Effective Feedback to Small and Large Classes

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Abstract - Educational experts appear to be in broad agreement when it comes to the importance of feedback for effective learning. Students benefit from plenty of opportunity and encouragement to express their understanding, and from informed, supportive, possibly challenging, feedback. At the same time, we observe that many students at our university do not find that they receive helpful feedback. One in three engineering students disagree or strongly disagree with the Quality of Teaching questionnaire's "I received helpful feedback on how I was going" in the individual course, and most other disciplines find themselves in a similar situation. For the university as a whole, student responses to this question are clearly less positive than to other questions on quality of teaching, intellectual stimulation, staff interest, workload, and so on, and this state of affairs seems quite common in the Australian context. We discuss best practice in feedback provision, partly based on our interviews with students and staff. We have been particularly interested in identifying cost-effective ways of providing informed and constructive feedback to large classes. Feedback is often understood, by engineering students and staff alike, simply as comments on submitted work - typically written assignments. We argue in favour of a broader concept that covers a multitude of ways for a student to develop deep learning through conversation, including questions and answers provided by others, team work, study groups, and formative teacher-provided feedback during an assessment task. We emphasise the coaching role of the teacher, and feedback designed to encourage students to monitor own learning. Large classes pose particular logistic problems. We identify staff development as a crucial factor for consistent, effective feedback, and point to web-based feedback provision as a workable solution to some logistic problems. We briefly discuss the role of information technology more broadly, both for learning enhancement and for automated feedback provision.

Index Terms – Feedback to students, Formative assessment, Large class teaching.

INTRODUCTION

Few teachers or students would disagree with the claim that informed feedback to students is crucial for their learning. And educational experts, who may otherwise disagree on many points, seem in broad agreement when it comes to the value of feedback. Why then is it that university students seem, on the whole, less than pleased with the feedback they receive from teaching staff? This is certainly the situation across most of our university, including the Engineering Faculty (School). For example, one in three engineering students disagree or strongly disagree with the Quality of Teaching questionnaire's "I received helpful feedback on how I was going" in a given subject (Australian for “course”). Most other disciplines find themselves in a similar situation. Across the university, student responses to the statement about feedback are clearly less positive than to other questions, on quality of teaching, intellectual stimulation, staff interest, workload, and so on, and this picture is repeated throughout Australian universities (and, we guess, much more widely).

Students’ unhappiness with the feedback they receive is evident from several sources. It is expressed at meetings where staff and students discuss the quality of teaching, as well as in online and mandatory paper-based teaching quality questionnaires. Moreover, students have quite a strong case - Ramsden [7] cites studies that support the claims about low-quality feedback. For example, investigations by Entwistle et al. [3] of first year Electrical Engineering students in Scotland suggested that student failure was linked to an almost complete absence of feedback on progress during the first term of study. Even where frequent, timely feedback is provided to students, the question remains to what extent it is helpful and supports learning.

In this paper we reflect upon that question and discuss best practice in the provision of feedback. Our view on this has recently been sharpened, after we conducted interviews with students and staff at the University of Melbourne. The university runs an annual colloquium on teaching and learning, and one of the focal points in 2003 was “providing feedback to large classes”. A number of academics were asked to provide input for small workshops on the topic, as the relatively low level of student satisfaction continues to be of concern. In several disciplines, including Engineering, the University has experienced increasing class sizes, and it has been recognised that large student numbers only add to the problem of feedback provision. This paper reports on some findings and thoughts that sprang from our own workshop.

A SMALL LOCAL STUDY

Our first observation has been that, at least in our faculty, feedback provision is an issue, large classes or not. To gauge student satisfaction and the quality of teaching and learning, the University administers mandatory student questionnaires towards the end of each subject (course). Of the list of
questions that students are asked, we have been most interested in these:

**Question 2**: “This subject was well taught.”

**Question 4**: “I received helpful feedback on how I was going in this subject.”

Students respond to these on a Likert scale from 1 to 5, with 1 corresponding to “strongly disagree”, 3 to “neither agree nor disagree”, and 5 corresponding to “strongly agree”. Figure 1 shows student responses to Question 4, for two successive semesters’ Engineering subjects, that is, practically all Engineering subjects over a year. A small number of subjects are taught over the (southern hemisphere) summer, but are not included here. The student response is shown as a function of class size.

As expected, student satisfaction with feedback tends to fall as class size increases, and for very large classes, strong satisfaction is rare. However, one possible model that might fit well with the data is that the greatest negative impact of increasing class sizes happens as classes grow towards 100-120 enrolments. After that, the level of satisfaction appears relatively independent of actual size. The graph may even suggest that student satisfaction with feedback is greater in classes of size 400-600 than in classes of size 200-300. This could have several plausible explanations; for example, a lecturer is likely to approach the daunting task of running a class with 500 students with much more careful preparation and attention to logistics than that exercised when being in charge of a “mere” 200 students – by now a rather common class size in Australian universities.

In fact, the most surprising lesson provided by Figure 1 has to do with small classes. We have been struck by the large variation in student satisfaction levels for classes with, say, 5-15 students. As expected, many small-class students are very satisfied with the feedback they receive, but for many small classes, student satisfaction is far below what can be considered acceptable. The primary message appears to be that small-class teachers have much to learn from each other. There appears to be considerable scope for a staff development program that includes peer reviewing and peer support.

We have also wanted to understand the role played by quality feedback in students’ perception of the quality of teaching. Figure 2 plots satisfaction with teaching as a function of satisfaction with feedback. (We would ideally have liked to plot measures of “effectiveness” and “overall satisfaction with the course”, but the University has not, until mid-year 2003, asked students about “overall” satisfaction.) The figure suggests a clear correlation between students’ responses to the two questions.

There are disciplines where students are considerably happier with feedback. As expected, the Faculty of Music performs well, as do Arts. However, Question 4 (feedback) as a problematic outlier is a university-wide phenomenon. While reasonably satisfied with feedback, music students are still much happier with the quality of teaching they receive. Figure 3 shows, for the University’s major faculties, how students (in one semester in 2003) responded to Question 2 (quality of teaching, upper horizontal bar in the chart) and Question 4 (feedback, lower bar). The trend is clear, although we have been surprised to see how large the gap can be. Law students are amongst the least satisfied when it comes to “helpful feedback”, yet they are very satisfied with the quality of teaching they receive.

It should be a matter for concern that it is Question 4, on feedback, which inevitably comes out as the outlier. Ramsden [7] considers this question the most important and observes that it “seems that beneficial information about progress is valued even more by students than qualities such as clear explanations and stimulation of interest.” Similarly, the “chief finding … about the most effective courses at Harvard, as judged by students and alums, was the importance of quick and detailed feedback” [8].
views of the role of feedback and assessment in learning.

Assessment and Feedback to Students

While discussion of assessment has been firmly on the agenda for years, the conversation about good feedback is more muted. Most Engineering lecturers recognise that their students rate feedback poorly. However, often this is regarded as the inevitable consequence of large classes, a tight, prescribed curriculum, student attitude, and so on. The concept of feedback itself is mainly seen as unproblematic: feedback consists of marks and comments on submitted work – technical writing, essays, designs, computer programs, ... Feedback comes last, following the linear sequence of teaching, learning, and assessment – if feedback happens at all. Characteristically, the usually highest-stake assessment component, the written exam, lacks a formal feedback component.

As Ramsden [7] argues, the linear view of assessment and feedback fits in well with the (still dominant) transmission model of teaching, where the role of the teacher is to pass on knowledge to students, and then verify that the transmitted data were received and processed correctly. In this view, the role of assessment is primarily to perform the part of certification, and also to act as a stick that can be used to motivate students, through the threat of failure. Assessment is well known. Formative assessment is designed primarily with a view to promote and enhance learning, rather than measure it [1]. If the primary purpose of assessment is to help learning, rather than to certify that it has taken place, then continuous assessment becomes a crucial tool, and emphasis turns to assessment tasks that help focus and structure students’ learning. This actually extends the scope of useful tasks – those that simultaneously can motivate students and allow the development of generic skills – allowing the use of larger, authentic problems, designed for teams of students to solve collaboratively, for example. Assessment of this type is more open to subversion by students prepared to “cheat” or to get a free ride. Hence a common objection to many forms of formative assessment is that they cause an unacceptable devaluation of the “certification” role of assessment. We suggest, that, as with most things in life, the challenge is to find an appropriate balance. Formative assessment should not be seen as a replacement for summative assessment in a professional, accredited degree, but rather as a vital component that currently is under-utilised in mainstream engineering teaching.

Brown and Knight [1] discuss assessment models in detail. They are highly critical of the prevalence of summative assessment and the justifications usually offered for it (that it produces valid and reliable statements about students’ knowledge and skills, useful for prospective employers who can base their predictions about employee success on these statements). Brown and Knight suggest that employers in fact use grades as threshold variables, paying more attention to characteristics “not well described by existing summative accounts: … flexibility, the ability to work in a team, the potential to lead a team, initiative, reliability, motivation, interpersonal skills and so on” [1]. Formative assessment, on the other hand, emphasises the role of assessment as a promoter of learning. It “has the implication that growth is to be promoted, not left to the swirling patterns of ‘natural’ development by exposure to the subject matter of the degree.” Formative learning “provides a model for self-directed learning and hence for intellectual autonomy” [1]. Unfortunately, in current practice, too much assessment does not lead to feedback to students, hence a “major improvement in assessment systems would be to examine carefully departmental policies for generating feedback to students” [1]. Just as a lecturers’ view of the role of assessment can say much about their philosophy of learning, their view of the role of feedback, we believe, can reveal much about their attitude to assessment.

The prevailing view of feedback and its use is rather narrow: Feedback is seen as transmission of advice, from an expert, to a learner who needs to improve. It punctuates assessment tasks. The amount of feedback can vary from a...
mere mark to a (sometimes overwhelming) list of detailed objections, comments, and suggestions on how to better meet the next assessment hurdle. In any case, it is an after-the-event activity. It is summative, rather than designed to help learning here and now. We later revisit this view, arguing in favour of a broader concept.

**BEST PRACTICE IN FEEDBACK PROVISION**

In the study of Quality of Teaching data from our university, we soon noticed a few courses that stood out, with student responses well above average. One area was first-year mathematics. Across ten or so subjects (courses), students’ level of satisfaction with feedback was clearly above that for mathematics subjects as a whole, and also well above the results for the Science Faculty, and the University average. This was remarkable because first-year mathematics consists mainly of very large classes and is compulsory for a large variety of students from Science and Engineering.

Interviews with mathematics first-year teaching staff suggested that the high level of student satisfaction was achieved through a number of means, including:

- Frequent assessment tasks, for marks.
- Prompt feedback, usually provided within one week of submission.
- Clear guidelines and systematic staff development for markers.
- A policy of feedback provision, encouraging markers to provide positive, constructive feedback in all cases.

None of these are surprising – best practice here appears to be nothing but the practicing of principles that have been preached and accepted for a long time. Interviews with students have only confirmed the value of these measures. In particular, frequent assessment appeared to be important to students. Students were rather modest in their demand for prompt feedback, one later-year student stating that he preferred to receive feedback on submitted work before the date of the final exam! Finally, some students mentioned that they saw their peers as a more important source of feedback than teaching staff, claiming that most of their learning happened through interaction with other students, in study groups, and via team-oriented assessment tasks.

**FEEDBACK AS COACHING**

Students’ emphasis on the value of peer feedback suggests a broader view of feedback as a conversation whose purpose is to illuminate learning and maximise learning opportunities for as many as possible, as efficiently as possible. The feedback provider’s role is not simply to offer advice, but to facilitate discussion and enable new understanding [5]. Effective ways of doing this involve the use of electronic discussion boards, the web, and lecture time. We are led to a view of feedback, less as private advice from a lecturer to a student, and more as a public exercise of shared learning. The feedback provider’s role is comparable to that of the football coach who is prepared to interrupt training at any time in order to expose the errors of individual players, so that the entire team can learn from them.

It follows that feedback should not be considered separate from assessment and should not be relegated to after students have submitted their work. In fact, it is while students are actively engaged in an assessment task that the potential for learning is greatest, and hence the right amount of feedback may have highest impact. At that point, students are motivated and focused on the task, open to new ideas and suggestions. This is where feedback can be most effective, if the assessment task has been designed appropriately.

George Polya, who taught several of the last century’s greatest mathematicians, claimed that learning is optimised when just the right amount of formative feedback is provided. “The student should acquire as much experience of independent work as possible. But if he is left alone with his problem without any help or with insufficient help, he may make no progress at all. If the teacher helps too much, nothing is left to the student. The teacher should help, but not too much and not too little, so that the student shall have a reasonable share of the work” [6]. To foster student autonomy, the teacher guides the navigation of the problem, but carefully avoids taking ownership of the solution.

The view of feedback as coaching agrees with the view of assessment primarily for learning, rather than for credentialing or certification. Formative feedback includes any kind of communication that promotes learning. It may include advice intended to improve students’ learning skills, rather than just subject-specific skills and knowledge, or it may be designed to encourage reflection or critical thinking.

Huba and Freed [5] insist that useful feedback tells students something new about their understanding. To clarify expectations and provide marking guidelines (among other things), Huba and Freed propose the use of “rubrics”, as a systematic way of providing clear, public criteria against which work will be judged [5].

**FAIR FORMATIVE FEEDBACK PROVISION**

If feedback is free to students already as they are working on an assessment task, how does one ensure that nobody gets more help than others? Most teachers know the student who turns up three days before a piece of work is due and says “I’ve completed the assignment, and here is my solution, but before I hand it in, could you just go through it and check that I’m doing the right thing?” Even the keenest lecturer-as-coach will likely respond “Sorry, it doesn’t work like that – I don’t have the time, and it would not be fair to other students if you get two attempts when they have one.”

Our use of the web, however, has made fairness far easier to achieve. The first author has recently adopted a policy of accepting questions related to assessment tasks only if they are asked in plenum or submitted by email. As soon as an electronically submitted question has been answered, the question and answer appear on the subject’s web page, accessible to all. Hints are provided only in broadcast mode – in the lecture theatre, or on the web. Students are still welcome to turn up individually to discuss the subject, but
assessment-related questions will not be answered individually. Two additional advantages flow from this policy. First, the same question need no longer be answered repeatedly. Second, electronically submitted and publicized questions encourage students to express their current understanding and learning obstacles more clearly. (Questions are anonymized as an additional incentive to ask, but even so, students still make an effort to be clear.)

**Question.** Re Q3, I have a regular language R and I believe that Hull(R) is non-regular. My problem is determining what the language Hull(R) actually is. I have chosen

\[ R = \{ w | w \text{ has the same number of occurrences of 01 and 10} \}. \]

This language is not simply the intersection of itself and the set of even length strings (which is why I believe it is a good candidate, as the \( \text{Hull}(R) \) of the string '0101' produces '011' which is not in \( A \)). So I have an understanding of the language \( \text{Hull}(R) \), but no formal definition I can run the pumping lemma on.

**Answer.** Okay, interesting. Your \( R \) actually is the same as

\[ L = \{ w \in \{0,1\}^* | w \text{ begins and ends with the same symbol} \} \]

right? I think the hull is the intersection of \( L \) and the set of even-length strings. Surely '01011' was not there in the first place, as it has two occurrences of 01 but only one occurrence of 10.

Note that you can use a larger alphabet than just \( \{0,1\} \). That may help.

**FIGURE 4**

**EXAMPLE OF FORMATIVE FEEDBACK DURING ASSESSMENT**

Figure 4 shows an example of a web-broadcast question and answer. Q3 refers to one of the problems given in a take-home exam. It is not necessary to understand the problem to appreciate the interaction that takes place here. The student appears to be struggling with some concepts in formal language theory, but understands what is required to solve the problem. He or she proposes a solution but is unable to verify that it works (in fact it does not). Along the way, the student makes an elementary mistake. The answer attempts to keep the student motivated, while not giving away too much, and at the same time offering something of interest to a wider group of students. The final hint is useful, and accessible to all. It does not by itself lead to a solution, but it will re-start many students who have got stuck.

Willingness to interact in this way with students while they are working on an assessment task is time-consuming, but allows for more challenging problems to be tackled. In fact, the ideal assessment task has several tough learning hurdles built in, various obstacles and twists. It is designed to be “feedback-rich”, that is, to offer plenty of scope for discussion and help, although the latter is provided in quanta of “not too much and not too little”. The final written exam should not be similarly challenging. It should mainly serve to check that students know and understand the basic concepts and methods of the subject. The formative assessment task should allow for sufficient time for discussions and individual student reflection to take place. It should, of course, reflect the goals of the curriculum.

**Session F1E**

**LARGE CLASSES, AUTOMATED FEEDBACK?**

As class size grows, detailed, timely feedback becomes more of a problem. With more staff involved in marking and feedback provision, reasonable levels of consistency and quality become harder to maintain. Gibbs [4], arguing strongly in favour of peer and self-assessment, even peer assessment for no marks, observes that “in the face of increasing student numbers, it is common for feedback to be slow: the sheer volume and logistics of commenting on and returning student work within a week defeats all but the most committed and organized teacher. … Providing feedback on students’ work is one of the most expensive components in their education but it is often not an effective investment simply because it happens too slowly” [4].

For the large class, the marking process itself is repetitive, time-consuming, and prone to inconsistency. At the University of Melbourne, some commerce classes have close to 1500 students, and Science numbers approach the same level. In such an environment it is not uncommon for marking and feedback to be provided, under time pressure, by a large number of casual staff (typically older students), with limited experience and insufficient support in the form of marking guidelines. The result is, not surprisingly, terse feedback, correctly identified by students as shallow.

On the other hand, economy of scale should offer large classes some advantages. The cost-effectiveness of a carefully prepared model solution, presented in front of the whole class, only increases with the size of the class. Displaying, in front of the whole class, a handful of the most common errors made in an assignment, discussing and correcting them, is time well spent. It is one of the best opportunities for getting a large class to interact. Even for the best students, who avoided the errors under scrutiny, a session of careful error diagnosis, analysis and discussion provides a powerful learning experience.

Since cost-effectiveness may grow with class size, some types of investment into web-delivered feedback become attractive. We already mentioned the model of broadcast fair formative feedback, which uses a question-and-answer web page to share all questions asked, as well as all help given. This is an inexpensive tool, using reliable technology and cutting back the time spent providing help to the large class, simply because it avoids so much repetition.

But for the large class, even more sophisticated (and expensive) tools may turn out as good investments. For example, low-cost multi-media tools are now available that enable the creation and web-based low bandwidth delivery of presentations involving sound, graphics, even animation. Hence it becomes possible, for a reasonable investment of time, to provide students with purpose-built learning event “clips” that they can play when and as often as they like. Such presentations can primarily deliver material that would otherwise be developed on a white-board. However, with the use of voice overlay, one can begin to approximate what
happens in the tutorial or the assignment feedback session. We have recently begun to experiment with such tools, sometimes using two voices in dialogue to create online dramatisation of various learning events, and we believe that the scope for this technology is considerable.

There is already considerable use of multimedia for feedback, mainly in response to the large class problem. We increasingly see continuous assessment, even mid-term tests, being provided as online quizzes. Typically served up as a list of multiple-choice questions, they have the advantage of offering immediate, automatic marking and, sometimes, automated rudimentary comments and suggestions. They are cost-efficient, but it is of some concern, however, that they often appear to replace assessment tasks that had a higher potential for promoting deep learning.

A further, possibly under-developed or under-utilised, opportunity for time saving is computer-aided marking. The idea is simple. When we provide written feedback on many submissions, we find ourselves making the same comments and suggestions repeatedly. It is easy to provide tool support for a “comment bank” that can be developed before and during marking, to facilitate re-use of comments. This leaves time for more detailed feedback. The next step is almost as obvious: One can tie a marking scheme in with the use of comments (comment 1 comes with a deduction of 0.5 marks, say), and then marks can be calculated automatically. This can only improve marking consistency when a large number of markers deal with a large number of students. Moreover, it allows for painless re-calculation of marks, should the marking scheme turn out to need revision. We are not aware of widespread use of any such tool. Mindtrail®, a commercial product, had the above features, but does not appear to be traded any more. Mindtrail forced clear criteria to be developed for each aspect of assessment, and the creation of a “knowledge tree”, not unlike rubrics, to be created. Cargill [2], evaluating the tool, does not address the issue of time-efficiency, but finds that this type of tool does improve marking consistency, and suggests that the insistence on detailed marking criteria is an advantage.

But arguably the largest improvement to the quality of feedback would be better staff development, and in particular, staff development programs that extend to casual staff, who, at least in the Australian context, are responsible for the bulk of direct feedback to students.

**Conclusion**

Feedback is essential in the learning process, and the provision of good feedback should be a high priority goal. We find the general state of feedback provision lacking, as also student responses to quality-of-teaching questionnaires suggest. There is considerable variation in the quality of feedback provided in individual faculties (schools). We suggest that part of the problem is that many see feedback as something that punctuates assessment, rather than something that is provided continuously. Quality feedback needs to be considered a primary task of teaching, and assessment tasks need to be better designed so as to offer more opportunity for formative feedback.

**Acknowledgment**

We thank Alistair Moffat for help with figures 1 and 2 and the many other colleagues at the University of Melbourne who agreed to discuss best practice feedback with us.

**References**


