given a mark out 100. Again this mark was multiplied by the number of students to give the total group marks. The students were asked to enter a mark out of 10 on their forms for each of their colleagues in the group. The forms were read by the machine and an average peer mark (out of 10) was calculated for each student. All the average marks for the whole group were added together to give a sum of peer marks for the whole group. This was then used to calculate the proportion of peer marks that each student had obtained. The final mark for each student was then calculated as this proportion of the total group marks. Although it is possible to get over 100% with this formula we will cap any one student's mark to this maximum. So far this situation has not arisen.

A major advantage of this scheme is that it takes into account whether the students are harsh or lenient markers.

Obviously the system will not work if students fail to return their forms. Consequently the students were told that they would get no marks for their project if they failed to hand the forms in — there was a very high return rate of forms.

The students were much happier with this scheme. The students appreciated being able to reward hard work and penalise freeloaders. There were favourable reports from both the end of module evaluation questionnaires and the staff-student committee meeting. Some of the students with low grades complained but because the group leaders had been instructed to keep attendance registers it was relatively easy to point out to them that they had contributed very little and they usually agreed without further complaint.

This second scheme solved the problems as far as the students were concerned, but there was still a major administrative problem for us relating to the reading of the forms. Although the ICR system was very efficient it relied on the students using legible script and filling all the boxes in correctly. In particular problems occurred when a student failed to give an absent student 0 rather than leave the form blank. Each time the forms were illegible or filled in wrongly, they had to be checked by the operator. With the large numbers of students involved this became very onerous.

YEAR 3 — MOVE THE ADMIN ONLINE

As a result of the problems we have changed the system again this year. This time the students are required to enter their marks for their colleagues using a web-based form. The web forms have built in validation so that they cannot be submitted with any blank fields. Each student is sent an email giving them a unique URL code which has been generated from their matriculation number and name. This URL gives them access to their own individual website which has a web form with a list of their other group members and spaces to enter their marks.

The system is currently working well. It is important to emphasise that we have only been able to cope with running a successful peer-assessment scheme for such a large class, because we have had the assistance of a dedicated IT specialist and suitable technology. The programming required for generating the web forms and using Excel to calculate the marks is not extremely advanced. It can be done in a number of ways, but does require someone with suitable experience.

FURTHER DEVELOPMENT

One factor that perhaps could be improved is what we tell the students about how their final grade is calculated. In their instructions for the Lifestyle Assignment they are told:

"You will be allocated a mark according to the overall group performance (i.e. a mark for the poster and the debate) *and* to how your own group has assessed your contribution to the group tasks".

This seems to be perfectly adequate but there are always a few students who like to know precisely how their mark is calculated. On reflection following writing up this case study, in future we will use the explanation given here as information on the students' Level 1 Biology website.

5

Peer-assessment of practical write-ups using an explicit marking schedule

IAN HUGHES

BACKGROUND AND RATIONALE

This method of peer-assessment was introduced into a first year pharmacology programme with 50–160 students per year and has also been used with 2nd year medical students (275). Many of the learning

objectives were particular to the content of each of the exercises to which peer-assessment was applied but, in addition, some generic problems and learning objectives were addressed by use of this method of peer-assessment:

- *Utilization of feedback.* There was little evidence that students took any notice of (or even read) the material laboriously written on each practical by members of staff. This method provides each student with a full explanation of what should have been done. Every students gets excellent and timely feedback to which, by the nature of the process, they must pay attention.

- *Development of critical evaluation skills.* Students have to make judgements about the quality of their work to achieve the standards to which they aspire and in order to time-manage their activities. This is not something which comes easy to all students and practice with critical evaluation in the early part of a course helps prepare students for what they will need to do later. The ability to be critical of your own work and that of others is a valuable transferable skill. Surveys show graduates in first employment have to assess the work of others surprisingly early in their jobs. Graduates are often not prepared for this.

- *Better understanding of the material.* Students, like everyone else, need a better understanding to assess something than to produce it. This is particularly true if dealing with somebody else's work where the words and their order are not those you yourself would have used.

- *Improved learning.* This method provides a second look at the material covered. Learning is improved and reinforced by the feedback resulting from participation in the assessment process.

- *Motivation.* This method enables students to see the standard others achieve and where their own work may be improved. This is more powerful than seeing a 'perfect answer' written by a member of academic staff ('of course they can produce a good answer or they wouldn't be on the academic staff!'). Seeing your peers are doing a much better job than you are even when subject to the same pressures is a powerful spur for improvement.

- *Developing independence.* Students confront the 'personal relationship' issue and learn to make assessments independent of any personal relationship. This requires a very different attitude to that which many students have on leaving school ("always look after your mates").

- *Significant reduction in marking time.* The time involved in marking practical write-ups each week was becoming unsustainable as student numbers increased. Using peer-assessment 250 or more practical write-ups can be marked in one hour.

'HOW TO DO IT'

The task for the students was to provide a write-up, following a set of instructions, of a scheduled laboratory practical or computer simulated experiment. This practical schedule usually included some questions to test the students' understanding of the material. Written answers to these questions were required as part of the practical write-up.

The write-ups are handed in by a published deadline and there are penalties for being late. Work presented by the deadline is stamped as being received (this stops students slipping late write-ups into the marking session). Split groups may have different deadlines providing they are not too far apart. Time is set aside in the timetable (1 hour) for a marking session and it is made clear that attendance is compulsory, any student missing (without good reason) the marking session looses half the marks they are assigned. It is important to be firm about this as if 200 students do the work and only 120 turn up to the marking session *you* have to mark the other 80 write-ups! At the marking session, having previously explained the advantages of peer-marking, I distribute the write-ups and a record sheet on which the marker fills in their name, the name of the student being marked, the final mark awarded and signs to accept responsibility. An explicit marking schedule is distributed. I emphasise the need for silence during marking and enforce it. I then go through the marking schedule step by step explaining, with pre-prepared slides or acetates, how things should be done, what graphs should look like etc.

Students annotate the write-up they are marking as appropriate and decide what proportion of the marks allocated for each point should be awarded for the material presented. Students asking if a certain wording is worth x or y marks are told they must make the decision from the information they have. Students total the marks awarded, fill in and sign the record sheet. The write-ups, marking schedule

and record sheet are collected so marks can be recorded and then the write-up and marking schedule are made available for collection by the owner. Students are told that a portion of the write-ups will be check marked by staff and that any student who feels they had been marked unfairly could have their write-up re-marked by a member of academic staff (less than 2% do so).

💡 ADVICE ON USING THIS APPROACH

Generally, for students, the process of self-assessment is easier to perform than peer-assessment. I often make the first exposure one of self-assessment and then progress to peer-assessment. It is easier to find key words and phrases in work you have done yourself since you know where everything is. This makes the assessment process easier. However, there is a tendency to assess what you meant to write rather than what is actually there. In addition there is a greater potential for cheating as it has been known for students to fill in or change material in their own submitted work while assessing it. However, self-marking does provide an easy introduction to peer-marking and this can be useful.

Not all practical work is easily amenable to this method as it really hinges on the task set. Work resulting from following a practical schedule is readily peer-assessed. The same measurements have been made with similar data obtained and processed the same way. The write-up needs to follow a specified format that controls the order in which material is presented and the type of data presentation (e.g. present the data in a table, draw a graph etc.). This enables an explicit marking schedule to be provided with the material broken down into small pieces, each of which is associated with specific criteria or requirements for marks to be awarded. Thus, work in year 1/2 is more likely to fulfil these requirements.

Work resulting from a task like 'Describe an ideal vehicle' is not easily peer-assessed except at the very broadest level, since 'vehicle' may have been taken to mean different things (storage vehicle, transport vehicle, communication vehicle or vehicle in which to dissolve something) and 'ideal' will depend on where the writer is coming from. The marking schedule to meet all possibilities is either so general as to ignore specific content or so extensive that it takes too long to write and is very difficult for students to follow. Final year level work, where several completely different but valid approaches to the task could have been taken, is therefore difficult to peer-assess using the simple methods described here. Likewise, "Is the work well presented?" is not a reasonable question as there are no specific criteria associated with it. Each student may make a judgement based on different criteria and considerable personal preference may come into the assessment.

The practical work needs to be done by the student body over a short period of time so the assessment session can follow in a timely manner. If six weeks elapse between the first student doing the work and the assessment process the students will have forgotten what it was all about. Work done as part of a 'circussed' set of exercises is therefore not suitable as the first group cannot be assessed as soon as they have completed the task (or they will pass the answers on to others) and it may be several weeks before all students have done all the tasks, without getting any feedback on their performance.

The task set needs to change from year to year. If an identical task is set each year the marking schedules will get passed on and while student performance might improve year on year this is only because they are copying out last year's marking schedule. I currently have a set of three versions of each exercise which I rotate each year and have not yet any evidence that the material gets passed on. I have had instances where students handed in a write-up based on *last* year's exercise data and then complained that I had not warned them that the exercise was different year on year!

👤 TROUBLESHOOTING

Don't think your students are going to enjoy peer-assessment! Many believe assessment is the job of the teacher ("don't you get paid for this?"), many complain that peer-assessment is hard work ("you have to think and make judgements"), and that it's tiring ("I'm really bushed at the end of a marking session"). Some find it difficult to concentrate for a whole hour. Some believe student markers are unfair or inaccurate. The reasons for introducing peer- or self-marking need to be explained to students if it is to be introduced without resentment. See Figure 1 for documentation that has been used effectively in preparing students.

Silence in class during the marking process is imperative. Otherwise students will miss your explanations, ask for repetitions or misunderstand what was required and the marking session will take forever. In an ideal world, it might be possible to allow or encourage students to discuss and compare what is written in the material they are marking; but when I have tried this, the time taken was greatly prolonged and while some students were bored, others demanded more time. Not a good idea in practice; unless there is only a small amount of material to mark and no absolute deadline to complete the process by.

Figure 1. Part of a document used in preparing students for peer-marking, explaining the benefits to them

Student Guide to Peer-Assessment of Practicals

Why are we doing this?

You should get several things out of this method of assessment which may be new to you:

1. It is an open marking system; therefore you can see what was required and how to improve your work.

2. You see mistakes others make and therefore can avoid them; you also see the standard achieved by others and can set your own work in the spectrum of marks.

3. You get a full explanation of the practical and how you should have processed the data and done the discussion. Therefore your information and understanding is improved.

4. You get practise in assessing others and their work. You will need this skill quite early in a career and you will need to come to terms with the problem of bias; someone who is a good friend may have done poor work; it can be disturbing to have to give them a poor mark.

5. In assessing others you should acquire the ability to stand back from your own work and assess that as well. This is an essential ability in a scientist; an unbiased and objective assessment of the standards you have achieved in your own work. Once you are away from the teacher/pupil relationship (i.e. leave university) you will be the person who decides if a piece of work is good enough to be considered as finished and passed to your boss.

The method of marking adopted in this module is designed with the above factors in mind.

? DOES IT WORK?

The published evidence (Hughes, 1995 and 2001) indicates the students on average produced better write-ups when using peer-assessment than they did when staff marking was used. The data demonstrate that this is not due to students being easier markers.

Peer-assessment saves an enormous amount of staff time, provides excellent feedback and achieves many of the points bulleted above. Marking accuracy is often queried but students can always check their mark against their copy of the marking schedule and appeal to the tutor if they are dissatisfied. To test reproducibility of marking three copies of the same practical were peer-marked independently by students as part of the normal marking session. The marks awarded differed by only 3% demonstrating the consistency of the marking process. In addition, I have, using the same marking schedule, personally marked several samples of peer-marked work. In every case the discrepancy was less than 5%. Confidence can be placed in peer-generated marks which can therefore be used as part of the marks which contribute to final module grades. External examiners have not objected to the use of peer-assessed marks in this way.

Several colleagues have started to utilize this method and no new problems or difficulties have been encountered.

⊕ ACCOMPANYING MATERIAL

The accompanying website to this guide (http://www.heabioscience.academy.ac.uk/TeachingGuides/) contains an extended version of this case study and the following additional material:

- an explicit peer-marking schedule;

- peer-assessment of oral presentations.