Pluses and minuses**

In the University’s grade point system, pluses and minuses are not attached to grades except in the schools of Law and Dentistry. While you are welcome to use pluses and minuses to evaluate work in your course throughout the semester, the final grades you submit will ultimately appear on student transcripts without those qualifiers.

**Department grading policies**

If your department has a grading rubric for your course or for all courses in your subject, find it and familiarize yourself with it.

**Familiarizing your students with your grading criteria**

Include evaluation criteria in your syllabus, and explain it to students. Be absolutely clear about what makes up a course grade. What are basic standards of achievement? What weight does each class assignment get? Where do attendance, revision, extra credit, effort, or improvement fit in? How will you treat partial or incomplete work? How much does showing all work count toward the answer? Define just what you mean by class participation if it is something you choose to grade. When is it acceptable for students to work in groups, and when must they work individually? How will you deal with plagiarism or cheating?

Whatever your standards are, make certain they are consistent, fair, and applicable to the work performed for the class.
The First Year Grading Policy

For the first two semesters of enrollment, matriculated students who are beginning their college studies may withdraw from a course at any time during the semester, but no later than the last day of classes. Any course for which a grade of W is assigned will not be posted on the official transcript. This policy is not available for transfer students and does not apply to the summer session.

Grading Methods

Standards of comparison

All grading requires comparison of some kind. The two main kinds are comparison with fellow students (also known as grading on a curve) and comparison with set standards. Each method reflects a certain philosophy about grading, and it will be up to you, in conjunction with your department, to decide which philosophy is most appropriate for your course. Whichever you choose, apply it to the course as a whole. Do not mix methods, and make it clear to students how their grade is being determined at the outset of the semester.

Comparison with fellow students’ performance

This method assigns grades along a spectrum determined by the performance of a relevant group of students. Cutoff points for A’s or C’s are not determined by absolute criteria, but by a reasonable distribution within the class. Possible comparison groups are all students taking a particular course one semester or all students who have ever taken this particular course from this instructor. The purpose of this method is to foster some competition among students, for it rewards students whose performance is outstanding compared to that of their peers. However, grade standards can rise or fall with the aptitude or ineptitude of a given class, as the distribution is spread among higher or lower objective scores.

Non-comparison with fellow students’ performance

The purpose of this method is to measure students’ performance against fixed, objective criteria. There are no quotas in each grade category, because theoretically, all students could earn A’s or could fail, according to the criteria. Thus, standards of performance remain uniform from class to class unless the criteria themselves are revised. Additionally, grades reflect students’ objectively measured achievement of course goals rather than their performance relative to fellow students. This method de-emphasizes student competition and focuses instead on the material.
Answer key

This type of grading scale of the non-comparison method is typical for grading based in problem-solving disciplines. Although homework and exams may involve an evaluation regarding the quality of how the student arrived at the answer, the Answer Key is mostly clear-cut, with a minimal amount of variation in correct answers.

Rubric

A rubric is typical for grading of short answers and essays, often rooted in humanities and social science disciplines. It is a form of the Primary Trait Analysis, which is criterion-referenced scoring. A Rubric provides a roadmap for a range of acceptable answers and criterion for evaluating the quality of those answers. Often a great amount of gray area exists for assignments and exams requiring a Rubric, but a well-defined Rubric can assist in evaluating students’ work. You may also consider sharing a general Rubric with your students, so they are aware of how you will be evaluating their work.

Planning ahead to grade

- Allow a reasonable amount of time to grade, and be realistic about what you can do. Can you really grade 20 problem sets on a single Saturday afternoon? Probably not, and if you try, you may be exhausted and irritated by the time you grade the last problem. Allow for undistracted time and necessary rest breaks as you would for any other important task. Break your work up into manageable chunks—nothing can put you in a worse mood for grading than looking at a teetering tower of exams and thinking you have to push through them all at one sitting. If you grade as a group and need to hold a marathon session, build in breaks, snacks, and anything else needed to keep the mood light and your performance optimal.

- Make comments as you grade, but record tentative grades on a separate sheet of paper. When you are done, review assignments to check that your grading has remained consistent. Was that early $B$ really comparable to the $B$ you awarded right at the end? Once you are satisfied that all grades are accurate, record them.

- Set aside a paper or exam and return to it at a later time if you have doubts about the grade it deserves. A fresh perspective may help you see the problem, or you may realize that you need the advice of a fellow TA or professor on a question of procedure or academic honesty.
Avoiding bias

Bias can creep into your grading when you inadvertently weigh what you know about the student as an individual into your evaluation of a paper or examination. Certain kinds of discrimination, such as on the basis of race, religion, age, sex, color, disability, sexual orientation, and national or ethnic origin are a violation of the University’s anti-discrimination policy and may be a violation of state or federal laws. Other biases can arise from simple personality affinities or conflicts, your personal frustration with a student’s attitude expressed in class, or your desire to encourage a student who is struggling with the material.

If you are worried about subjectivity, separate the students’ names from their assignments when grading. If you cannot manage to disguise the student’s identity from yourself, ask a colleague who does not know the student to read the work anonymously and assess the accuracy of your grade. Remind yourself that the students you do not like can still earn A’s and students you enjoy can still do poorly. It is your job to evaluate their work accurately, not to commiserate.

Providing helpful feedback

When students receive graded work, they should see more than a grade; they should be given written information about their performance. It is frustrating to receive a paper with just a letter grade of C. With multiple-choice tests, it is fairly easy to indicate which answers were correct and which were missed, but work requiring problem solving, writing, or performance of routines should be returned with a grade and some commentary about the work. Consider the following feedback strategies:

- Keep comments positive. Point out what you like as well as what is flawed; explain where problems lie and point to solutions rather than just noting errors. For papers or pieces longer than a page or two, sum up with general remarks, and start them off positively. Make sure your remarks are tactful so you do not risk hurting the student’s feelings when pointing out problems.

- Interject frequent but succinct notes to indicate both strengths and weaknesses. While comments should be sufficient to indicate the basis of the grade, they should not be excessive. Too many comments in the margin only overwhelm and frustrate students.

- Conduct a class session to avoid writing the same corrections on dozens of pages if the whole class makes similar mistakes. (You might also create a solution key.) If one student has particular problems, arrange a conference to analyze the work and to suggest appropriate outside resources, such as the Writing Resource Center (WRC) or
the tutoring programs offered by Educational Services for Students (ESS). Finally, offer a summary of your positive and constructive comments to that you ensure that the student takes away the message you intended, which should be positive, helpful commentary that encourages the student to try the next graded activity.

Section and Cross-Section Grading

Grading in a course that has many sections poses special problems. Each instructor and grader must agree upon uniform criteria and methods for grading large numbers of students working with different instructors, and must make certain students perceive that uniformity. Students become frustrated and angry if they think one section is being treated more leniently than another section—especially if they are in the section being judged by stricter criteria. To avoid discrepancies between course sections, consider the following strategies:

- Meet with all instructors, TAs, and relevant personnel before the semester begins to establish standards and practices. Will the class be graded on a curve or according to set criteria? Does everyone agree on what the criteria will be? Whatever variation is permitted among sections, each should require the same general kinds of assignments and total quantity of work and should judge all work by a single approved standard.

- Schedule grading workshops (where copies of papers are read and graded by all course instructors/TAs) to ensure fairness among sections. Some departments grade multi-section exams by dividing the work among graders by question: one person grades all of question 1, another grades all of question 2, and so on. If the course is team-taught or has just one or two TAs, you may choose to divide work up equally and grade it, then trade it for review.

- Return graded assignments as a unified team. The professor should never belittle the TA’s effort, and TAs should never denigrate the professor’s work. If students sense division, they may exploit it; certainly they will have less confidence in your ability to conduct the class together.

Grading Group Projects/Group Lab Reports

Many classes now incorporate group projects or group lab reports that help students learn how to work in a team atmosphere. While this approach is good in theory, the day-to-day reality of this tactic can be a nightmare for conscientious students who may end up doing most of the work because their teammates have not learned effective time management. To avoid grading a team paper or project that may have been essentially written by one or two teammates rather than the entire team, try the following approaches:
• Have the teams create a team charter at the beginning of the project that asks team members to secure this information: contact information, meeting times, a tentative schedule on how to approach the project, and strategies for handling team conflict.
• Require that the teams to submit weekly logs on which they record their progress and any issues that they are having with the team as well as their ways for responding to team conflict.
• Direct students to turn in a rough draft of the project about a week before the project is due. On that draft, each team member should initial the portion contributed to the entire project along with a list of questions that the team members may have about the project and/or their rough draft. Award a portion of the total points designated for this project to this rough draft. Make yourself available to answer questions about the rough draft either in class and/or during office hours. Read the drafts for overall issues and provide written feedback.
• For the final draft, ask students, again, to initial their contributions and sign a statement that all teammates contributed equally to the completion of the project. Teams may also be required to provide individual team evaluations that be submitted anonymously or as a signed assessment. On the team evaluation, students are asked to rate their own performance as well as their teammates.
• Decide before giving a team project whether the teammates will be given one group grade or individual grades. (If you want to assess individual effort, you may assign a specific percentage of the grade for the overall project and then a particular percentage for individual effort.)

Using the process described above, you may lessen the pressure for one or two teammates to produce the entire project because their teammates are not waiting until the last moment to submit their portions of the work.

Defending and Justifying a Grade

Despite all your careful planning and checking, a student might challenge the grade you have marked or ask for a more complete explanation than you have provided. First, do not panic. This issue is not necessarily indicative of your grading policy or practice, or a sign that your students are about to rise up in revolt. There are three distinct possibilities for such dissatisfaction, and you will need to determine as calmly and fairly as you can which applies.

• **You have made a mistake in grading.** TAs, as well as seasoned faculty, are capable of misreading an answer or being too hurried or too tired to think properly at the end of a long grading session. Mistakes happen, and when they do, you should acknowledge and correct them.

• **The student misunderstands your comments or criteria or did not completely understand the assignment.** You can usually resolve this situation by going through
the exam or assignment, item by item, and discussing problems and strengths until you reach a mutual understanding.

- **The student understands why you graded as you did but disagrees with your criteria or procedure.** This disagreement can range in degree from feeling that a particular question or assignment should be weighted differently to a total philosophical impasse about grading in your course. If you cannot reach a mutually satisfactory arrangement in conference, send the student to the class professor or the faculty member in charge of the course.

**Principles to Keep in Mind When Reviewing Grades**

**You do not have to give an immediate answer.**

If students approach you at the end of class on the day you have returned assignments, do not feel you have to resolve all appeals before you leave the classroom. Encourage students to come to your office hours or arrange conferences with you. Ask them to let you take the paper and review it before you meet. After all, you do not want to give it a cursory assessment. Some professors adhere to a 24-hour policy for questions about exams. In other words, students may not speak with their professors about exam grades until the next day in order to defuse any emotional response to their grades. Indicating the points taken off for each question on a students’ paper may also help eliminate issues. Finally, many professors make photocopies of the exams before returning them and they let students know about this policy. This strategy may eliminate students from feeling so much pressure about their grades that they are willing to be less than ethical about their complaints to you about their exams.

**You can review the entire assignment, not just the question or section with which the student is dissatisfied.**

Many departments announce that when a grade is questioned, the whole exam or paper will be reviewed, and scores may go down as well as up.

**If you can defend and explain the grade, stand firm.**

While you do not want to be so rigid that you cling to mistakes you made, you also do not want the word to spread that you can be argued into improving a grade. Explain as fully as you can what the grade was based upon and why you feel your assessment is correct. If you have doubts about grading a particular exam or paper, consult with a colleague or supervisor, providing a copy of the item in question with the student’s name removed to preserve confidentiality.
Work Cited


Additional Resources

Print


Electronic

