

Autograding Excel spreadsheets: An alternative method of assessment

Moira Sarsfield and Steve Cook

Department of Life Sciences, Faculty of Natural Sciences, Imperial College London.

ABSTRACT

In the first year of the biology degree stream at Imperial we now use three different forms of assessment for practical classes:

- online quizzes in Blackboard;
- autograding using Excel spreadsheets; and
- traditionally marked write-ups, usually prepared by the student in Word.

The drivers for the introduction of the new assessment methods were:

- to deal with increasing numbers – from 110 to 220 students per class – meaning many more papers to mark;
- to improve the quality of feedback, making it more extensive, more consistent and more quickly delivered.

This poster describes the autograding method which is particularly useful for assessing the ability of first year students to analyse and present data from practical classes.

The autograding process is described, and examples are presented to highlight educational and technical features. Extensions and alternative uses of autograding are discussed, and details are provided on the reactions of staff and students to this new assessment method.

THE AUTOGRADING PROCESS

The autograding process was developed by Dr Steve Cook, and it works as follows:

- Students download a spreadsheet template from Blackboard (A). The template can include calculations, graphs, MCQs, short answer questions, and more.
- They complete the spreadsheet, following the instructions given in the practical schedule (B) and on the spreadsheet itself and upload the completed version into the Blackboard assignment dropbox.
- The tutor constructs a model answer file (C), which includes information on the correct answers. These may be simple comparisons, Excel calculations based on data in the spreadsheet or regexes. General feedback and scores for correct answers are also included in this file.
- All of the completed spreadsheets are downloaded from Blackboard in ZIP format.
- A Perl script grades all the spreadsheets in the ZIP file by comparing the data with the model answer.
- Marks and feedback are inserted automatically into a copy of each student's spreadsheet (D), which is renamed with their username.
- A gradebook is prepared (E) showing overall results from all students.
- Results are returned via Blackboard: general feedback (F), individual grade and link to individual marked spreadsheet including feedback.

The spreadsheet is protected so that the students can only enter data into the appropriate cells.

Full instructions are provided and each spreadsheet is colour coded in the same way so that students become accustomed to the requirements.

Students must calculate their answers using Excel formulae, which is a very useful transferable skill.

Electronic assessment
Follow the instructions in the Excel spreadsheet. For Biuret and Bradford, use your data to perform linear regressions of BSA mass (x) vs. absorbance (y) and calculate the slope (m), y-intercept (c) and the correlation coefficient (r). Use these parameters to calculate the mass of ovalbumin in the assay tube, and from this, the ovalbumin concentration in the original UNKNOWN. The final result should be the protein concentration in the original UNKNOWN in mg mL⁻¹.

Marks and general feedback are automatically inserted onto a copy of the spreadsheet which is returned to the student and further feedback is provided for all students via the discussion forum.

The model answer checks the student's answer, using the student's own data.

Numerical comparisons, regexes and functions can be used within the model answer.

Boolean logic can be used in the model answer - e.g. AND (&&), OR (|).

The program can be run once without marking to ascertain class data for use within the model answer.

Statistics for each question are produced in the gradebook allowing a check to be made on the overall results. Common errors can also be noted and general feedback provided on these.

	V	W	X	Y	Z	BH
Test 10 (/1)	0	1	0	1	1	11C26
Test 11 (/1)	0	1	1	1	1	0.282
Test 12 (/1)	0	1	0	1	1	0.282
Test 13 (/1)	1	1	0	1	1	0.417
Test 14 (/1)	1	1	1	1	1	0.339
Mean	0.729281768	0.917127072	0.524861878	0.73480665	0.25966851	0.389414
Stdev	0.445563355	0.276454799	0.500766754	0.442660631	0.43966894	0.074708

The gradebook collates details of the marks and answers for each student.

EXTENSIONS AND ALTERNATIVE USES

Paragraph answers The autograding system can also be used to assess paragraph answers which are manually marked. In this case, the marker gives a mark and feedback for each paragraph answer within the gradebook and then this information is copied back into each student's spreadsheet. Markers comment that this improves the consistency of their marking, as they can cross-check marks, and that they can easily provide more extensive feedback for each student, as text fields are automatically completed within Excel.

Peer review Spreadsheets were used on the Biochemistry degree stream to gather peer review grades and comments on poster presentations. The data was then collated into a gradebook using the autograding program, and individual feedback was provided.

Collection of data with validation The autograding process was used to collect student choices for final year options on the Biomedical Science degree stream. The options available are very complex, and we wanted to ensure that students provided all required information and didn't select impossible combinations. This required data validation which was achieved within a data-collection spreadsheet. Choices were collated into a single spreadsheet using the autograding program. Familiarity with autograding makes these methods very easy for students to use.

REACTIONS OF STUDENTS

A survey of first year students showed that 90% preferred autograding spreadsheets to paper write-ups. The reasons given for this preference were:

- Lots of feedback – 60%
- Quick turnaround – 60%
- Transferable skills – 60%

The only negative comment made was of 'harshness' (20% of respondents).

REACTIONS OF STAFF

Staff appreciate that the autograding process makes marking quicker, simpler and more objective. Well-written general feedback usually covers most cases, and individual clarification can be provided where students have further questions.

The turnaround time can be rapid, which is useful when results of one practical feed into a subsequent practical.

It is important that this is not the only assessment method used. Writing up a traditional lab report is still a required skill which must be practised and assessed.