Logistics and Development

Constructing Effective Assignments, Problem Sets, and Exam Questions
Best Practices for Teaching and Learning

This session on the effective homework and exam questions will be divided into two parts. First, we will discuss the logistics of assessment methods. Then in the second part, we will discuss the development of these assessments. Let's talk about logistics first.

When thinking about assessments for your course, it is important to keep several logistics in mind. First, you need to determine the frequency of your assignments. At MIT, in science, technology, engineering, and math courses, having weekly or bi-weekly assignments is common. This frequency of assignments serves to provide your students with many opportunities for practice at retrieval, which we learned about in an earlier session. Remember, deliberate practice is required to reach a high or expert level of performance.

It is also important to remember that the practice opportunities must provide activities that motivate students to improve their performance. In addition, having frequent assignments provides you, the instructor, with opportunities to see how well your students are learning. By pacing assignments regularly throughout the course, students are more likely to exhibit regular study habits, and will have decreased tendencies to procrastinate.

It is important to keep in mind that assignments should coordinate with your lecture topics. Assignments should not require information, skills, or techniques that have not been covered in the course. If an assignment does diverge from the course material, it is important to explain the reasons for doing so.

There are two cases in which assignments may not align with the course material. The first case is having pre-class assignments that students complete prior to attending class. The purpose of pre-class assignments is for students to read or even watch a pre-recorded lecture prior to coming to class. The class period can then be devoted to problem solving sessions. This method, sometimes referred to as a flipped classroom, is used by Professor Eric Mazur at Harvard University.

The second case is having pre-tests. Pre-tests are used to gauge students' level of knowledge prior to the course or a section. Instructors can then adjust the material covered in class accordingly to align with the level of prior knowledge and students' misconceptions.

When planning the course's assessments, the instructor should specify the collaboration policy. For example, are students allowed to work together to solve the problems? Perhaps students can work together to identify a problem solving strategy, but each student is required to solve the problem individually. Whatever your collaboration strategy is, make sure to specify it on your course syllabus.

The instructor should provide students with tips on solving problems. Tips are especially important for students who may lack the necessary experience or strategies to solve problems effectively. There are several strategies that students can use when solving problems.

For example, one strategy is for a student to write out all of the information that is requested by the problem. The student can also write down all of the information that is provided in the problem. Some students may find it's useful to break the problem into small parts, and solve each of these smaller parts, possibly with the easiest steps first. By providing your novice students with problem solving strategies, you as the expert will help your students reach an expert level of thinking.

It is important to provide feedback on students' work in a timely fashion. When I refer to feedback, I am not just referring to a grade on the problem. Instead, I am referring to the process of identifying a student's mistakes, and providing individualized feedback on their problem solving strategy.

This type of individualized feedback will enable your students to learn from their mistakes and identify their misconceptions. As the instructor, you should not only provide solutions to all of your assignments. You should also provide individualized feedback. Don't worry though, you may be panicking, believing that this will be an incredibly difficult task to achieve given the constraints of your course.

It is important to note that you don't need to grade every question on every assignment. One strategy is to grade a few questions on each assignment, but don't tell your students in advance which questions will be graded. By not telling your students which questions will be graded, your students will provide a high level of effort on all questions.

Another strategy is to give your students ungraded assignments with solutions, and then administer graded quizzes to evaluate their understanding of the assignment material. Keep in mind, that while providing feedback is important, having students incorporate your feedback is an even more important learning process. If you are teaching a course with teaching assistants, they may need help in grading and providing the appropriate feedback. In these cases, providing well-written grading rubrics to your teaching assistants is an effective way to ensure that grading is consistent across all members of the teaching staff, and that the teaching assistants are well-versed in providing constructive feedback.

The last step is to check in with students to gauge how long the assignments are taking them to complete. By checking in with students to see how long the assignments are taking, you will be able to determine whether they are too easy or too challenging. This process is especially important, both at the beginning of a course and when you are teaching at a new institution with a new population of students. This will ensure that your assessments are of an appropriate level.

Now that we have talked about specifics regarding the logistics of assessments, let's talk about how we develop effective assignment and exam questions. When you are developing your assessments, consider making the first assignment a review or using a pre-test. This first assignment can serve as a means to provide yourself with information regarding the prior knowledge of your students. The first assignment can also serve as a pre-test. If you administer the same quiz at the end of the course, which is called a post-test, then you can assess the learning gains of your students.

When developing questions, vary the sources and types of materials that you use. Instead of using all textbook problems for your course, try to obtain questions from many different sources, such as other colleagues and different reference materials. Also, using real world examples to provide authentic assessment questions can motivate and engage your students in learning.

Another consideration is to develop questions that meet many different cognitive levels of Bloom's Taxonomy, and require different sets of knowledge to complete. It is important to not only align your questions with your learning objectives, but also to make sure that your assignment questions are consistent with your exam questions, and that they address a wide range of cognitive levels. Also, consider providing extra questions at the end of a problem set that are more challenging to encourage your students to move beyond the basic course content.

Identifying the method that students use to solve a problem will provide you with information regarding your students thought processes. Consider having students describe in words how they solved a problem. This process will provide you with insight regarding how students address your problems.

The last point to consider when developing questions is to make sure that you have validated your problems prior to assigning them to your students. Before assigning the problems to your students, review each problem for length, clarity, difficulty level, and errors. In addition, if you have recently completed the problem, then it will be easier for you to help students solve the problem, perhaps during your office hours. This review process is especially important when you are developing exam question.