Generating Coursework Feedback for Large Groups of Students Using MS Excel and MS Word

Paper

Philip Denton

School of Pharmacy and Chemistry, Liverpool John Moores University, Liverpool, L3 3AF, UK.
E-mail: p.denton@livjm.ac.uk

A novel electronic procedure for generating and returning coursework feedback to students has been introduced by tutors at Liverpool John Moores University. The technique uses a combination of Microsoft Excel 97 and Microsoft Word 97 to generate personalised feedback sheets that can include the student's mark, position in the class, and a series of statements selected from a bank of comments, written by the tutor. Feedback sheets can be printed off and returned to students with their marked work, or distributed via e-mail. This procedure is particularly suited to classes undertaking the same coursework assignment, a common feature of undergraduate chemistry courses, and can make the assessment of work from large groups considerably less onerous. The operation of the software is described and the responses of staff and students to the procedure are reported.

Introduction

The importance of assessment in learning is well documented.[1, 2] It is generally accepted that if students are to gain the maximum educational benefit from a written coursework submission, their marked script should be returned with appropriate annotations. In particular, tutors should indicate to students where they have done well, where their misunderstandings are, and what follow-up work might be required.[3] Such written comments do more to motivate students than ticks or crosses alone. Indeed, Ramsden[4] suggests that "*…beneficial information about progress is valued even more by students than qualities such as clear explanations and the stimulation of interest.*" Accordingly, studies in this area indicate that an absence of feedback is an important contributory cause of student failure.[4]

Although educationally sound, the extensive annotation of students' work requires a considerable investment of time and effort by the assessor. It is understood, however, that marked work should be returned as quickly as possible if students are to pay attention to the marker's comments. Thus, Gibbs and Habeshaw state that a few weeks after a coursework submission, students have moved onto another topic and, "*have neither the time or the interest to take feedback to heart.*"[3] The introduction of electronic methods can decrease the time taken for feedback to be returned to students. For example, the use of multiple choice question sheets, where student responses are analysed by an optical mark reader, [5] enable work to be graded rapidly. Such approaches have been criticised, however, if they give the student no way of knowing why they got particular question incorrect.[6] Advanced software packages that require students to answer a series of questions may provide in-depth explanations of answers and direct the student to further reading.[7, 8] It is evident that computer assessments that provide immediate feedback can have a positive effect on student attainment.[9]

The Examine software developed at the University of Nottingham neatly illustrates a drawback of all the computer-assisted methods of assessment that are currently available.[10] Although this package will accept multiple-choice answers, numerical responses and written text passages up to 150 words in length, the latter cannot be marked by computer. This is a major limitation, given that a large part of student assessment in chemistry relies on the grading of written work, such as laboratory reports.

Electronic methods can be employed to generate written feedback to students on work that is assessed by tutors. It is suggested, for example, that a word processor is used to build up a bank of feedback comments, which can be copied and pasted into personalised feedback sheets along with general comments relating to the class performance.[11] Presumably, however, this would require the tutor to undertake a number of tedious cut and paste operations. Ideally one would want a system that could automatically generate large amounts of individualised feedback, after tutors had entered the minimum possible amount of information relating to the assessed exercise.

At present, there appears to be a dearth of commercially available software for generating written comments to university students on their assessed work. The development of *electronic feedback*, a software package based on MS Excel 97 and MS Word 97, is a response to this recognised need. The programme has an additional advantage in that it allows tutors to distribute feedback via e-mail. The purpose of this paper is to describe this method and to report on its effectiveness when marking chemistry coursework at Liverpool John Moores University (JMU). Given that Excel and Word are applications that have a wide user base and that most institutions have well developed e-mail networks, it is thought that this procedure will be readily transferable.

Method

The electronic feedback software consists of two programs: *Feebac5.xls*, an MS Excel 97 workbook, and *Fb.doc*, a MS Word 97 document. Together, these programmes can be used by tutors to generate individual word-processed feedback reports that can be printed and/or e-mailed to each member of the class. Each feedback sheet details the student's name and can include the percentage mark, class rank, a general comment, and a series of comments directed specifically at the student. To illustrate the operation of the software, a fictitious set of data has been created. This data set is smaller in size than one that might typically be considered, but is sufficient to convey the essential details of the procedure. An example feedback sheet that has been generated using this data set is shown in Figure 1.

Preparation

The Excel workbook *Feedbac.xls* is composed of a series of worksheets; *Configure*, *List*, *Header*, *Annos*, *Numbers* and *Report*, that contain a number of blank cells. The feedback sheets are created using data that is entered into these cells by the assessor. Tutors enter student names, e-mail addresses and registration numbers into the *List* worksheet, Figure 2. Typically, this information is readily transferred from institutional electronic information services. The class list shown in Figure 2 has the format preferred by JMU in which data appears in the order; e-mail address, forename, surname and registration number. Users can configure the software so that it will accept

FEEDBACK SHEET Created at 13:23 pm on 18/9/2000

Determination of a rate constant for the reaction of I^-(aq) and $S_2O_8^{2-}$(aq).

Assessed by Dr. Philip Denton

STUDENT: **CATHERINE BAKER**

MARK: **24 % (HIGHEST: 76 %, AVERAGE: 46 %, LOWEST: 24 %)**

RANK: **8th out of 8**

COMMENT: **Satisfactory work. This work was submitted late. A lateness penalty has been applied. The numbers on your work have the following meanings. Note that the % figures after each comment indicate the % of students who required that particular comment.**

3 Your axis is not numbered correctly. Always select chart type XY SCATTER when using MS Excel. (25%)

2 Lab. reports should have the following sub-headings and should be presented in the following order; introduction, method, results, conclusion. (88%)

5 Your graph should display the individual data points, in addition to a best-fit line. The data points should NOT be joined together by a "dot to dot" type line. (63%)

1 When comparing your result with value(s) from the literature, you should state the author, title, year, and publisher of any data sources you refer to. In this experiment $k_2 = 1.0 \times 10^{-2}$ mol^{-1} dm^3 s^{-1} (J. Chem. Ed. 1997, page 972). (75%)

4 Incorrect units/units not stated clearly. In this experiment, t in s, V in ml, k_1 in s^{-1}, k_2 in mol^{-1} dm^3 s^{-1}, ln (V_{inf} - V) is unitless. Correct units should be stated in all column headings and on graph axes. (38%)

6 A best-fit line (BFL) is required. In a plot of ln(V_{inf} - V) versus t, the BFL should be linear. In a plot of V versus t, the BFL should be curved and should pass through the values of V_{calc}. (50%)

7 Your graph title is unclear/incorrect or absent. As a minimum, it should state the quantities plotted on the Y and X axes. (38%)

8 There is insufficient discussion of experimental error in your work. The main errors in this practical result from the volatilisation of I_2 during heating and uncertainties in the end point due to incomplete decolourisation of the starch indicator. (50%)

Electronic Feedback 5. Licenced to Dr. Philip Denton until 01/07/2002.

Figure 1: Example feedback sheet produced using the electronic feedback procedure.

List

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
	e-mail		**Forename**	**Surname**	**Regno**	
1	PACCBAKE	MISS	CATHERINE	BAKER	66342	
2	PACJBALE	MISS	JOANNE MA	BALEED	206282	
3	PACABASS	MR	AHMED HAF	BASSI	46634	
4	PACRBERA	MISS	RAMANDEE	BERAHNEG	283599	
5	PACABULL	MR	AMIR	BULLOCK	125146	
6	PACJCAME	MISS	JULIE ELIZA	CAMERON	328365	
7	PACACAVE	MR	ALASTAIR J	CAVE	133879	
8	PACBCHAK	MR	BENJAMIN	CHAKRABO	134667	
9	PACPEVAN	MR	PARTHA PR	EVANS	628045	
10	PACHFAZL	MISS	HAYLEY	FAZLEE	234042	
11	PACMHARR	MR	MOHAMMA	HARRIS	265837	
12						

Figure 2: Example *List* sheet from the spreadsheet Feedbac.xls.

electronic details in the order favoured by their institution.

The marker enters specific details of the activity that is being assessed into the *Header* worksheet, including the title of the coursework and the maximum mark that can be awarded. The assessor can also put in statements that they wish to appear in the 'Comment' section of the feedback sheet, Figure 1. Some of these comments will only appear if the student's mark falls within certain boundaries. Thus, the example *Header* worksheet in Figure 3 has been completed so that any student awarded a mark of 60 % or above, but below 70 %,

Header

Enter filename	Uchemed
Title of Coursework	Determination of a rate constant for the reaction of I}-(aq) and S{2O{8}2}-(aq).

33 **Maximum Mark**

Maximum % Mark	Comment
70	Excellent work.
60	Very good work.
50	Good Work.
40	Satisfactory work.
30	Unsatisfactory work.
0	Poor work.

Other Comments

Top Mark	Top of the class, well done!
Late Work	This work was submitted late. A lateness penalty has been applied.
All Students	The numbers on your work have the following meanings. Note that the % figures after each comment indicate the % of students who required that particular comment.

Figure 3: Example *Header* sheet from the spreadsheet Feedbac.xls.

Annotations

Determination of a rate constant for the reaction of I}-(aq) and S{2O{8}2}-(aq).
Dr. Philip Denton

Number of scripts marked (to date)	8
Highest Mark (%)	76
Average Mark (%)	46
Lowest Mark (%)	24
Standard Deviation (%)	16

	Meaning of the annotations	**% of students with this annotation**
1	When comparing your result with value(s) from the literature, you should state the author, title, year, and publisher of any data sources you refer to. In this experiment k{2 = 1.0 x 10}-}2 mol}-}1 dm}3 s}-}1 (J. Chem. Ed. 1997, page 972).	75
2	Lab. reports should have the following sub-headings and should be presented in the following order; introduction, method, results, conclusion.	88
3	Your axis is not numbered correctly. Always select chart type XY SCATTER when using MS Excel.	25
4	Incorrect units/units not stated clearly. In this experiment, t in s, V in ml, k{1 in s}-}1, k{2 in mol}-}1 dm}3 s}-}1, ln (V{i{n{f - V) is unitless. Correct units should be stated in all column headings and on graph axes.	38
5	Your graph should display the individual data points, in addition to a best fit line. The data points should NOT be joined together by a "dot to dot" type line.	63
6	A best-fit line (BFL) is required. In a plot of ln(V{i{n{f - V) versus t, the BFL should be linear. In a plot of V versus t, the BFL should be curved and should pass through the values of V{c{a{l{c.	50
7	Your graph title is unclear/incorrect or absent. As a minimum, it should state the quantities plotted on the Y and X axes.	38
8	There is insufficient discussion of experimental error in your work. The main errors in this practical result from the volatilisation of I{2 during heating and uncertainties in the end point due to incomplete decolourisation of the starch indicator.	50

Figure 4: Example *Annos* sheet from the spreadsheet Feedbac.xls.

receives the comment, "*Very good work*." Additional comments can be directed to those students who are subsequently identified as having handed work in late, and to the student who secured the highest mark.

Tutors are required to enter a series of feedback statements into the *Annos* worksheet, Figure 4. The statistical information that appears on this sheet will be considered subsequently. Typically, the feedback comments are those which past experience shows are most likely to be needed during marking, e.g. "*You have failed to state the correct units*". Clearly, the number of written comments required will depend on the nature of the assessment activity. When a large group of students have submitted practical reports on a particular experiment, for example, the same errors and misunderstandings crop up time and time again, limiting the number of statements that is required. Since Excel does not have the facility readily to format text, comments that contain superscripts, subscripts, line breaks or tab spaces can be entered using a series of special characters. Thus, '{' = convert next character to a subscript, '}' = convert next character to a superscript, '^' = insert line break, '¬' = insert tab space. For example, the formula of the persulphate ion is 'S{2O{8}2}-' using this system.

Marking

The three worksheets described up to this point, *List*, *Header* and *Annos* can be completed before the students have submitted their work. During marking itself the students' scripts are annotated with digits where each number corresponds to one of the feedback comments on the *Annos* worksheet. In this way tutors can avoid having to write the

Number				Mark awarded to late work before the imposition of a lateness penalty.									
				/33	Final mark awarded or PMC. /33	Annotations (max. 25)							
Cohort	%												
1	24	CATHERINE BAKER	A	14	8	3	2	5	1	4	6	7	8
2	PMC	JOANNE BALEED	A		PMC								
3	52	AHMED BASSI	A		17	2	3	1	7				
4	48	RAMANDEEP BERAH	A		16	5	4	1	2				
5	39	AMIR BULLOCK	A	16	13	6	8	1					
6	45	JULIE CAMERON	A		15	1	2	5	6				
7	76	ALASTAIR CAVE	A		25	2	5	6					
8	52	BENJAMIN CHAKRAB	A		17	5	8	2					
9		PARTHA EVANS	A										
10	30	HAYLEY FAZLEE	A		10	4	7	2	1	8			
11		MOHAMMED HARRIS	A										

Figure 5: Example *Numbers* sheet from the spreadsheet Feedbac.xls

same comment repeatedly on students' work. Upon receipt of their marked work, students can appreciate the meaning of the numerical annotations on their work by referring to their feedback sheet.

Before any feedback sheets can be generated it is necessary to provide the *Feedbac.xls* workbook with details of which feedback comments were assigned to which students and also the marks that were awarded. Tutors can put this information into the *Numbers* worksheet, Figure 5, which is created automatically when a class list has been entered into the *List* worksheet. Adjacent to each name are 27 empty cells. The first cell is only filled in if a student handed their work in late. Tutors enter the mark awarded before the imposition of any lateness penalty. The feedback sheet for this student will then include the comment for late work that is specified on the *Header* worksheet. Into the second cell, tutors enter the final mark that has been awarded to the work. This score is automatically converted into a percentage by dividing it by the maximum mark that has been entered into the *Header* worksheet. Alternatively, tutors can enter 'PMC' into the second cell if it is known that the student is not going to submit any work because they have personal mitigating circumstances. The calculated % mark or 'PMC' is displayed on the *Numbers* worksheet in the second column. In the remaining 25 blank cells that are adjacent to each student's name, tutors put the numbers that correspond to the feedback statements that have been allocated to that class member on their marked script. Thus, the maximum number of comments that can be assigned to a particular student is 25.

Upon completion of the *Numbers* worksheet, the *Annos* worksheet displays statistical details relating to the activity, Figure 4. Thus the maximum, average and minimum percentage marks are reported and this information is reproduced on the feedback sheet, Figure 1. The *Annos* worksheet also computes the percentage of students who required a particular comment during marking, Figure 4. These values are reproduced on the feedback sheet as a percentage figure in brackets after each comment, Figure 1.

Generating and returning feedback to students

When a mark for a particular student is entered into the *Numbers* worksheet, the spreadsheet automatically generates the corresponding feedback sheet. Excel does not have the capability to produce large amounts of formatted text. Thus, before printing or e-mailing, the feedback sheets must be copied and pasted into the MS Word 97 document *Fb.doc*. Both *electronic feedback* programmes, *Feedbac.xls* and *Fb.doc*, incorporate a series of visual basic programmes that enable this copying, pasting and formatting procedure to be accomplished via a couple of mouse clicks.

Evaluation of electronic feedback

The educational benefits of electronic feedback were evaluated by studying the frequency with which feedback comments that relate to a particular error were used during marking. Clearly, one would hope that the frequency of use of such comments would gradually decrease over time as students reacted to their feedback and corrected their mistakes.

The attitudes of students to the electronic feedback strategy was ascertained by their responses to a structured questionnaire that was completed by 58 first year undergraduate students within the JMU

Meaning of the annotation (abridged)	% of students with this annotation (7/10/99)	% of students with this annotation (23/9/99)
Lab. reports should be presented in the following order; introduction, method, results, conclusion.	60	36
Your graph axis is not numbered correctly. Always select chart type XY SCATTER when using MS Excel.	36	2
Incorrect units/units not stated clearly.	98	74
Your graph should display the individual data points, in addition to a line.	34	2
Your best-fit line is incorrect and/or absent.	91	31
Your graph title is unclear/incorrect or absent.	57	7
Your graph axis is not labelled correctly or is not labelled at all.	21	0

Figure 6: Assessment profiles from two first year undergraduate chemistry practicals.

School of Pharmacy and Chemistry. This was in addition to three focus groups, each consisting of three students chosen at random. Members of staff were also requested to offer their views on the software after it was presented to them during a JMU training session.

Results

The *electronic feedback* method has been used to assess physical chemistry laboratory reports and worksheet assignments submitted by first and second year undergraduates at JMU. The procedure has been found to work well in practice. Ideally, the bank of feedback statements should be written before the assessor receives the students' work to enable the marking to be completed as quickly as possible. There is no reason, however, why it cannot be gradually built up during marking itself.

When marking laboratory reports, the same initial bank of general feedback comments can be used. These are then edited and augmented so that they are appropriate to each experiment. Typically, about 25 distinct comments are required. Many of the comments relate to core skills such as report writing and the graphical representation of experimental data. The frequency with which particular comments were used when marking two first year undergraduate physical chemistry experiments, conducted two weeks apart, is shown in Figure 6. By the time the students came to undertake the second practical they had already received e-mailed feedback on the first. As is evident, the ability of the students to present their work in an appropriate scientific manner had improved markedly over this period.

Annotating students' work with numbers in place of comments ensures that marking is relatively straightforward and rapid. Moreover, the *List* and *Header* worksheets of the *Feedbac.xls* file can be filled efficiently if electronic class list information is available. The time taken to complete the *Annos* worksheet will depend on the number and complexity of the feedback comments. As discussed above, however, if the assessed assignment is similar to one that has been set previously, tutors may find that it is possible to use an existing bank of feedback comments that has been appropriately modified. In this way, the time taken to enter the *Annos* worksheet can be considerably reduced. The *Numbers* worksheet can be completed quickly if marked scripts are first arranged in class list order, before the marks and the numerical annotations that appear on the work are entered.

Students reacted positively to the electronic feedback procedure when questioned in the focus groups and in responding to the questionnaire. All the interviewed students felt that the e-mailing of feedback was an efficient way to receive details of their performance in an assessment, as it removed the requirement for them to wait until the next time they met the lecturer. It was evident that students were comfortable with the principle of receiving feedback when they were at a computer

terminal on their own. The focus groups confirmed that they were more likely to pay attention to the electronic feedback that is returned quickly and felt that it was then acceptable to wait 2-3 weeks for marked coursework to be returned.

The questionnaire revealed that 88% of the undergraduates felt that it was useful to have written feedback e-mailed to them in advance of receiving their marked script. The vast majority stated that they appreciated knowing the maximum, average and minimum marks for the activity (91 %) as well as their position in the class (88 %). All questioned students found the comments on their feedback sheet useful and most of the class (81%) felt that they had received more written feedback than they normally obtained from tutors. It became clear that one of the particular advantages of the electronic feedback procedure is its ability to return lengthy, detailed comments on a particular aspect of the assessment. The responses of two students were typical, "*It is a helpful method of marking as it enables you to see how and why mistakes were made...*" and, "*It offers a more in-depth description of how you have gone wrong*." A number of students also commented that the printed feedback sheets overcame difficulties associated with the legibility of staff handwriting. In response to the question, "*should electronic feedback be used more regularly within the School*", 100% of respondents said, "*Yes*".

After the staff training session, 31 colleagues returned written sheets to provide feedback on the session. Those staff who have a familiarity with Excel reported minimal difficulties using the software. One member of staff commented, "*A fairly complex piece of software which I will feel more confident of using once I've tried it out using my own annotations. Educationally, a very sound method*." Other staff acknowledged that the procedure could become second nature with practice. 5 members of staff said they would definitely not use the software in future, either because they had an existing electronic system that they preferred, or because they had experienced difficulties using the software.

Discussion

Up to now, the electronic feedback technique has been used primarily in the grading of chemistry coursework. The procedure is quite general, however, and can be used for any assessment where it is expected that students will make the same errors repeatedly. It is clear that the electronic feedback approach can make the marking process considerably less onerous as it removes the requirement to annotate students' work with repeated hand-written comments. The package would be of particular interest to those tutors who find that, using conventional methods, they are unable to return as much feedback as they would wish to. Although this approach is perhaps less personal than traditional marking, there is no reason why tutors cannot supplement their printed feedback with hand-written comments to individual students.

The two files that comprise electronic feedback are password protected to prevent the accidental overwriting of essential subroutines. Thus, there are limited opportunities for customisation. Tutors can have some control over the final appearance of the feedback sheets, however, and may choose to omit details of the maximum, average and minimum marks as well as the student's position in the class. Tutors who prefer to allocate grades instead of marks can choose to hide the percentage marks that are normally displayed on the feedback sheets and can write feedback statements such as 'Grade B+'. Each statement can have a particular number associated with it and these can be allocated to students in the customary manner.

The software need not necessarily be used exclusively when marking assessments where the same errors crop up repeatedly. If they so wish, tutors can write a single, lengthy feedback comment for each student and use the software to generate the corresponding feedback sheets. In this way the software can be used to e-mail feedback to students on highly individual assessments such as project work. If this approach is adopted, the number that corresponds to the feedback comment, and the percentage of students requiring that statement, may be omitted from the feedback sheet.

Acknowledgement

This work was completed as part of the Postgraduate Certificate in Learning and Teaching in Higher Education 1999/2000. I wish to thank all the tutors associated with this course.

Supporting material

Copies of the requisite software and a user guide are available from the author. Interested persons should send a stamped addressed A4 envelope and a formatted 3½" disk. Please include your e-mail address so that you may be contacted subsequently for your opinions of the software. Respondents should indicate how they wish their title and name to appear on the feedback sheet, as this information cannot be changed subsequently. This is a security precaution that is included so as to prevent the unauthorised proliferation of the software.

References

1 G. Brown, J. Bull and M. Pendlebury, *Assessing Student Learning in Higher Education*, Routledge, London, 1997, p. 7.
2 G. Gibbs, *Improving the Quality of Student Learning*, Technical and Educational Services, Bristol, 1992, p. 17.
3 G. Gibbs and T. Habeshaw, *Preparing to Teach: An Introduction to Effective Teaching in Higher Education*, Technical and Educational Services, Bristol, 1993, p. 95.
4 P.Ramsden, *Learning to Teach in Higher Education*, Routledge, London, 1993.,
5 T. King, *Using an Optical Mark Reader for Continuous Student Assessment: a Case Study in Higher Education in Computer Assisted Assessment*., ed.-s, J. Darby and J. Martin, 1994, p. 23.
6 G. Gibbs, S. Habeshaw and T. Habeshaw, *53 Interesting Ways to Assess Your Students*, Technical and Educational Services, Bristol, 1986, p. 77.
7 B.S. Nicholls, *U. Chem. Ed.*, 1998, **2**, 10.
8 B.S. Nicholls, *U. Chem. Ed*., 1999. **3,** 22.
9 S.L. Helgeson and D.D. Kumar, *Journal of Computers in Mathematics and Science Assessment*, 1993, **12**, 227.
10 L. Barnett, D. Brunner, P. Maier and Warren, *A Technology in Teaching and Learning: A Guide for Academics*, Interactive Learning Centre, University of Southampton, 1996, p. 59.
11 S. Habeshaw, G. Gibbs and T. Habeshaw, *53 Problems with Large Classes: Making the Best of a Bad Job*, Technical and Educational Services, Bristol, 1992, p. 136.