

## Problem Sets & Exams Tip Sheet

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### I. Problem Sets

Problems are an excellent teaching device for quantitative courses. Frequently students who think they understand concepts discover in applying them to a problem that they actually have to dig a little deeper to fully grasp the concept. Moreover, students typically start out disliking the problem sets and end up demanding more practice problems when they discover it's the best way to learn the material. Several faculty have suggested the following tips regarding the use of problem sets.

#### **Problems as Teaching Devices**

Problems are most effective as teaching devices (as contrasted with testing devices) when they're sequential. The first 1-2 problems get the students started and should be within the capacity of most of the class so they don't get discouraged. Subsequent problems might be more challenging. If possible, the last part should challenge the strongest students. Ideally, the sequence of problems would lead students through the analytic process step-by-step.

#### **Using Names, Places, and Specific Goods and Services**

It is useful to have the problem cast as a real world issue rather than an abstraction. Wastes dumped in the Woonsocket River, MCAT scores in Massachusetts cities and towns, magazine subscriptions purchased by the Millville Public Library, discriminatory pricing by Getaway Airlines... all the concepts used in such problems are easier to think about in concrete terms. Choosing examples from current public policy issues that students care about increases student engagement, retention, and recall over time.

#### **Length and Frequency of Assignments**

Some HKS faculty believe that shorter and more frequent assignments help the students stay on top of the material, not a minor consideration in a course where each class builds on the previous one. The rationale: Students are likely to wait to tackle an assignment until the night before it's due and then find they can't finish it. Remedy: maximize the number of nights before by breaking the assignment into smaller pieces.

#### **Answer Sheets**

Good answer sheets are absolutely essential if you want the CAs to assist in checking the homework, and they are a great opportunity for further teaching. For example, a concept on which the problem set focuses may have an interesting wrinkle or piece of history that you don't have time to bring up in class, but you can provide a paragraph on it in the answer sheet.

#### **Study Groups**

Study groups are a good vehicle, if properly used, for working through problem sets. Students should be urged to tackle the problem set before meeting with the study group. When they meet, they hash it out and agree on the approach and the solution. Then, before handing it in, each should do it alone to ensure mastery.

### **Counting or Not Counting the Problem Sets toward the Course Grade**

Many instructors believe they must count homework performance in the final grade in order to make sure the students give careful attention to it. The downside to this approach is that the instructor then must create new problems (and new answer sheets) every year. Otherwise a few opportunistic souls will get their hands on last year's answer sheets and make good use of them, which is bad for their own learning and also for their more conscientious peers' sense of fair play.

There are a number of ways to handle this. Some instructors count only whether or not the homework problem sets have been turned in; students' grades are penalized if they do not submit some reasonable percentage of the problems. Other instructors do not count homework performance in the final grade unless the student is on the borderline of failing the course. These instructors report that this has not led to neglect of homework. What makes it work is the students' belief that they can't pass the exams if they don't really understand how to work the problems.

### **Questions for Practicing Explanations**

Consider creating short homework or even exam questions that ask students to explain a concept in a language appropriate to a policymaker who is intelligent but not well versed in statistics. E.g., "This policymaker has read that the income elasticity of demand for energy in a developing country may be quite different from that in an industrialized country. Explain (in one short paragraph) in terms that she will understand." Such questions are particularly relevant for the kinds of work that many of our students will eventually be doing.

## **II. Exams**

Examinations play a strong role in shaping what students focus on in a course. In *Our Underachieving Colleges*, Derek Bok notes that students "study with an eye toward the kinds of questions they expect to see on their exams; as a result, instructors need to reinforce the aims of their courses by taking care to construct exams that call for the very kinds of thinking that they most want to encourage" (pp. 120-21).

The alignment principle would suggest that whatever is on the test should faithfully reflect themes and materials frequently stressed during the semester. Examinations should never be an afterthought. Nor, if the course is repeated more than once, should they be simply carbon copies of those administered the year before. Ideally, examinations should allow the instructor to gauge student learning. This is one reason why take-home examinations and examination substitutes such as research papers have become more commonly used in recent years. At their worst, examinations simply test how adept students are at taking examinations, i.e., writing rapidly under time pressure. At their best, they help students process and review material that would otherwise remain unprocessed and unreviewed, and thus unlikely to wind up in students' long-term memory stores.