MANAGING MULTIPLE ASSESSMENT METHODS WITH 1000+ CHEMISTRY STUDENTS – Lawrie Gahan

University: University of Queensland
Faculty: Biological and Chemical sciences
Subject: Chemistry 1A (CHEM1012)
Coordinator: Lawrie Gahan (gahan@chemistry.uq.edu.au)
Size: 1100 students (approx. in Semester 1)
Year: 2001

The following case study is based on an interview with the course coordinator of CHEM1012, Associate Professor Lawrie Gahan, as well as information derived from course materials (such as the web-site, course outline, learning guide, etc).

This case study is most interesting for its variety of assessment given such large numbers of students. The assessment is spread over the semester and requires students to build on their practical and theoretical knowledge. It builds assessment into the teaching and learning process by allowing students to work collaboratively (on the Computer Managed Tests) and yet is efficient (80% of it is semi-automated) and objective.

A brief overview of the course’s organisation will be followed by a detailed description of the assessment schedule.

CHEM1012: Teaching modes and assessment

Lectures, laboratories and PASS (Peer Assisted Study Sessions) are used. Lectures are delivered in 3 streams. Each stream covers the same material but there may be different lecturers in the three streams. Each lecture stream contains approximately 350-400 students. Each student is required to attend 3 separate lectures per week. The lecturing staff teach blocks of lectures according to four separate modules (topics): 1) Atomic structure and bonding; 2) Organic chemistry; 3) Chemical equilibria and thermodynamics and 4) Equilibria in aqueous solution.

Students are provided with lab manuals containing answer sheets for each experiment they conduct. Lab demonstrators mark students’ individual answer sheets during class. Approximately 90 students attend each lab session. Material from lectures or laboratories that students do not completely understand can be discussed and clarified during PASS.

PASS

PASS is a non-compulsory study scheme offered once per week starting in Week 3. PASS offers the students an opportunity to interact with one another as well as the PASS leaders (2nd and 3rd year students who previously performed well in the subject). The sessions are informal cooperative learning groups based on lecture material content. Evidence from previous semesters has shown a direct correlation between regular PASS attendance and higher results. Around 60% of CHEM1012 students attend PASS.

Pracs

Students attend a 1-hour introductory prac (laboratory) at the start of semester and five 3-hour prac sessions after this (ie. approx. every second week). The five graded experiments are conducted during these times. A prac manual is provided free to all students containing notes and exercises which must be completed before and during each lab.
Other learning materials
In addition to the prac manual, students are provided with a full set of lecture notes and are encouraged to purchase the learning guide and 2 set texts. The textbooks are *Chemistry* (by Zumdahl) and *Organic Chemistry* (by Hart). The learning guide can be purchased for a nominal fee. Alternatively, students can down-load the learning guide workbook from the web-site. The web site also has copies of the lecture notes, answer sheets for the problem sheets handed out in lectures, course information, news items, the practice examination paper (and answers), information regarding the deadlines for the CMT tests and any other information deemed important. We do not use bulletin boards. We use an “in-house” bulk email facility to communicate with students either as a group, or individually.

The learning guide was devised in a collaborative effort from the teaching team with the assistance of an educational designer from TEDI. It contains learning tips, activities and test yourself (self-assessment) exercises, as well as suggestion for other available sources of information such as texts, useful websites and online labs. It has been designed to act as a personal tutor for students as well as being a major resource during Peer Assisted Study Sessions (discussed earlier). Based on student feedback the Learning Guides are to be modified to enhance their adoption as a student resource.

Assessment
The assessment schedule for CHEM1012 is as follows:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Format</th>
<th>Weight (%)</th>
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<tbody>
<tr>
<td>Online</td>
<td>Four CMTs are held throughout the semester. Students are given about 1 week to down-load, print and input their answers to the CMTs. Each CMT is worth 5%.</td>
<td>20</td>
</tr>
<tr>
<td>Practical Component</td>
<td>Practical classes are held during the teaching semester. Five of these involve conducting experiments, each worth 4%.</td>
<td>20</td>
</tr>
<tr>
<td>Exam (End of Semester)</td>
<td>Multiple choice questions</td>
<td>60</td>
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Students’ final grades are awarded on the basis of the total mark, but some minimum requirements must be met to obtain a grade of 3 or higher. These are:

- The Laboratory Component – students are required to attempt all 5 experiments, and must score a total of at least 10 marks (from a possible 20).
- The Computer Managed Testing (CMT) Component - students are required to attempt all four (4) CMTs.
- Students who do not meet these minimum requirements are given an incomplete (INC) grade and have the opportunity to complete the requirements.

More about CMTs
CMTs have proved an effective way to ensure that large numbers of students can regularly assess their understanding of particular topics. Students access the CMTs in computer labs using their usernames and passwords. The schedule of CMT tests is arranged prior to the commencement of semester and students are notified on the release and return dates for each test. Each student can print off his/her own set of 12 randomly allocated questions (from a question bank devised by lecturers), work on them with the help of peers and study materials for up to one week, then enter the answers via the computer to be
graded. In this way, students are informally engaging in peer-assessment and feedback and assessment becomes part of their learning process.

The marking of CMTs is automated and efficient. The CMT questions require either a multiple-choice response or a short numerical answer. The CMT test for each section is released usually in the last week of the lecture block concerned with that topic, with the return date usually a week or so after the completion of the lecture material being examined. A cut-off date is set for each quiz, after which time students’ answers are no longer marked by the computer. Students attending tutorials and following up with study should have little difficulty in attempting the questions and achieving good results.

According to feedback from teaching staff and students, the CMTs serve as useful learning tools, especially with large numbers of students. For teachers, their value lies not only in their efficiency but in their objectivity, leading to fewer student requests for re-marking. For students, CMTs allow identification of strengths and weaknesses, as well as the opportunity to work cooperatively and to learn from mistakes made.

The CMT system is managed by one member of the academic staff who oversees the system for all the first year subjects using the facility (CHEM1012, CHEM1013, ENGG1040).

**Conclusion**

CHEM1012 is a major first year subject required as a prerequisite in many programs in the biological and physical sciences. As such, the subject has to cater for students with very diverse backgrounds, interests and expectations. According to Lawrie:

The enabling sciences (Chemistry, Physics and Mathematics) are pyramidal in the manner in which students’ knowledge is built up. However they “suffer” from the requirement for basic knowledge upon which more advanced (and often more exciting) knowledge can then be built.

Indeed, many students see CHEM1012 as a difficult subject, content rich, with a heavy workload. The laboratory component is seen as enjoyable but often impersonal. As such, CHEM1012 is a very challenging course to teach well.

However, many techniques have been introduced to improve the quality of student learning in the course. The teaching team have attempted through the CMT and laboratory component to reduce the dependence on the final examination as the major assessment tool. Furthermore, the introduction of minimum requirements for CMT and laboratory participation has improved markedly student success in the subject. The introduction of PASS has added another more informal dimension to the manner in which the topics in CHEM1012 are viewed by students.