

Formative peer and self feedback as a catalyst for change within science teaching

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Abstract: Feedback to students is vital for effective learning; however, it is a relatively under-researched area in the UK. This study sought to use new and more effective methods of formative feedback to students within the context of Chemistry teaching in order to facilitate student learning. Emphasis was placed on the use of Student Directed Assessment, and in particular, the use of Student Self and Peer-Assessment. During semester 2 of the 2005-06 academic year, a cohort of some 100 Chemistry students and 33 Natural Sciences students attended a series of problem-based workshops designed to test Self and Peer Assessment methods. Results show that both Peer and Self Assessment were preferred over Tutor Assessment. Whilst Peer Assessment was viewed as helping to learn more on specific topics, Self Assessment was perceived as having a didactic value as they learned from their own mistakes. [*Chem. Educ. Res. Pract.*, 2007, **8** (1), 80-92]

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Introduction

The number of students in Higher Education in the UK has greatly increased over the last decade. The present government has set a target to continue this growth, requiring a further 17,000 lecturers to be employed by the year 2010 to teach the extra students (Ratchford, 2006). In the current academic context, it is widely accepted that feedback is an essential component in the process of learning and in a student's development (Weaver, 2006), although it has not always been seen this way (Fritz, 2000). Unfortunately, despite the best efforts to retain a level of consistency in the quality and amount of feedback given to students, recent surveys carried out on students have highlighted their dissatisfaction with the feedback they receive.

The National Student Survey in 2005 provided a snapshot of one year within the Higher Education sector. The Survey showed that whilst most students were overwhelmingly satisfied with the quality of courses, there was a general dissatisfaction in many Higher Education institutions with the provision of assessment and feedback. Responses to the 'Assessment and Feedback' section of the survey gave 86 out of 128 (67%) participating institutions their lowest score.

At the University of Bath, dissatisfaction with feedback amongst students was highlighted by the Student Satisfaction Survey in 2003. A suggested cause of the problem was the increasing student-staff ratio, which has resulted in the decline of feedback to students (Macaskill, 2006). It is claimed that both teachers and students consider feedback to students an important process in aiding the learning and development of students' skills. When Business, and Art and Design students were asked if they thought "that feedback is helpful to

explain gaps in knowledge and understanding” and “*constructive criticism is needed to know how to improve*” (Weaver, 2006), there was an overwhelming majority in strong agreement.

The Quality Assurance Agency for Higher Education stipulates the provision of effective and appropriate feedback within Higher Education. Craft (2001) and others identified feedback as one of the four key conditions for creative learning. Therefore, where there is a lack of effective feedback, the students’ learning could be hindered. In response to this, the Higher Education Academy has produced a briefing paper within a project for ‘Student Enhanced Learning through Effective Feedback’ (Nicol, 2005). The aim of the project is to help practitioners who wish to improve feedback or be inspired with new ideas. They identified seven features of good feedback practice:

1. Facilitates the development of self-assessment (reflection) in learning.
2. Encourages teacher and peer dialogue around learning.
3. Helps clarify what good performance is (goals, criteria, standards expected).
4. Provides opportunities to close the gap between current and desired performance.
5. Delivers high quality information to students about their learning.
6. Encourages positive motivational beliefs and self-esteem
7. Provides information to teachers that can be used to shape the teaching.

These are all good ideals for feedback given to students. However, in practical terms, and with time pressures on staff, they can be merely ideals that direct the provision of feedback to a more effective path. This is recognised within this paper, and specific strategies are described that seek to improve current feedback mechanisms which are, for example, those that involve written or verbal communication between tutor and student, such as tutorials and essay transcripts. These methods of feedback are time-consuming, especially in institutions where the academic year is based on a modular system with multiple assessments per semester. There is a need to adapt current procedures, or experiment with new methods to provide for the increasing number of students who are ever more diverse. This should be done in a way that requires little extra time and commitment from the tutor, but also in a way that meets the needs of the students.

Research Methods

There are many methods of feedback, including ‘group needs’ led feedback, statement banks (Rust, 2001) and those implemented via computer software (Tasker, 2006) and the e-learning technologies (Price, 2006). Currently, within this Department, some of the methods for giving formative feedback to students are: tutorials (made up of ~ 6 students), problem workshops (comprising ~30 students), coursework response, and laboratory work response. Even with a wide variety of feedback opportunities, the aforementioned surveys show that students are dissatisfied with the feedback that they receive in the Department of Chemistry. This prompted the investigation into enhancing feedback processes and an exploration of mechanisms that could provide better feedback to students without placing further burdens onto academic staff. In our context, it was decided that student formative assessments in semester 2 should be explored as a possible solution to the feedback problem. One potential approach is the use of Student Directed Assessment, in particular via Peer and Self Assessment.

Peer Assessment

A University Engineering Department used the scheme of Peer Assessment within a compulsory second year module (Gibbs, 1999). Its aim was to counter the growing workload for the tutors due to larger numbers of students and to improve the feedback to students as a way to enhance their learning. The result of the new scheme was that the average marks of the

students increased from 45% to 75%! The Peer Assessment workshops not only had a large impact on the average marks of the students, but were also found to teach students other key skills through marking others' work. The process allowed them to note errors of their own, and guided them to other ways in solving problems. This encouraged 'active student learning' and an element of Self Assessment. This method of Peer Assessment also provided prompt feedback to the students, which was received positively by the students.

In a similar way, research by Jordan (1999) noted that Student-Student Assessment and Feedback also promoted team effort, which encouraged even the more 'reticent' students to take part in the group work.

Self Assessment

Boud (1991) defined Self-Assessment as: "*The involvement of students in identifying standards and/or criteria to apply to their work and making judgements about the extent to which they have met these criteria and standards.*" This method of assessment encourages students to identify their own strengths and/or weaknesses, as well as to request the kinds of feedback they would like to receive on their work before handing it in. They can also mark and evaluate their own work, making judgements directed by a clear mark/assessment scheme.

When a Self Assessment scheme was used (alongside peer assessment) in the English Department at St Andrews University (Mallett, 1995) the benefits were perceived as follows:

- The students learnt more about their own working style.
- The students became more self aware, and were encouraged to think more carefully about the criteria, aims and objectives of a module.
- The staff were able to give more directed feedback.
- The tutor learnt from the comments made by students how to tone comments made on future assignments.

Mallett (1995) stated in this case study that it would have been feasible to contribute the marks awarded from the results from the self assessed essays to the summative mark for the course. However, colleagues in the department did not share his view. Nevertheless, these benefits are notable and suggest that it would be useful to investigate the use of Self-Assessment further.

Zoller and co-workers have studied student self-assessment and self-grading of Higher-Order Cognitive Skills (HOCS) type chemistry examinations (Zoller et al., 1997, 1999). The authors concluded that potential exists for adequate student self-assessment, but reported a gap between the students' self-assessment (overestimation) and their teachers' assessment, which was attributed to the prevailing Lower-Order-Cognitive-Skills (LOCS) orientation in the practice of science/chemistry teaching.

All these studies demonstrate that the student is at the heart of Peer and Self-Assessment. Since these processes are relatively under-researched in Higher Education, we carried out this small scale investigation aiming to shed more light on the use of Peer and Self-Assessment in a Higher Education context, and particularly in science. Additional reasons for selecting Peer and Self Assessment for study are as follows:

- Supporting literature has shown that in other institutions Peer and Self-Assessment has been successful in providing an alternative method for feedback to students where there is pressure on staff time.
- Methods of Peer and Self-Assessment can be implemented and investigated in the time that is available for the project.
- Peer and Self-Assessment is likely to increase students' confidence. This is especially important, as the aim of the workshops is to increase the confidence of the students in using skills that they have learnt.

The Higher Education Academy (HEA) gives several suggestions on how to prepare Self and Peer-assessment activities (Orsmond, 2004). Some of these are:

- Give clear instructions to the students relating to all of the stages of the assessment process, e.g. mechanisms for disagreement and the extent the marks count. (Instructions should be given in writing and verbally).
- Give the students structured written schedules, so that the marking criteria are clear.
- Make modifications where necessary.
- Repeat exercises with the same student cohort.
- Ensure that students have a clear understanding of the feedback that they can expect to receive.

Method

The student cohort involved in the investigation of Peer and Self-Assessment, some 140 in total, were those taking first year Organic Chemistry modules in the academic year 2005-06. They were chosen for the following reasons:

- As new to university study, they came with no preconceived ideas on assessment and feedback at this level.
- The foundation level of this subject topic permeates many different programmes of study.
- As first years, they also offer the potential for a longitudinal study in years 2 and 3.

The students were divided into four independent teaching groups for their workshops, which were timetabled across consecutive weeks; this allowed for consistency in the investigation. These timetabled workshops placed emphasis on improving skills in drawing reaction mechanisms, rather than the frequent format of using knowledge from lectures to answer problems. This in turn made the workshops ideal to investigate both the students' reactions to different methods of feedback, and particularly those points of the 'Good Feedback practice' mentioned earlier.

Taking the above suggestions from the HEA into consideration, two problem papers were designed. The questions on the first paper sought to guide the students through practice in drawing reaction mechanisms with the aim to help them to practise these important skills. It was also essential to allow enough time during the workshop for assessment and feedback to the students and also feedback to be received *from* the students about the process undertaken.

Four groups of students containing roughly equal numbers (~35) took part in the investigation (three groups of Chemistry students and one group of Natural Sciences students); they each had a different form of assessment method as follows.

Group 1 – Peer assessment workshop

Group 2 – Control workshop

Group 3 – Tutor assessed workshop

Group 4 – (Natural Sciences students) – Self assessed workshop

The control workshop was included for comparison. This was run as a 'normal' workshop in that, as in general departmental workshops, it did not involve any aspect of feedback other than a tutor being available to answer questions, and to go over general group problems on the board.

The Tutor-assessed workshop was given so that comparisons could be made between the groups of the level of satisfaction with the feedback they received. The students received feedback on their answer sheets from the tutor, which they received a week later. They also had the opportunity to look over the mark scheme at this point. This allowed us to investigate how much the students valued a fast feedback response, as received by groups 1 and 4.

Groups 1 and 4 received Peer and Self Assessment feedback

The marking criteria given to students were within the answer sheets with the comprehensive answers to the questions in the workshop. The sheets also had clear directions as to how the worksheets should be marked, particularly in week 1, as this was the first week of the new feedback methods. Groups 1 and 4 received these sheets within the workshop to mark either each other's work, or their own (depending on the group). Group 2 received the answer sheet at the end of the workshop and Group 3 received the answer sheet at the beginning of the following session, accompanied by their annotated workshop sheet. At all stages, verbal instructions were given to the students on how to complete their task.

A fast and efficient way of receiving feedback from the students was required because of the limited time at the end of the workshop, and the need to obtain feedback from all of the students present. From past experience, questionnaires were not considered to be the best option, as the return rate is rarely above 50%, therefore it was decided that students would be asked to raise their hands if they agreed with statements that were shown on the Overhead projector. An assistant in the workshop recorded the number in agreement.

The workshops

There were eight 50 minute workshops given in total, two each to groups 1, 2, 3 and 4. The general structure of the workshops in week 1 was as follows:

- Introduction of those taking the workshop.
- Initial warm-up activity using the overhead projector (10 minutes) with a view to encourage the students to settle into the workshop, and to give them confidence in their chemistry knowledge before being given the workshop sheet. Answers to these activities were drawn on the blackboard by students in the group, and corrections were explained to the group as a whole by the tutor.
- Workshop sheets were handed out to the students and tutors were available to assist with any questions. (~25 minutes)
- Additional problems were given to students on the blackboard for those who had finished early.
- For the relevant workshops, answer sheets were given to the students 15 minutes before the end of the workshop.
- In the last 5 minutes of the relevant workshops, feedback was collected from the students.

The structure of the week 2 workshops was very similar, apart from the absence of introductions of the tutors (on the basis that by then the students knew who we were) and the activities given to the students to complete during the workshop were different.

The workshop sheets varied in character from week 1 to week 2. The workshop in week 1 was skills-based, involving practice in drawing reaction mechanisms. The workshop in week 2 was more content driven, which meant that in order to succeed the students had to have attended the lectures. The initial activity for week 2 provided the students with a helpful starting point for the first questions on the worksheet, and was designed so students would have a deeper understanding of why reactions occur as they do.

Results

Peer assessment workshops

In view of the fact that little peer assessment is carried out in the Chemistry Department, it was pleasing to see from the responses that students liked the Peer Assessment workshop method. This can be seen from 68% of students being happy for the process to continue in future workshops, and no student thought that the method should never be used again. All the students agreed that they liked the fast feedback response of peer marking. The number of

those who found the peer marking method helpful to their own learning increased markedly from week 1 to week 2 by 30% and can be explained by the increased confidence or growing familiarity with the procedure (Raaheim, 1991).

As seen earlier, the workshop in week 2 was more content driven and meant that in order to succeed, the students had to have attended the lectures. This could also explain why there was a 30% increase in agreement for the statement: *“You found it helpful to look over someone else’s work, in helping your own understanding of the topics covered today”*. The workshop in week 2 required that students had an understanding of the work and perhaps stretched them further than the workshop in week 1, which was skills-based. It would also seem that 100% of students (28/28 and 25/25) were positive about the fast feedback procedure over both weeks. Nonetheless, it is important to note that almost half of the students (50% in week 1 and 44% in week 2) were not happy with a fellow student marking their work. This could be due to the lack of anonymity in the marking. This lack of anonymity has ethical implications, which will be discussed later. Also, 18% of students in week 1 felt that they would rather have a tutor annotate their work.

As it can be seen from the results in Tables 1 and 2 below, students became more confident in using the peer assessment method, as eight (32% of attendees) students felt they were more confident in marking work than the previous week (statement 1).

For both weeks 1 and 2, roughly half of the students felt that they found peer comments helpful (statement 3) although this method of giving feedback from model answers leaves little room for students to add subjective comments.

Table 1. Feedback results from Peer Assessment workshop 1.

	Statement	Students who agreed /28	% of students who agreed
1	You would rather mark your own work than have a friend mark it.	14	50%
2	You found it helpful to your own learning to look over someone else’s work and mark it.	4	14%
3	You found any comments on your work helpful	14	50%
4	You would like this method to occur in every workshop.	1	7%
5	You would prefer to have your work commented on by a tutor and returned the following week.	5	18%
6	You like the fast feedback response of peer marking	28	100%
7	You did not like marking someone else’s work.	4	14%
8	You did not like another student marking your work.	8	29%

Table 2. Feedback results from Peer Assessment workshop 2.

	Statement	Students who agreed /25	% of students who agreed
1	You found the process of marking work more straightforward this week after having done it last week.	8	32%
2	You would rather mark your own work than have a friend mark it.	11	44%
3	You found it helpful to look over someone else's work, in helping your own understanding of the topics covered today.	11	44%
4	You found any comments on your work helpful.	11	44%
5	After using peer assessment again today you feel more positive about the process than you did last week.	6	24%
6	After using peer assessment again today you would rather that it was not used again in a workshop	0	0
7	After using peer assessment again today, you would be happy for it to continue in some workshops.	17	68%

Tutor marked workshops

Students were asked to respond to the statements relating to the tutor's comments on their worksheets in workshop 2 (Table 3). Although thirty students were present at the workshop, only twenty-three of them responded to the statements, as some had attended the previous workshop. All the students who responded, agreed with the statement that they found the feedback comments easy to understand (statement 1) and 70% of students said this feedback helped them to see where they could improve (statement 2). This is very encouraging, as an aim of good feedback is to provide opportunities to "*close the gap between current and desired performance*" (Nicol, 2005). More than half of the students felt that they would like feedback during the workshop (statement 5). This reflects the opinion of those students who were involved in the peer assessment workshops, where 100% of the students liked the 'fast feedback' response.

Table 3. Feedback results from students in Tutor Assessment workshop 2.

	Statement	Number of students /23	% of students who agreed
1	You found the feedback comments easy to understand.	23	100%
2	From the comments on the sheet you see how you can improve your technique	16	70%
3	You did not pay much attention to the comments made on the sheet.	2	9%
4	You had forgotten the workshop from last week	0	0
5	You would prefer feedback during the mechanism workshop.	13	57%
6	You would have preferred to mark your own workshop from an answer sheet.	6	26%
7	You would like this method of tutor marking to occur in every workshop.	12	52%
8	You do not like this method of feedback and would rather that it was not continued within workshops.	7	30%

This style of workshop was the one example where 30% of the students agreed that they did not like the tutor marked method of feedback and would rather it did not happen again (statement 8). This finding reflects a preference for an alternative to the 'traditional' feedback approach.

Self-Assessment workshops

Students were asked to respond to the statements at the end of each workshop (Tables 4 and 5). Table 4 reveals that 100% of students agreed that they liked the fast feedback mechanism in the Self-Assessment. These results echo students' views in the Peer Assessment workshops, where several students felt that they would abstain rather than agree with statement 7 in workshop 1. It would seem that the system of receiving fast feedback appealed to them more than having more frequent workshops in the style of Self Assessment.

These views altered greatly in week 2 (Table 5) where 100% of the students were happy to receive feedback from Self-Assessment methods in future workshops (statement 4) and all found the process of marking their own work more straightforward, having done it the week before (statement 2).

When asked, only three students said that they had completed the marking without much thought over the two weeks. If this was an honest response from all participating students, this is a valuable indication that the students took the process seriously and thought about the marking that they were doing. Here again, students seemed very reluctant to having their workshop sheet annotated by a tutor. This has been the case in all of the previous workshops.

Table 4. Feedback results from Self-Assessed workshop 1.

	Statement	Number of students who agreed/33	% of students who agreed
1	You found it helpful to receive the answers during the workshop.	33	100%
2	You found it helpful to mark your own work from the answers.	33	100%
3	You would prefer the tutor to mark your work and hand it back with comments.	0	0
4	You learnt from your mistakes by going over the answers yourself.	33	100%
5	You liked receiving fast feedback from the self-assessment structure to this workshop.	33	100%
6	You did not pay much attention to marking your own work and went quickly through the marking process without much thought.	3	9%
7	You like the method of self-assessment and would like it to occur more frequently in workshops.	30	90%
8	You would like this method to occur in every workshop.	9	27%
9	You do not like this method of feedback and would rather that it was not continued within workshops	0	0

Table 5. Feedback results from Self-Assessed workshop 2.

	Statement	Number of students who agreed/26	% of students who agreed
1	You were happier with the self-marking process this week than you were last week?	0	0
2	You found it more straightforward to look through your own work and mark it because you had followed this procedure last week.	26	100%
3	You found it helpful to receive the answers during the workshop this week.	26	100%
4	You found it helpful to mark your own work from the answers.	26	100%
5	You would prefer to complete the workshop first, before getting the answers.	8	31%
6	You would prefer the tutor to mark your work and hand it back with comments.	0	0
7	You did not pay much attention to marking your own work and went through the marking process without much thought.	0	0
8	After doing this style of workshop again you would like this method to be used more often in workshops.	26	100%
9	After doing this style of workshop today you would like this method to be used in every workshop.	16	62%
10	You do not like this style of workshop and would rather that it did not continue within workshops.	0	0

Control workshop

The feedback was collected from students in the second control workshops by the method described earlier. As can be seen in Table 6, 100% of the students agreed with the statement that they were “*content receiving the answer sheet to look through in [their] own time*” (statement 1). The majority of students also seemed satisfied with the feedback they had received during the workshop, though some (23%) felt that they would have liked to receive more, and a further 13% claimed that the level of feedback was inadequate.

Table 6. Feedback results from the Control workshop.

	Statement	Number of students/30	% of students who agreed
1	You have been content receiving the answer sheet to look through in your own time.	30	100%
2	You would have found it helpful to go through the answer sheet within the workshop.	8	27%
3	You feel the feedback you received within the workshops over the past 2 weeks has been adequate.	23	77%
4	You think that the feedback given in the workshops over the past 2 weeks has been inadequate.	4	13%
5	You like the idea of swapping sheets with another student to be marked to receive feedback.	0	0

With hindsight it would seem that the way question 5 was phrased may have confused students, as it produced no response, therefore making it impossible to evaluate the result of this statement. Perhaps a simpler statement such as 'you like peer-marking and receiving feedback from another student' may elicit more responses in the future?

As well as the workshops, interviews were carried out with two students, one each from the peer and tutor assessment workshops. The aim of these interviews was to clarify the feedback received from students, and also to analyse more deeply student perception of feedback. As the number of responses is very small, they should be treated with caution. The main points from the interviews were as follows:

(Student A attended the Peer Assessment workshop and Student B attended the tutor assessed workshop)

- Both students were unsure of the feedback that they could expect from the University and neither of the students had read the student handbook for their course. They felt that this could reflect a relatively accurate picture for the majority of students on their course.
- Both considered their respective workshops to have provided adequate feedback. Student A felt that more time to annotate their peer's work would have enabled the students to learn more from the procedure. He also commented that although feedback from a tutor would have been better, peer feedback was better than none at all.
- Both students agreed that they expected less feedback at University compared to school. Student A acknowledged that "*the focus is supposed to be more on you getting the work done yourself*".

Discussion

The results from the feedback received from students highlight the fact that:

Tutor comments were not preferred to self or peer-assessment by the students.

A perhaps surprising finding from the data collected was that students overwhelmingly felt that they would not like to have a tutor annotate their work individually. This was especially clear for several reasons:

The observed reaction of the students in the tutor-assessed workshop could have been due to the fact that they had to hand in their worksheets at the end. Those students who had not completed the work would be reluctant to hand it in.

All students in the Self and Peer Assessment workshops agreed that they would not like to have a tutor mark their work, but would instead prefer receiving an answer sheet and marking their own work. The students marked the worksheets during the workshop, which meant that they also received fast feedback from the peer and self assessment mechanisms.

Another reason could be that the thought of handing work in to be commented on unsettled the students, as there seemed to be a belief that tutors will think less of them if they did not do well. This perception concerning the tutor-assessed workshop may be linked to the 'fear of failing' as described by Stiggins (1999), who goes on to say that "*the trick is to help students understand that failure holds the seeds of later success.*"

Results from later exam feedback tutorials came as a surprise when they revealed that feedback from the tutor was deemed to be very valuable. The tutor's feedback in these tutorials was generally in the form of a verbal feedback with no peer assessment involved. Self-assessment may have occurred, but this would have been at the discretion of the individual tutors and the way that they chose to run their feedback tutorials. The interview analysis with our students indicated that they would rate tutor feedback very highly. When probed further, it seemed that there is a difference in the minds of the students between having annotated comments from a tutor and having face-to-face feedback with a tutor. Students claim they would prefer to have either feedback from a peer or the opportunity to go

through their own work with a view to self critique and learn from their mistakes, rather than receive written feedback on their work from a tutor.

Thus the ranking in order of preference for written feedback from the results seems to be *Peer Assessment, followed by Self Assessment, followed by Tutor Assessment*. This observation is largely based on how the students would like the procedure to run in future workshops. This is a very interesting result as it suggests that there is great value in exploring Peer and Self-Assessment as a method of feedback to students and in doing so to move away from the more conventional use of tutor written feedback.

Fast feedback appreciated

Students who received feedback in the workshop (those in the peer and self assessment workshops) were unanimous in agreement that fast feedback was good. Over half of the students in the tutor marked workshop would have preferred faster feedback. With regards to the tutor marked workshops, students were concerned with the fact that they had received feedback several weeks after the workshop. The University Quality Assurance specification advises that feedback is given within 3 weeks (QA, 2002), therefore any feedback given within this time period is within that of the Quality Assurance specifications. However, this is perhaps too long for students to wait in order to be able to implement what they have learnt in the workshops and feedback process. A similar issue with laboratory reports came up during interviews. These are produced weekly, but marking and feedback can take several weeks and the feedback comments were often of little use at this point for improvement.

The promptness of feedback is one of the conditions for the success of a student centred approach adopted by Gibbs (1999) in assessment. A Student Centred learning approach is where the focus is on the student's learning, as opposed to being on the teacher transmitting knowledge. Harden (2000) says that the focus is on student learning and "*what students do to achieve this, rather than what the teacher does*". Yorke (2003) notes from this study of Peer Assessment with Engineering students that the "*improvement in student's end-of-course outcomes was very marked*" and relates the success to fast feedback that the students received.

Self Assessment – students learnt from their mistakes

It was interesting to see that all students taking part in the Self-Assessment workshop agreed that they learnt from their mistakes through marking their own work from the answer sheet. This is very pleasing, as a good feedback practice should "*provide opportunities to close the gap between current and desired performance*" (Nicol, 2005). However, the feedback would seem to be more helpful to the students if they had more time to complete the workshop sheet and answers. This is reflected by 31% of students in week 2 agreeing that they would "*prefer to complete the workshop first, before getting the answers*".

In an interview, Student A's responses about this workshop highlighted the need to increase the time allocated to 'Peer-Assessment' to increase its potential to provide good feedback to students. Boud (1991) stressed the need to allow time for students to assimilate the process of giving and receiving feedback.

As Peer Assessment is relatively unknown by students and tutors in the Chemistry Department, an investment of time is required to both prepare and undertake assessment in this way. Our results show that time spent this way has paid off, with 30% of students increasing in confidence with giving and using peer feedback. However, time may not resolve the fact the some students are not happy with marking other student's work, or having their work marked by peers. An issue that arose from the Peer-Assessment workshops was that of ethics. Indeed, students did not appear completely satisfied with exchanging worksheets in a way that was not anonymous. Because the workshop was run in this way, the possibility of

marking work objectively was greatly reduced and may have hindered the learning process. An anonymous process would reduce this element and improve student learning by removing potential awkwardness from students knowing who their marker was and whom they were marking.

Anonymity would be crucial if the process of Peer-Assessment were to move beyond giving feedback in a formative assessment context to that of summative assessment. This would avoid bias influenced by factors such as: over-marking friends, gender bias (as noted in Langan, 2005) and dominant individuals receiving higher marks.

A better-designed study would have to be developed in order to dispel concerns over the validity and fairness of peer marked work compared to tutor assessment (Falchikov, 1989).

Conclusion

The study of peer- and self-assessment workshops has shown convincingly that students valued this fast feedback approach and that they appreciated the quality of feedback received from their peers or from the Self Assessment exercise. Interestingly, the study also revealed that students viewed feedback from Peer- and Self-Assessment more favourably than tutor feedback. Thus the dual aim of giving quality feedback to students, but without adding more time pressures on to tutors was achieved. This will lead to greater enhancement of feedback mechanisms within the programmes of study offered by the Department of Chemistry at the University of Bath. It is also hoped that in the near future more studies will follow with a view to explore further the potential of Self and Peer Assessment in order to improve the quality of feedback to students throughout the programmes of study.

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