

# The Final Exam

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“Hey Pops, you want to help me study for my Algebra final?” asked my son.

I replied, “Sure thing, we’ve been working together all semester, so why stop now? Did your teacher hand out a review sheet?”

“Yeah, take a look at this practice test we got today.”

“So what’s the first problem?” Graph the following equations. “Hey kiddo, do you remember how we graph absolute values?”

“Not a clue, we did that six units ago back in September!”

Flipping back 200+ pages in the text, I muttered under my breath something like, “That’s just great. You didn’t tell me we were taking a comprehensive final!”

Why do some instructors administer exams at the end of a course that cover an entire semester of content while others test only the last unit or two? Ask most students and they will tell you that some instructors are simply more mean-hearted than others. Certainly, there must be more behind a professor’s testing strategy than a personality disorder. As part of a campus-wide testing office for some 25 years, I have seen hundreds of exams and spoken with almost as many professors about their testing concerns. However, I had never specifically asked faculty about their strategies for giving final course assessments. How do faculty decide on the type of assessment to use at the end of a course? Do they follow any guidelines while making these decisions?

A quick skim of the best-selling measurement textbooks offers very little on the topic. There is a great amount of wisdom available on how to develop classroom exams in general, including some excellent previous offerings in this column (Perlman, McCann, and McFadden, 1999). Yet, there are few written words of advice for developing the course-ending assessment known simply as ‘The Final.’

To better understand how and why professors develop final exams I went to the streets, or in our case, the campus quad. With clipboard in hand I asked the passing faculty about their final exams. Their responses reflected a variety of assessment purposes and strategies as well as their thoughts about administering final exams. I offer the following listing and discussion of the considerations or questions professors seem to be addressing when developing a final exam.

## **What are some reasons for giving a comprehensive final?**

“I’m afraid students will forget the early material if I don’t include it again on the final.”

“I test the whole semester of work on the final to make sure the students have it!”

“A final exam should pull together a semester of content – connect the disconnected.”

It seems apparent that professors have two major reasons or purposes for administering a comprehensive final – they either want students to “show” what they know or to “use” what they have learned from the entire semester of work.

**“Show” Finals.** I categorize under the “Show” heading faculty who cover a semester of content through a compilation of objective items, often multiple-choice and short answer. “show” finals are intended to make students study and review all of a semester’s content in order to demonstrate student mastery of knowledge. Professors administering “show” finals often want to prepare students for the next course in a sequence. They believe (or hope) forcing study and review of an entire semester of content will enable students to “hit the ground running” in the early days of the next course in the sequence. Following this thought, the “show” final is as much a pre-measure for the next course as it is a post-measure of the current course. Some professors want students to use these post-measures as self-assessments of their ability to continue in the discipline. A poor final exam performance may encourage a student to get remedial help before continuing in the course sequence or major.

Another way of understanding “show” finals is to think of them as assessments at the initial levels of a learning hierarchy. Benjamin Bloom and a committee of colleagues developed one of the best-known learning hierarchies. The Taxonomy of Educational Objectives (Bloom, Engelhart, Furst, Hill, and Krathwohl, 1956) views the learning process as climbing a ladder of learning outcome rungs. A student can only get to the top level by successfully climbing the lower steps. Bloom’s taxonomy has six learning levels, starting with simple knowledge outcomes and proceeding through increasingly complex levels of comprehension, application, analysis, synthesis, and evaluation. The hierarchy is progressive in that achievement of comprehension objectives relies on the mastery of knowledge-level objectives, achievement at the application level requires successful completion of knowledge and comprehension objectives, and so on.

The majority of “show” finals I have seen through the years attempt to measure student attainment of knowledge, basic understanding of content, and possibly the ability to apply material. Successful performance on a “show” final demonstrates the foundation for moving up the ladder of learning. Necessary terms, elementary concepts, and core principles need to be mastered before students can perform higher levels of learning such as analysis and synthesis. For example, students should not be expected to critique the appropriateness of a given research design until they have learned of competing alternative designs and their respective strengths and weaknesses. “Show” finals are used by professors who are interested in providing a solid foundation of knowledge by encouraging students to study for a compilation of objective and short-answer exam items.

**“Use” Finals.** Professors administering “use” finals typically want students to demonstrate their ability to use a semester’s worth of accumulated knowledge by performing at higher levels of learning. There are at least two kinds of “use” finals: finals that require students to use their knowledge to produce or create an end-product, and finals that provide problems or tasks requiring the application of acquired information. An example of the first type would be an undergraduate senior seminar take-home final requiring students to develop their own theory of personality. Another example is requiring students in a

statistics course to collect journal articles wherein statistical procedures are used either properly or improperly, and then to provide reasons for their selections.

Examples of the second type of “use” final, which often involves problem solving or task completion, can be found in statistics courses where students are required to perform analyses on a given set of data. These professors are assuming one cannot conduct an ANOVA without knowledge of means and variances. Another example is a final that requires students to demonstrate their knowledge of JAVA programming by finding errors in a given program. For both examples, the student is not asked to show knowledge by creating an end-product such as a theory or critique, but instead is asked to apply what he or she has learned to complete a task or to solve a problem.

Using Bloom’s Taxonomy, it may be useful to think of “use” exams as assessing higher order learning than “show” exams. Critiquing a journal article or comparing two theories of color vision demonstrate learning at the analysis or evaluation levels of Bloom’s taxonomy. Both require an ability to break down material into constituent parts and to identify and evaluate the relationship of the parts. Furthermore, asking students to develop a theory of personality or to design an experiment challenges them to demonstrate an ability to put together elements and parts to form a whole (abilities at the synthesis level of Bloom’s taxonomy).

In sum, I have learned that professors using comprehensive exams do have a reason for doing so, reasons that are not at all related to a penchant for cruelty to students. The faculty want students to either show their accumulated knowledge by answering a collection of items or to use their expertise by creating some end-product or by completing a problem/task. Professors seem more inclined to administer “show” finals when teaching introductory material or the first course in a sequence, when they are most concerned about laying a foundation of knowledge. “Use” finals requiring evidence of higher order learning, such as analysis and synthesis, are most often given in courses taught at the end of a sequence, in capstone courses, or possibly at the conclusion of practicum or intern experiences.

**Non-Comprehensive Last Exam.** Of course some professors prefer not to give a comprehensive final of either type described. Typically, these professors structure their assessment program (including all exams, papers, and projects) to assess student learning sequentially and have no interest in back-tracking or retesting content through a comprehensive final. For most of these professors the final exam or paper is the last assessment of uncovered material, such as the fourth of four exams. This assessment strategy may be most appropriate for courses whose content stands alone (e.g., the course is not part of a series of courses) or when the course material is not cumulative in nature (e.g., a stand-alone course on laboratory measurement techniques where a different apparatus or tool is covered in each unit).

### **How is the type or format of the final exam selected?**

“I always give a multiple-choice final so I can get my grades turned in on time.”

“My final is an essay exam, just like the other three course exams.”

“The final exam is the only test I give in my senior courses.”

Even with the help of teaching assistants, professors teaching very large classes face a daunting, time-

consuming task of grading a large stack of essay finals. Consequently, logistical concerns such as end-of-semester grade submission deadlines as well as holiday travel arrangements may dictate testing format. While I don't mean to discount practical or logistical concerns, I would hope there are some pedagogical reasons behind our choice of testing formats.

**Select a final exam format that matches the level of learning taught at during the semester.** A common student complaint expressed on end-of-course student rating forms is this mismatch between teaching and testing. Students don't think it is fair for professors to ask a series of fact/text-based multiple-choice items at the end of a senior seminar course which has centered on discussion and debate of issues.

**Choose more than one testing format and complement other course assessments.** Just as today's experts (Gardner, 1993) remind us to attend to differences in our student's preferences for learning, we should also acknowledge student differences in their ability to take tests and to demonstrate learning. Ask a large group of students about their testing preferences and about as many students will prefer essay over multiple-choice as vice versa. For this reason I have always stressed at faculty workshops the use of more than one testing format in a course. The use of multiple formats may mean giving a mix of multiple-choice, essay, and take-home exams, or having multiple-choice and essay items included on the same exam. The final should be complementary to the other course assessments. In other words, if all hourly exams used both m-c and short answer items, so should the final exam; or if the hourly exams used m-c, short answer, or essay items, then the final shouldn't use an item type so different from these as to confuse the students.

**Use more than one graded assignment.** When planning the semester, a professor should be considering not only what type of assessments to require but how many. With the exception of courses requiring a major paper or class project, measurement experts suggest requiring more than one or two graded components. We all have a bad day! Students should not fear having their entire course grade rest on a single poor performance. I strongly believe the larger the number and variety of course assessments, the greater the likelihood a final course grade will represent an accurate (valid and reliable) measure of student learning. I felt compelled to include this last pedagogical concern for all of the professors I spoke with who think it is sufficient to give only a single assessment – the final exam.

**Is the final exam more difficult or weighted more heavily?**

“My exams are pretty easy until I get to the final exam.”

“I give a final covering the last four weeks of class but give it more weight than the other unit exams.”

**Exam Difficulty.** The answer to the question of “How difficult?” depends on one's interpretation of difficulty. If difficulty refers to testing achievement at higher rather than lower levels of learning, then I would say comprehensive “use” finals are and should be more difficult than other course assessments. However, if we define difficulty as the number of students answering items correctly, I would argue the difficulty level of “show” finals or non-comprehensive finals should not differ from the other course assessments. The fourth (or final) exam covering only the last three units of a course should have a similar score distribution as the other three exams. The difficulty indices (percentage of students answering an item correctly -Ory & Ryan, 1993) for items on a comprehensive “show” exam should be

similar to the difficulty indices for items previously administered on other exams. Just because it is the last exam is not reason for giving fewer high grades and more lower grades than on previous exams. I have yet to hear of any pedagogical defense for doing otherwise. Unfortunately, most attempts to make a final exam more difficult than the other semester exams often result in the professor using unfamiliar item types, tricky wording, or the testing of trivial information, all of which are obvious violations of sound test construction practice.

**Exam weight.** The amount of weight assigned to a final exam depends on the number and type of other assessments used in the course to calculate a course grade. There is no single formula to apply to all classes. Obviously, “use” finals requiring a major class project or term paper will need to place the lion’s share of weight on the final course grade, whereas a final exam covering the last three out of twelve units can be weighed equally with the other three or four exams. While I certainly see the value of large end-of-course projects and papers that account for a majority of the final grade, I recommend using more rather than fewer course assessments. As previously stated, by using 3-5 graded components we can be more confident in our final grade while not placing too great an influence on any one assessment.

**Exam score distribution.** Remember, unless you are using standard scores for each exam, desired weights and actual weights may differ depending on the standard deviation for each exam (e.g., an exam with a larger spread of scores will have greater weight when combining raw scores from different exams -Ory & Ryan, 1993).

### **Do you use final exams to motivate or reward students?**

“I let students know where they stand before the final and they can either take it or not depending on what grade they want.”

“I give students the option of taking a final exam or writing a paper.”

**Motivation.** I believe it is fair to say most professors motivate students to prepare for their final by simply assigning it the highest weight of the graded components. Heavily weighted finals encourage students to continue studying in order to either maintain a high grade or provide hope that a low grade can be raised by a strong performance on the final.

Some professors may also attempt to motivate student performance on the final by allowing students to choose from several assessment alternatives, such as taking an in-class exam, completing a take-home exam, or writing a paper. There are, however, some pedagogical concerns when using an alternative assessment strategy. It is difficult to determine the comparability of different assessments. Is performance on a take-home exam comparable to performance on an in-class exam? Is writing a paper comparable to taking a final exam? It is also difficult to assign grades to alternative assessments when there are uneven numbers of different assessments submitted. If only one paper is handed in, you better have a carefully crafted rubric for grading papers, because there are no other papers to use for comparison.

**Reward.** Some faculty seem to be more interested in using the final exam to reward rather than motivate students. These professors do not require a final exam but instead offer it as a way for students to reach

their desired course grade. If a student is content with their course grade they can skip the exam. I have two concerns with this strategy. The first concern is the previously discussed problem of possibly having an insufficient number of exams submitted for grading comparisons. The second concern only applies if the optional final is the only measure of the last few weeks of class material. If it is, I wonder why a professor would spend days preparing and teaching material that may never get tested. Is the material covered from the last hourly exam to the time of the final any less important? I realize not all students are motivated by grades alone, but I am concerned about the waning interest of our students if we fail to have an assessment of the last few weeks of the course.

### **Do you provide feedback to enhance student learning?**

“Students can pick up their final exam results in my office at the beginning of the next semester.”

“My students can see what they have learned through their final exam score.”

I have heard many professors express the importance of using tests to give feedback to students about what they have and have not learned. However, many of these same professors are unwilling to spend “valuable” class-time reviewing exam results. Instead, students are often told to use the professor’s office hours if they have a question about the exam. Failing to spend class-time discussing common errors and misunderstanding is missing an opportunity for further learning. Unfortunately, much of the same can be said of faculty who express interest in using finals to provide feedback (for further coursework or study in the discipline), but who make little effort to do so. Student feedback is more than knowing a score. But how can we provide useful feedback from a final exam that is given on the last day of class?

**Students must have a way to get their exams or papers back, either from the professor or the departmental office.** This sounds obvious, but how many professors do you know that merely post final exam scores on their door and don’t bother returning individual exams or papers? It is easy to ask students to provide a self-addressed stamped envelope so they can get their papers returned.

**Feedback on a paper or written project should be of sufficient detail to allow students to know what the grader did and did not see in the work.** A copy of an exam should be posted along with the answers on a locked bulletin board or web-site. Ideally, the correct answers could be presented along with a brief comment, text reference, or the most common mistake made on the problem. Our reluctance to publicly display our exams should be over-ruled by a greater interest in enhancing student learning. We shouldn’t use the same exam every year anyway, and besides, we can always use some of the items again in later years.

**Make yourself available for student questions and concerns.** After these conditions have been met, it is still important (and necessary) to make yourself available for further discussion. Tell your students to use e-mail or to stop by your office next semester if they have any questions. At this point you are probably remembering how few of your students have picked up their finals and thinking that receiving feedback is the responsibility of the professor and the student. I respond to your thoughts by asking how much of your students’ lack of interest or irresponsibility has been fostered by our collective failure to offer useful feedback in the past? Why should students bother to pick up their exams or papers if all they find written on the pages is a letter grade or numerical score at the top? Most likely all of us could do a

better job of providing useful feedback.

## **Conclusion**

My less-than-scientific survey of our faculty revealed that there are many hows and whys to using final exams. Some of the beliefs and practices described by the faculty follow sound pedagogy and learning theory, while others are less supported. Whatever their foundation, I would conclude that final exams should be not just reflections of the personality of their makers, but products created from thoughtful attention to several considerations. I have tried to identify some of these considerations within a discussion of pedagogy and accepted testing practice. I welcome your comments, observations, or disagreements (e-mail me at [ory@uiuc.edu](mailto:ory@uiuc.edu)).