



Assessment That Promotes Learning

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The teacher in an elementary school class is understood to have the capability of evaluating all of the students across a range of skills throughout the school year. That teacher also has the responsibility to intervene when he or she recognizes a deficiency in a student. For teachers of large college classes, neither of these statements is true. Typically, college teachers evaluate their classes only a few times, using tests that telescope all of the relevant skills into a single number or letter grade. Thus, they may never understand their students' performance in a detailed way.

Furthermore, intervening to save a particular student in college has traditionally been viewed as the student's--not the teacher's--responsibility. These circumstances make it reasonable for the teacher of college courses, especially large ones, to look for ways to help students recognize when they need to intervene on their own behalf. But the methods whereby this is accomplished need to be simple to apply and easy to evaluate. Ideally, the system ought to work like the self-repair mechanisms of biological organisms. That is, it should be driven by the desire of the *students* to do well rather than by the *teacher's* attention to the problems of individual students. But students and teachers seem to look at courses in very different ways. As a teacher, I view my courses in terms of learning goals and material coverage, with examinations and assignments as a necessary chore. Students, on the other hand, seem to view them as a certain number of assignments and a certain number of examinations or papers. For me, tests measure the flow of a process. For students, tests *are* the process.

Recently, I have been looking for ways to use this consuming student concern about tests and grades and points as a vehicle not only to measure how well students have learned material, but also to assess and improve how they learn, how they think, and how they come to value certain ways of learning and thinking and knowing.

Designing Assessment Strategies

As teachers, we need to make explicit connections between the skills we expect students to bring with them--skills we all too frequently treat implicitly--and traditional modes of assessment. For example, if a particular skill or way of thinking underlies the proper solution to a problem, we should try to find ways to let the student assess this skill beforehand, rather than letting him or her stumble up against it when trying to solve a larger problem. When choosing assessment strategies, we also need to remember a few simple points about how students learn.

First, the single most important factor influencing learning is what the learner already knows. This observation has two important ramifications for me. One is that I expect the students to be able to call on knowledge and skills from prerequisite courses, and it is important that I let them know that. The other is that I expect them to come prepared to class each day. Usually that means they have read ahead or done a certain problem, so it is important for me to demonstrate what that day's task is. Just saying that they must be prepared is not enough; I must also *show* them what they must do to be prepared.

The second factor to remember is that awareness of learning motivates learning. This is an easy one to forget, and one I need to attend to more often. I try to find ways for students to experience the payoff when they make an investment in improving their learning/thinking skills. When they see results, they become more highly motivated. My tendency, however, is to ask more challenging questions as students get more sophisticated, so that test results tend to stay constant. This interferes with the buildup of confidence I would like to encourage. Even though *I* can see their growth, *they* don't if their test scores remain fixed.

Obviously, making student self-assessment an integral part of the course assessment process is ultimately beneficial for all concerned. Many students will do poorly in a course without ever facing up to the underlying problems. Close off this escape route, but do it so that the students, rather than you, do the extra work. Many times these issues arise because students have never had to master certain basic study skills. For example, a surprising number of students go through a course without ever registering what the goals for the course are and without realizing what the expectations are in terms of study time, skill acquisition, or use of background information. I now try to include this sort of information on my syllabus. But the problem remains that many students won't read that part of the syllabus. Similarly, when they receive their first graded assignment, many students will view it almost clinically, ascribing all failing to the sadistic inclinations of the teacher rather than acknowledging any causal relationship to their own behavior.

Ultimately, both students and teachers share the responsibility for what transpires within and because of a particular instructional setting. The common theme in solving or resolving problems is in discovering ways that will make students explicitly aware of the broader learning goals of the course and will require them to assess their performance and their learning practices. I am sure there are many ways to approach these problems. But the following are examples of some strategies I have used to help to coordinate both the teacher's and the students' responsibilities. These examples may give you an idea of the range of possibilities when seeking modes of assessment that will promote learning.

A Sampling of Assessment Strategies

Syllabus and Day 1 Questionnaire

You have only about two weeks to establish the course pattern. Therefore, it is a good idea to seek feedback from the very beginning when you talk about your goals and expectations. Because many students simply do not read the sections of my syllabus dealing with course objectives, I have devised a questionnaire that is to be handed in at the second class meeting. For obvious reasons, students think I am asking for information about them, and to a certain extent I am. But my primary goal is to get them to think about course goals and study expectations in the course. They are--I have discovered--more likely to read my comments in the syllabus while filling out this questionnaire. When I have collected these questionnaires, I do not always return them to students and, in fact, have found them to be quite useful when students visit during office hours.

Syllabus and Day 1 Questionnaire

Name: _____

1. Please indicate your term standing, length of time at UP (and where you were before, if applicable).
2. How well-prepared do you think you are for this course, in terms of prerequisite course material? Have you already had courses that significantly duplicate the material of this course?
3. Which goals of this course are most relevant to your situation and plans?
4. How many hours outside of class do you anticipate spending on this course in an average week?
5. Do you tend to "surge study"? That is, do you go for several weeks with little or no out-of-class work followed by marathon sessions before exams? If so, what is your opinion as to the effectiveness of this for (1) getting a good grade and (2) learning the material in a way that allows you to retain it after the course is over?

Analysis of Performance on First Exam

The goal of this assessment activity is to make the students analyze what they did not do right and, in effect, take a pledge (to the instructor and to themselves) not to make that mistake again. It is common sense to make such analyses and vows, but we are all human, after all, and can use some coercion at times. If this works, the improved studying is greatly reinforced. If it fails, the shy student is perhaps more likely to visit the instructor. After students complete the first exam performance analyses, they give them to me along with their exams. I look at both and return the exams once again, but keep the critiques on file.

Analysis of Performance on First Exam

Name: _____

Section (1 or 2): _____ Grade on Exam 1: _____

1. Analyze what prevented you from achieving a higher score on this exam. Consider the following factors as well as any others appropriate to your case.
 - a. inadequate knowledge of background terms, quantities, definitions
 - b. inadequate understanding of relationships
 - c. misinterpretation of questions on examination
 - d. poor mental condition due to physical or emotional stress
2. Analyze your readiness for this exam. Consider
3. Did you spend adequate time on learning the material, and whether that time was spread out wisely? (Estimate time.)
4. Was your time effectively spent? Were you achieving understanding, or were you simply going through the mechanical motions of underlining text and solving problems without getting concepts into your mind?
5. Did you use office hours, tutorial services, and/other students for help?

6. Indicate what you plan to do differently in order to do better on the next exam.

Second Exam Follow-up

After the second exam, I get all of the same students to turn in another sheet that asks them to analyze the effectiveness of the first exam questionnaire with regards to their scores on the second exam.

Post-Mortem on Examination 2

Name: _____

Grade on Exam 1: _____ on Exam 2: _____

1. Please comment on your preparation for Exam 2 compared to Exam 1.
2. How do you think this has affected your performance on Exam 2? (If you are still not satisfied with your performance, you should see me in office hours if you have not already done so.)

Bringing a Daily Problem to the Lecture

This assessment tool is a problem assigned at each lecture to be turned in at the beginning of the next lecture. For my large classes, I have some TA assistance to grade daily problems (zero if missing, 1/2 if partly right, 1 if essentially right). The maximum value is 50 points out of 650 for the entire course, so it is a small enough portion that I can justify not worrying about collaboration (in fact, collaboration is perfectly fine), yet a large enough portion so that students can't bring themselves to blow it off. I try to make these "of the essence" problems--problems that are not very intricate, but which focus on very important points. I try to tune things so that near the beginning of each class, I can show the solution for the problem just turned in and reinforce an important point. They all pay close attention to this problem because of their "points." Of necessity, they also learn something.

Benefits of the daily problem include the following:

- Encourages attendance, even though someone else could drop off a student's problem.
- Discourages tardiness since I don't accept the problems after showing the solution.
- Permits emphasis of an earlier point or reading ahead of material relevant for the current lecture.
- Reveals common misconceptions at level of small-point problems rather than at more costly level of exams.

While this device is more labor intensive than the others, it is sufficiently effective to warrant the extra effort.

In-Class Problem

This is a device to get the class to recognize that I expect them to use information from earlier courses, that this is a course where concepts are more important than equations, and that working in groups is useful and OK with the instructor.

During the first week of class, I ask students to form informal groups of 3-4 among neighbors. Then I show them a problem on the overhead. Here is an example that I could use in a junior-level physical chemistry course:

On the world of Chyra, temperature is measured in degrees Grath ($^{\circ}\text{G}$) after the scientist Lyr Dahl Grath. Gases are found to double in volume, at constant pressure, when the temperature is raised from 0.0°G to 100.0°G . What is the value of absolute zero in $^{\circ}\text{G}$?

This is a problem that may or may not be shown with a set of multiple-choice answers. Students discuss this for a few moments and then report to the group as a whole. When the correct answer is revealed through discussion, I ask "What does this question tell you about this course?" Again, they discuss this for a moment in their groups and report to the whole class.

Here are the messages I am hoping they get:

- Group learning is OK.
- Some of my classmates are pretty smart.
- The professor expects me to remember stuff from earlier courses.
- I am expected to understand, not just memorize formulas.
- I cannot just plug into a formula. There is no particular formula to use for this problem.
- By understanding this question, I see clearly something that was not clear before.

This group work also helps to network the new graduate students and the CES transfer students who make up a significant portion of the physical chemistry course. It is also administratively easy--no papers are collected, nothing is graded.

The Lab Writeup

This is a scheme we are moving towards implementing in our freshman chemistry lab course, but it could apply to any course where a series of critiqued assignments are submitted. The lab instructor will grade the first lab report with extensive comments (as we already do), and the student will get back that report in time to read it over before starting the next laboratory exercise. The student then begins the next lab report by answering the question, "What weaknesses were found in your previous laboratory report, and how do you plan to overcome them in this report?" I anticipate the following benefits:

- The student is forced to look at and reflect on prior comments.
- The student pledges to do something about the criticisms.

A much more effective connection is thereby established between the student and the lab instructor on the topic of report writing. It should serve to motivate the instructor too, since he or she will observe that the comments they are making actually influence the student's subsequent performance.

Conclusion

These examples give you an idea of the range of possibilities when seeking modes of assessment that promote learning. Undoubtedly, many other teachers have tried tactics similar to these as well as others I haven't thought about. The common theme here is finding ways to make students explicitly aware of the broader learning goals of the course and require them to assess their performance and their learning practices.

Afterward

John Lowe's seminar has already resulted in the use of such assessment techniques in other classrooms. For example, Jonathan Goldstine (Computer Science) immediately used his notes from the seminar to redesign some of the questionnaires. We include them on the back page in order to show how these activities can be easily modified for use in your own classes.

Analysis of Performance on First Exam

Fill this form out and hand it in to the instructor this week. In return for your handing it in by the end of the week, your lowest quiz score will be discarded when your average is computed during the rest of the semester.

Name: _____

Section (1 or 2): _____

Study Habits: Estimate how many hours a week you spend studying for this course outside of class. (Include the time you spend doing homework.) Describe how you typically spend the time. What form of studying do you find helps you the most (for example, studying the text, working practice problems, talking to other students, etc.)? If your exam score was at least 70%, you can stop after you answer this question; otherwise, complete the rest of the form.

Performance on Exam: Analyze what prevented you from making a higher score on this exam. Consider the following possible factors as well as any others appropriate to your case: inadequate background knowledge, inadequate understanding of concepts, misinterpretation of questions on the exam, poor mental condition due to physical or emotional stress.

Preparation for This Exam: Analyze your readiness of this exam. Consider whether you spent adequate time learning the material and whether that time was spread out wisely. Consider

whether you were studying effectively, achieving understanding rather than just going through the motions. Consider whether you went to office hours or spoke to other students for help.

Preparation for Next Exam: Indicate what you plan to do differently in order to do better on the next exam.

Second Exam Follow-Up

I am handing out this second questionnaire because I would like to learn whether the questionnaire that you filled out after the first exam was helpful to you. If you turned in the first questionnaire earlier and you turn in this follow-up questionnaire by Wednesday, I will drop your **two** lowest quiz scores when computing your average.

Name: _____

Section (1 or 2): _____

Enter below your score on the first midterm, your score on the second midterm, and the differences (e.g., +10 if your second exam was 10 points higher, -15 if 15 points lower.)

1st Exam: _____ 2nd Exam: _____ Difference: _____

If your first score was at least 70: Analyze your performance on the second exam. (Was your score about what you expected? If your second score was appreciably higher or lower than your first score, what do you think caused the change?)

If your score rose from below 70 to above 70: Analyze why your score improved on the second exam. (Did you make the changes in the way you prepared for the second exam that you said you would on the first questionnaire?)

If not, why did you decide not to? If so, how much did the changes help you? Did you make any other changes?)

If both your scores were below 70: Analyze why your second exam score remained below 70. (Did you make the changes in the way you prepared for the second exam that you said you would on the first questionnaire? If not, why did you decide not to? If so, why do you think that the changes did not help you as much as you hoped? Did you make any other changes?)