Closing the feedback loop: physics undergraduates' use of feedback comments on laboratory coursework

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The laboratory notebooks of physics undergraduates taking two second-year practical courses were audited to discover whether they had used feedback comments in their subsequent coursework. Ninety-five per cent of the 37 students on the first course and 100% of the 14 students on the second course whose work was audited had used feedback. The marker's comments were classified into two groups based on whether they addressed simple (mastery) or complex (developmental) learning outcomes. Mastery comments were more likely to be acted on than developmental comments which aimed to extend students' skills and understanding to higher levels. This has implications for the use of feedback audit as a quality control process, since the feedback which is most commonly applied by students is not the most valuable for the development of higher order skills. Following reflection on the results for the first course, students taking the second course were given responsibility for checking their peers' notebooks against preset criteria. Peer checking improved students' marks but did not eliminate the need for mastery feedback. It is argued that a direct audit of students' use of feedback is particularly valuable when undertaken by the teacher who provides the feedback.

Keywords: feedback; written comments; effectiveness; audit; coursework

Introduction

The feedback university students receive on their coursework is an important factor in how they judge the overall quality of their educational experience (Ramsden 2003). National higher education policy in the UK recognises this by including two items on the timeliness and helpfulness of feedback in the National Student Survey (NSS) completed by students graduating from all UK universities (UNISTATS 2012). The NSS has made coursework feedback a high-profile issue in the increasingly competitive world of higher education, and many universities have responded by introducing minimum service standards for feedback on assessed coursework. At the same time, rising student numbers and increasing workloads for academic staff limit both the quantity and quality of the feedback that can realistically be provided to each student. It is, therefore, important for academics to ensure that the feedback they do provide is as effective as possible in promoting student learning.

This raises the question of how to judge whether feedback is effective. Educational researchers have recognised that it is difficult to measure the outcomes of coursework feedback in a university setting. Students often submit work for assessment at the end of a course. By the time their work has been marked they have

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moved on to other courses, and the feedback provided may not be directly relevant to their next assignments (Ramsden 2003). In this situation, it has been reported that some students never read their feedback and may not even collect their marked work (Hounsell 2007).

These difficulties have led educational researchers to develop proxy measures for the effectiveness of feedback. One approach has been to analyse the nature and quality of feedback comments made by the markers. Brown and Glover (2006) developed a feedback classification system based on five categories: comments on content, comments related to skills, comments encouraging further learning, motivational comments and demotivational comments. This approach was later extended by Orsmond and Merry (2011) into a nine-category system. However, Price et al. (2012) have criticised evaluation based on analysis of markers' comments on the grounds that 'Input measures such as timing, frequency, quantity or externally judged product quality can only indicate that some of the conditions for effective feedback are in place. They cannot prove that feedback is effective' (287). Clearly, if students are not even reading their feedback, the quality of the marker's comments is irrelevant to their learning.

An alternative approach is to ask the students themselves to evaluate the effectiveness of the feedback they receive. Researchers using this method have reported a range of difficulties: for example, students may not be able to read their assessor's handwriting, they may not understand their assessor's comments and, even if they do, they may not know how to use it in the way the marker intended (Chanock 2000; Carless 2006; Price and O'Donovan 2006; Weaver 2006; Crisp 2007; Walker 2009; Ferguson 2011). Although this approach has provided valuable insights, it suffers from several shortcomings as an evaluation method: it is resource-intensive in terms of both data collection and analysis; it may be limited by low response rates to questionnaires; students may not be able to recognise the benefits provided by feedback; evaluation comments from students may be difficult for teachers to act on; and the timing of the evaluation is critical because if students are asked too soon after receiving feedback they may not have had an opportunity to apply it, whereas if they are asked too long after receiving the feedback they may have assimilated their learning and no longer remember it.

Both these approaches suffer from the additional weakness that they do not directly engage the teacher in the evaluation process. Unless academics are evaluating and reflecting on the effectiveness of their own feedback, they may remain unaware of their students' problems and continue to provide feedback which students cannot use (Higgins, Hartley, and Skelton 2002). Ramsden (2003) stressed the importance of lecturers studying their students' work in order to find out about their learning. Hattie and Timperley (2007) concluded from their extensive review of research that it is just as important for teachers to learn from feedback as it is for students. More recently, Boud and Molloy (2013) have also emphasised that teachers have a professional responsibility to use performance information to modify the feedback they provide. Nicol and Macfarlane-Dick (2011) have identified the provision of information to teachers which can be used to shape teaching as one of their seven key principles of effective feedback. Hounsell (2007) pointed out that teachers faced with increasing marking loads need evidence that their feedback is being used in order to maintain their morale. On the other hand, when evaluation of feedback is carried out by independent researchers, managers or students, there is an increased risk that teachers will feel threatened and decline to engage with the results. Even in

the best case there will be delay in communicating the evaluation results to the teacher, reducing the probability that teachers will be able to use them to improve their practice.

The most direct approach to evaluating and improving the effectiveness of feedback is, therefore, for teachers to audit their students' subsequent work themselves, and to adjust their feedback in response to the results. Boud has pointed out that 'Feedback in education is only worthy of the name if the feedback loop is completed: that is, if teachers can detect in the work of students that the information they have provided has made a difference to what students do' (2007, 18). There have been very few published reports of investigations in higher education where the feedback loop has been completed, and I have been unable to find any previous report where the loop has been completed by the teacher who originally provided the feedback. This paper describes a case study of two undergraduate laboratory physics courses where this could be achieved, because students submit coursework which is marked and returned during the course. The information obtained by auditing students' written work has been supplemented by limited feedback obtained directly from individual students. Although this is a small study of one particular teaching situation, it illustrates how conducting a feedback audit and reflecting on the results can lead directly to improvements in the teacher's feedback practice, to valuable insights into the assessment process and to the formulation of practical steps for improving assessment and feedback on these and other courses in the future.

The current study

This paper describes an audit conducted on written feedback provided to second-year undergraduate students taking two courses in laboratory physics during the 2012–2013 academic year. I planned the study before the beginning of the academic year as a personal action research project to evaluate and improve my own feedback. The initial aims of the audit were to measure the effectiveness of my feedback in improving students' performance in laboratory coursework, to improve the effectiveness of my feedback and to establish a baseline to allow the effects of any future changes in marking procedures to be measured.

The two courses included in this audit were PHAS2440, a second-year laboratory course running during Term 1, and PHAS2441, a Term 2 course. Both courses are taught by a course coordinator and a team of academics with assistance from postgraduate student demonstrators. I was the course coordinator for PHAS2441 during the 2012–2013 academic year. The courses are examined by continuous assessment, so the marks awarded for each experiment count towards the students' final degree classification. Thus, the feedback provided on students' coursework is both formative and summative. Coursework marking is shared among the academic staff members of the course teaching team.

The audit was conducted in two stages: feedback on PHAS2440 coursework was audited during Term 1 and the first half of Term 2, while the audit of PHAS2441 coursework started during the second half of Term 2 and was completed during summer 2013 after the examination period. This allowed time for reflection on the results of the first audit stage, and subsequent modification of the feedback given to the students in stage 2. Only my own feedback was included in the audit.

Audit method for course PHAS2440

Students taking course PHAS2440 complete a total of five experiments during the term. The students work on a laboratory experiment for two weeks, hand in their experiment notebook and then work on another experiment using a second note-book, while the first one is being marked. Markers are asked to return the work within two weeks, so the students receive feedback on their first experiment just before starting their third experiment, but too late to apply the feedback in their second experiment. Experience has shown that, with current staffing levels and student numbers, a two-week turnround is the fastest that can be sustained for this course. This audit included feedback I gave to students on their first experiment (which they could apply in experiments 3, 4 and 5), on their second experiment (which they could apply in experiments 4 and 5) and on their third experiment (which they could apply in experiment 5). Feedback I gave on students' fourth or fifth experiments was not included in the audit since they could not apply this feedback during the course.

After marking each of the first three experiments, I examined the marked books and made a note of comments I had made. Several weeks later, when the students had completed subsequent experiments, I inspected their notebooks to see whether my comments had been acted on. For example, if I had written the comment, 'Plot error bars on graph data points' on a student's second experiment, I looked at the same student's notebooks for experiments 4 and 5 and noted whether or not the student had plotted error bars on graphs after receiving my comment. This audit method did not require me to be the marker for any of the student's subsequent experiments, and it did not require students to perform any particular experiments from the selection of experiments available on the course.

Not all the feedback comments I had given to the students were included in the audit. A distinction was drawn between 'feed-back' comments and 'feed-forward' comments. The former relate only to the specific piece of coursework being marked, whereas the latter also relate to future tasks (Hounsell 2007). 'Feed-back' comments were excluded from the audit. When analysis began, it became apparent that for technical reasons certain 'feed-forward' comments would be applicable to some later experiments but not to others. These 'specific' feed-forward comments were excluded from the audit and only 'general' feed-forward comments which students would be able to apply in any of their future experiments were included. Table 1

Table 1.   Examples of feedback, specific feed-forward and general feed-forward comments.

Type of comment	Example
'Feed-back' comment: only applicable to the piece of work being marked (excluded from audit)	'Method correct but answer wrong because of arithmetic mistake on p. 7'
Specific feed-forward comment: applicable in certain subsequent experiments but not others (excluded from audit)	'When counts obey Poisson statistics it is not necessary to calculate the standard deviation of several measurements – the error will be the square root of the total number of counts'
General feed-forward comment: applicable to any subsequent experiment (included)	'Always start your conclusion with a summary of your results and state whether or not each result agrees with the accepted value'

shows actual examples of these three types of comment. Numerical results from the audit are presented here, but because of the small sample sizes no statistical analysis has been undertaken.

Audit results for course PHAS2440

The audit of PHAS2440 included the work of 37 students out of a total of 98 enrolled on the course. For 32 of the students, I marked only one of their first three experiments, while for the other five students I marked two of their first three experiments. A total of 164 general feed-forward comments were analysed. Each student had been given between two and seven general feed-forward comments per experiment.

The general feed-forward comments were divided into two categories for analysis. Some comments were very straightforward. Following Petty (2004), this simple type of comment was classified as a 'mastery' comment. Petty developed the distinction between 'mastery' and 'developmental' objectives as an aid to planning differentiated teaching for mixed ability student groups. Mastery objectives, which should be easily achieved by all students, consolidate previous learning and enhance students' confidence, while developmental objectives aim to develop students' skills and understanding to higher levels. Although Petty's classification was developed for curriculum planning, it is useful in the current context because it focuses on the type of learning outcome each feedback comment addresses. Table 2 shows actual examples of mastery and developmental feedback comments.

Table 3 presents numerical results from the audit. The students applied more than three-quarters (81%) of my comments in their later experiments: 90% of the mastery comments were acted on, compared with only 63% of the developmental comments. Individual students acted on different proportions of the feedback. Of the 37 students, 18 applied all the general feed-forward comments they were given, 17 applied some of the comments and two applied none.

Discussion of audit results for course PHAS2440

Overall, the results of the audit were encouraging: 95% of the students evidently read my feedback comments and attempted to apply some or all of them. This demonstrates that the assessment strategy on course PHAS2440 of returning marked work within two weeks is working well. Race notes that university students 'pay most attention to their scores or grades when they get back marked work, and are

Table 2. Examples of mastery and developmental feedback.

Mastery feedback	Developmental feedback
'Number figures and tables'	'Develop discussion: HOW would heating produce the effects you observed? WHY is voltage ripple smaller with a regulator in the circuit?'
'Round off error to 1 significant figure'	'Think critically about your results – does the straight line you fitted make physical sense? Does the theory predict a straight line relationship between these variables?'
'Show working in calculations'	'When you propose a possible explanation for an observation, tell me how your idea might be tested experimentally'

Table 3.   Proportion of comments applied by students (PHAS2440).

Number of students in sample	37		
Total comments analysed	164	Total comments applied	133 (81%)
Mastery comments	112	Mastery comments applied	100 (90%)
Developmental comments	52	Developmental comments applied	33 (63%)

often quite blind to valuable feedback which may accompany their returned work' (Race 1999, 64). The PHAS2440 students were clearly not 'blind' to written feedback on their laboratory coursework. On the contrary, the audit results suggest that they were reading it, learning from it and doing their best to apply it. However, this audit cannot provide proof that the students were changing their behaviour as a direct result of my written feedback, possibly they were acting on verbal feedback from demonstrators or comments made by other students.

The approach used in this study is described by Schön (1991) as 'reflection-in-action'. The essence of reflection-in-action is that the researcher regards each situation as unique and uncertain. Therefore, instead of fixing the experimental methodology before the start of the investigation, the researcher changes and adapts the methodology in response to results and new questions as they arise. The aim is to explore the situation and achieve insights and improvements, rather than to apply a rigorous research methodology, and therefore I was happy to observe improvements in students' work and not concerned with proving definitively how these had arisen.

Reflection on the initial results from the PHAS2440 audit generated three further questions:

(1) Why are some students not acting on some comments?
(2) Are the comments I made the kind which will improve the students' learning most effectively?
(3) How can my feedback be improved?

Each of these questions will now be discussed in turn.

Individual students' responses to feedback

Miller and Parlett (1974) investigated how students at Edinburgh University approached assessment in examinations. These authors distinguished three types of students: 'cue-seeking' students who actively searched for ways to improve their assessment marks, 'cue-conscious' students who did not actively search but recognised and responded to relevant information when it was provided and 'cue-deaf' students who did not respond no matter how often they were told. It appears that the majority of the students whose work was included in this audit were 'cue-seeking' or 'cue-conscious', but two of the students appeared to belong to the 'cue-deaf' category.

The group of 17 students who applied some but not all the feedback comments included a wide range, from a student who applied six out of seven comments (86%) to a student who applied only two out of seven (28%) comments. Eleven of these students acted on feedback inconsistently, applying it in some subsequent experiments but not in others. To explore the reasons for differing levels of response

to feedback, I sent an email during the first half of Term 2 to students who had not implemented all of my comments, inviting them to tell me their reasons for this. Two responses were received, both from students who had applied more than 80% of the feedback comments.

Student A had implemented six out of seven comments, including three developmental comments. The feedback not implemented was a mastery comment (rounding the error off to 1 significant figure):

> I think it would be mainly because I did not have time to read them through properly (more than once if needed.) It would be good if we could take lab books home for that purpose. Even now I cannot read them as our lab books are not given back for us to keep them. (Student A)

Student B had implemented five out of six comments, including one developmental comment. The feedback not implemented was a developmental comment (linking suggestions for further experiments to the results of error analysis):

> Last term I was timetabled for four lecture-based modules rather than three due to the option I picked, as a result, this meant that I had a very hectic schedule when it came round to improving my work based on all the comments made. Therefore, I picked those which I felt I could act on sufficiently in order to improve my work without both compromising my work in my other courses, as well as my marks in the PHAS 2440 course … Since I was lacking sufficient time to rectify every mistake I made, I wanted to make sure that I tried to correct the most important points first. (Student B)

These replies confirm the individual nature of students' responses to feedback. They highlight issues which have been identified in other investigations: students need time and opportunity to assimilate feedback (Student A) and, when under pressure of time they act strategically (Student B), responding only to the feedback they judge to be most important or easiest to implement. Responses of these types are well known from the educational research literature (e.g. Snyder 1971; Race 1999).

Was I making the right kinds of comments?

On analysing the results of this audit, I was surprised to see the high proportion of my feed-forward comments which were simple, mastery comments (68%). Most mastery comments were concerned with organising the laboratory notebook correctly or using standard terminology. Keeping a good laboratory notebook is an important professional skill, but students should also be learning developmentally. Reflecting on the audit results, it seemed to me that marking laboratory coursework would enhance the students' future learning better, and also be more interesting to mark if the emphasis of the feedback could be shifted away from mastery towards developmental comments.

A marker only has time to make a certain number of comments on each piece of coursework. Students only have time and energy to take in and apply a certain number of comments, and can feel overwhelmed if too much feedback is given (Nicol and Macfarlane-Dick 2011). Thus, a balance must be struck between feedback comments, mastery feed-forward comments and developmental feed-forward comments. Feedback comments are important because students want to be assured that the marker has read their work thoroughly, be informed where they went wrong and

understand why they received the summative mark they were given (Walker 2009; Ferguson 2011). Specific and general feed-forward comments are also important because without them students do not know how to improve their future work (Brown and Glover 2006; Weaver 2006; Ferguson 2011). However, I believe that developmental feed-forward comments are the most important category because they help our students learn to think like professional physicists. Without developmental comments, we risk producing graduates who keep well-organised laboratory note-books but have little understanding of experimental physics. As Orsmond and Merry noted in their investigation of biology students' use of feedback, 'A possible impli-cation of students using tutor feedback in (*a non-developmental*) way is that they are not developing into biologists, but merely becoming mimics of biologists' (2011, 133).

The audit showed that I had given four out of the 37 students (11%) no developmental feed-forward comments. Petty recommends that even the weaker stu-dents in a group should be given appropriate access to learning activities linked to developmental objectives, and not be restricted to routine mastery tasks. Since the aim of feedback is to help students achieve the learning outcomes for the course, it is clear that this principle should apply to feedback as well. Therefore, I decided that in future I would ensure that I made at least one developmental feed-forward com-ment on every experiment I marked, and also explain and emphasise the more com-plex developmental comments when discussing my feedback face-to-face with students in the laboratory. These changes were immediately implemented in PHAS2441.

How could my feedback be improved?

Providing mastery comments on coursework is simple, relatively quick and boring. Providing developmental comments is more difficult, slower but much more interest-ing. Many mastery comments could be made equally well by any conscientious mar-ker with a checklist – highlighting graphs with unlabelled axes does not require a marker with a PhD. Developmental comments, on the other hand, require a scientific understanding of the experiment, an educational understanding of the course objec-tives and a professional understanding of the characteristics of a good laboratory report.

Reflecting on the PHAS2440 audit results, it seemed to me that my marking could be more useful for the students' learning if responsibility for the routine, mas-tery comments could be transferred to the students. Monitoring the standard of their own work is an essential skill for university students to develop (Gibbs 2006; Nicol and Macfarlane-Dick 2011), and this would provide an opportunity for students to practise it.

Using an idea described by Gibbs, I decided to give the students taking course PHAS2441 in Term 2 a list of checks on the contents of their laboratory notebooks. I would ask them to check their laboratory partner's notebook against the list before the book was handed in for marking. The aims of this procedure were:

- To improve the students' learning by giving them responsibility for evaluating the standard of their partner's work (Black and Wiliam 1998).
- To improve the students' grades by eliminating deductions of marks for simple mistakes in notebook format/organisation.

- To reduce the need for all the academic staff markers to make routine mastery comments.
- To free up my own limited marking time to make more of the important developmental comments.

Since I was the course coordinator for PHAS2441, I had the authority to introduce this change in assessment procedure.

Continuation and development of the audit in course PHAS2441

Audit method

The laboratory part of course PHAS2441 comprised a short introductory experiment followed by a longer project-style experiment. I asked the other four academic demonstrators to mark and return the first experiment within two weeks of hand-in, so the students had the opportunity to apply their feedback in the later stages of the second experiment. Three of the four markers met this timescale, but one had to delay marking by one week due to illness.

A checklist for the contents of the notebook report was provided on a flip chart in the laboratory. I explained to the students that the purpose of the checklist was to prevent them from losing marks unnecessarily for simple mistakes. They were asked to check their partner's book on the grounds that it is easier to notice a mistake or omission in someone else's work than in your own. I also explained to the students that they were checking the format rather than the content of their partner's notebook; for example, they should check that graphs had units on the axes, but they did not need to decide whether the units were correct. When the students handed their books in for marking, I asked each of them to assure me that the checks had been completed. Many students reported that they had found and corrected mistakes during the peer-checking process.

Audit results for course PHAS2441

I marked the first experiment for 14 of the 75 students taking course PHAS2441. The comments I made on their experiment reports were analysed in the same way as for course PHAS2440: 62 general feed-forward comments were analysed, ranging from three to six comments per student. Thirty-seven comments (60%) were mastery comments. Following my reflections on the audit of course PHAS2440, I made sure that I gave at least one developmental feed-forward comment to every student.

Table 4 presents numerical results from the audit. The students taking course PHAS2441 applied just over half (55%) of my comments on their first experiment in their second experiment. This is a significantly lower proportion than the 81% of comments applied by the sample of PHAS2440 students. As in PHAS2440, mastery

Table 4. Proportion of comments applied by students (PHAS2441).

Number of students in sample	14		
Total comments analysed	62	Total comments applied	34 (55%)
Mastery comments	37	Mastery comments applied	27 (73%)
Developmental comments	25	Developmental comments applied	7 (28%)

comments were much more often acted on than developmental comments, and individual students acted on different proportions of my feedback. One student applied all of my general feed-forward comments, while the other 13 students applied some of them. Of the students who applied some comments but not others, the proportion applied ranged from five out of six (83%) to one out of five (20%).

I did not ask the PHAS2441 students why they applied some comments but not others, because this Term 2 course was marked during the examination period when all students are extremely busy.

Initially, it seemed disappointing that, in spite of the peer-checking process, I was still making a high proportion of mastery comments on the first experiment. However, looking at my comments in more detail, I found that 32 of the 37 mastery comments (86%) related to four specific mistakes: poor sketches of the apparatus; not drawing separate circuit diagrams for each part of the experiment; not labelling the axes of sketches of the oscilloscope screen; and not showing full working in calculations. The 'range' of different mastery comments required was, therefore, much smaller than for any of the first three PHAS2440 experiments, and I can now deal with this problem in future course presentations by making these requirements clear to the students beforehand. Only one student in the audit sample lost marks for a mistake that should have been corrected during the peer-checking process. These results indicate that peer checking does have the potential to free up my time as a marker to make developmental, rather than mastery, comments in future years once I have improved the assessment criteria on the checklist.

Although introducing peer checking was not effective in shifting the balance of my feedback comments from mastery towards developmental comments, it was successful in improving the students' marks. I compared the marks I gave students for the first experiment this year with the marks I gave for the same experiment the previous year. The same standardised marking scheme was used by all markers in both years, and both sets of marks were subject to a second-marking/moderating process. In 2012, when I marked the first experiment for 20 students, I gave an average mark of 69/100 with a standard deviation of 14. In 2013, my average mark for 14 students was 76 with a standard deviation of 5. In both years, the mode of the mark distribution was between 71 and 80. The increase in average mark and decrease in the standard deviation in 2013 was due to the elimination of a 'tail' of low marks. This indicates that the peer-checking process achieved its aim of preventing students losing marks for simple mistakes, as previously reported by Gibbs (2006).

Discussion

The audit results presented here show that 81% of the written general feed-forward comments I gave students on course PHAS2440, and 55% of the written general feed-forward comments I gave students on course PHAS2441, were applied in their subsequent coursework. My feedback on both courses is thus meeting Boud's criterion for effectiveness: I can see that it has made a difference to the students' work (Boud 2007). This result is encouraging, but analysis of the feedback using Petty's mastery/developmental distinction raises some points for consideration. Students were much more likely to action mastery comments than developmental comments, presumably because mastery comments are easier for students to understand and easier to apply. When students are under pressure from competing demands and

priorities, they will tend to respond strategically by acting on simple comments, while ignoring more demanding comments.

Developmental feedback is highly important for long-term student learning. Higgins, Hartley, and Skelton (2002) and Nicol and Macfarlane-Dick (2011) have stressed the importance of fostering students' higher order critical skills, rather than focussing feedback on the routine aspects of an essay assignment such as spelling and grammar. However, this audit suggests that, as a marker adjusts feedback to include developmental rather than mastery comments, there is an increasing likelihood that students will not act on it. I also found that when I audited the students' second PHAS2441 experiments to see whether they had acted on my comments, it was sometimes more difficult to be sure whether they had applied developmental comments or not. This is an example of the classic educational problem highlighted by Bloom (1956) and many subsequent researchers: it is much easier to assess lower order educational objectives than higher order skills. Price et al. (2012) have noted the difficulty of evaluating the impact of complex feedback aimed at the long-term development of the student. However, Vardi (2012) reports that feed-forward comments which address the deep aspects of an assessment assignment can be highly effective in improving students' work when given in the context of a well-designed assessment scheme.

Making developmental feed-forward comments forces the marker to think about each student's individual misunderstandings and needs. When markers are under pressure, there is a strong temptation to give mastery feedback, because it is quicker and easier to do. Students find mastery feedback easier to understand and apply, so there is a danger of academics and students becoming caught in a circle of complicity, in which marks are awarded for mastery objectives while developmental objectives become side-lined. The long-term consequences of such a situation would be highly detrimental for students' intellectual development, and this is why it is important to balance mastery and developmental objectives, as recommended by Petty (2004), and to give both kinds of objective due weight in feedback and in the marking scheme. This consideration also raises concerns about the use of the feedback evaluation for quality control, as practised by Crisp (2007) and Walker (2009). If markers know they will be judged on the proportion of students who apply their feedback, they may be tempted to beat the system by making 'low risk' mastery comments rather than 'high risk' developmental comments.

Boud and Molloy (2013) have rejected the approach of closing the feedback loop as a practical method for improving feedback in higher education on the grounds that it can only be used selectively. Instead, they advocate an approach which shifts the emphasis to the students. In their model, students would be encouraged to seek the feedback they need through active dialogue with their teachers. Probably, every teacher would agree on the value of assessment dialogue, but Boud and Molloy's model presupposes that all students are, or will rapidly become, 'cue seeking', and also that all students will have adequate time and energy to devote to seeking feedback on every assignment in each of their courses. As this study has illustrated, these conditions are unlikely to be realised in the pressurised world of higher education. We should also recognise that dialogue between teachers and students is easier in some disciplines than others: academic physicists and their students are not generally celebrated for their verbal communication skills.

I would argue that when an audit is implemented by the teacher who is providing the feedback, it *should* only be used selectively. As a teaching professional, I can

apply my observations and learning from this audit directly to the other courses I teach without needing to audit them as well. The direct audit has many strengths as an evaluation method. One very important advantage is timely provision of information directly to the teacher, so that improvements can be made quickly. This audit alerted me to my own poor practice in not providing developmental feedback to all the students on the first course, and I was immediately able to correct this for the second course. Another advantage for the teacher is being able to give detailed attention to particular aspects of feedback. For example, in this audit, I chose to focus on general, rather than specific, feed-forward comments in the first stage of the audit, and then to concentrate on developmental feed-forward comments in the second stage. I am confident that my written feedback improved during this audit. By the end of the second course, I had a much clearer idea of what I wanted the students to achieve, of the purposes of different kinds of comments and of how students were likely to use them.

On the basis of my own experience conducting this audit, I would unhesitatingly recommend the method to all teachers who wish to explore for themselves the effectiveness of the feedback they give their students. Teaching and learning are very personal matters, every teaching context is unique, and there is no guarantee that changes made in one teaching context will be successful in another (Ramsden 2003). Even when established principles of good feedback have been followed, it is only by studying directly how students have used their feedback that teachers can come to understand the complex dynamics of the real-life teaching and learning situations they and their students experience.

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Notes on contributor

Pam Donovan has over 30 years' experience of teaching in higher and professional education, working as a research fellow at the Cambridge University, a senior lecturer in physics at Birkbeck College London, and subsequently in a variety of training and organisational development roles in the National Health Service. She is currently a teaching fellow in the Department of Physics and Astronomy at University College London. Her specialist educational interests are development of work-based learning, assessment techniques and evaluation of the outcomes of training.

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