

A Collection of Teaching Tips: Teaching through the Pandemic

Effective assessments in an asynchronous, online, large-enrollment chemistry course

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Assessments are vital for effective learning (Bransford, Brown and Cocking, 2001): they are opportunities for students to demonstrate their emerging abilities, as well as receive timely corrective support.

The challenges of designing and administering effective assessments are particularly pronounced in large-enrollment asynchronous online courses, where students are likely to struggle with discipline-specific content as well as with understanding and monitoring of their learning progress. Instructors of large courses have many concerns around efficient grading and feedback giving and effective management of academic disruptions.

This teaching brief describes three assessment strategies which I used to create room for learning from mistakes, provide scaffolded practice, boost self-monitoring and discourage academic cheating in my undergraduate asynchronous large enrollment (700+ students) online Chemistry course.

Teaching and learning context

CHEM 167 General Chemistry for Engineers is mandatory for many incoming engineering majors. At the onset of Covid-19, the course was piloted in an online format as an intensive 8-week asynchronous Summer 2020 offering. It was transitioned to the routine semester's timeline in Fall 2020. The enrollment in Summer 2020 was 17 students; in Fall 2020 it increased to 734 students. The insights I share in the brief come from the Fall 2020 course.

Applied teaching strategy #1: Post-reading quizzes

The course employed 38 low-stake quizzes based on the lecture and discipline-specific video materials. All post-reading quizzes were auto graded in Canvas, the institutional learning management system, and consisted of 3-8 questions each. Each question incorporated feedback for just-in-time student support. These quizzes were administered frequently throughout the course and counted 35% towards the final grade.

Connection to course-learning objectives

The central, overall outcome for a general chemistry course is for students to be able to interpret, explain, and evaluate phenomena, both qualitatively and quantitatively. Post-reading quizzes helped students in their first steps towards these goals by asking to retrieve new knowledge and answer simple questions covered in the readings, lectures and videos.

Students post-reading quiz submission rates remained steady throughout the semester averaging 96.6% per quiz.

Why this strategy worked

The intended instructional goal of post-reading quizzes was to assess understanding of new concepts as students progressed through each module. Students could view their feedback for their quiz responses immediately upon quiz submission. Automated feedback incorporated into each question explained common misconceptions and encouraged students to review related concepts. It also invited students to replicate problem-solving.

The post-reading quizzes, although low-stakes, were timed to encourage student practice of test-taking under time constraints. This frequent and low-stakes way to both assess and inform students of their progress so far helped to keep their focus laser-sharp on the questions and clarity of their answers, rather than on seeking for assistance from the Internet and other unauthorized sources. Furthermore, knowing that content of each post-reading quiz was derived from the instructional materials linked in the Canvas course, the students resisted the urge to procrastinate and chose to spend time on the quiz review. This strategy was helpful for preparing students for higher-stakes assessments.

Applied teaching strategy #2: Online homework

The course used online assignments provided by the book publisher. Each module in the Canvas course was linked to a set of publisher-created questions. Students had four attempts for each question and were able to view automated feedback upon completion. The scores were automatically synched with the Canvas gradebook and counted 25% towards the final grade.

Connection to course-learning objectives

Online homework sets allowed students to practice problems of higher complexity than the content the post-reading quizzes. Each online homework set probed into all topics from a given module, thus, the students were challenged to test their knowledge in a comprehensive manner, even as they were still mastering new material.

Submissions rates were steady throughout the semester, with an average of 95% per online homework set.

Why this strategy worked

Online homework was designed for students to test and demonstrate their knowledge of new topics in a timely manner (homework sets were assigned due dates), but under low pressure and stress by allowing unlimited time on task and several attempts.

Deliberate practice is key to the learning process; I drove this home for my students by providing guidance and carefully selecting problems for each module.

Applied teaching strategy #3: Exams

Exams were the most challenging component of this assessment set up. There were four exams, given to students after every three modules. Thus, the normally daunting final exam was split into smaller summative assessments.

Each exam was administered as an auto-graded, timed Canvas quiz containing 25 questions. The exam questions were randomized: over the course of several months, 25 question banks were generated for each exam; each bank contained several variations of the same question. Randomization was achieved either by creating unique questions or using Formula Questions in Canvas Quizzes via automatic randomization of the numerical values.

These summative exams were open-book and open-notes. The time given to complete the exam was reasonable to answer all the questions individually, but not generous enough to look for help on the Internet. The non-proctored nature of the exams made me reflect carefully on the weight of these assessments and their role in the final grade. Typically, in a face-to-face class, such exams were weighted heavily (more than 60% of the final grade's weight comes from such exams). In the online course, we decided that the combined post-reading quizzes and online homework were

going to weight on the final grade more than the exams (35%, 25%, and 40%, respectively). This was the correct decision to make: when compared with the average grades earned by students when completing similar exams in heavily proctored settings in the previous semesters, the average grades for these open-book, open-notes proctored exams were comparable.

Connection to course-learning objectives

The instructional goal for the exams was to assess the integration, retainment, and application of multiple concepts.

Why this strategy worked

The exam questions tested conceptual understanding as well as problem solving skills. When the exams were preceded by a well-planned learning sequence in which students engaged with the lecture notes and videos first, retrieved new knowledge via post-reading quizzes next and practiced problem-solving and application via online homework, the impact on student ability to demonstrate achievement within a relatively strict time constrain was evident via the exam results comparable to student performance in the previous course iterations.

Key takeaways

The main goal of the assessments in this course was to provide students with adequate opportunities to engage, practice, learn, and re-learn the materials. Ensuring just-in-time feedback and maintaining assessment integrity were the other two objectives. Both the high frequency low-stake assessments and the thoughtful course grading strategy helped to reassure students that their engagement, practice and academic honesty matter. The students in this course demonstrated solid learning as a result of effective course design and facilitation.

References

J. D. Bransford, A. L. Brown and R. R. Cocking, *How People Learn: Brain, Mind, Experience, and School*, Washington, DC: National Academy Press, 2001.