FEEDBACK IN THE SCIENCES: WHAT IS WANTED AND WHAT IS GIVEN

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ABSTRACT

This paper reports the initial findings from a study investigating students' perceptions of the feedback they have received at university in order to gain insight into the kinds of feedback most sought by students. Four hundred and nineteen second-year university Science students completed a 53 item questionnaire. Using a Likert scale, the questionnaire examined i) how students experienced feedback, ii) what students did with feedback, iii) how useful students perceived feedback to be, and iv) what type of written feedback was important to students. Statistical analyses of the data indicated that students carefully read feedback, used it to both go over the current assignment and improve future assignments, and that feedback received contributed to their understanding of course content. In addition, the data showed that a significant majority of students reported both positive and negative feedback as useful. The results suggest that students use written feedback not only for reflection on the assessment for which it was provided but to feed forward on future assessments. The results will be discussed in relation to the model of feedback proposed by Hattie and Timperley (2007).

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INTRODUCTION

Giving feedback to students on their written assignments has long been accepted as essential practice in university teaching (Biggs, 1999; Gibbs, 1999; Hounsell, 1987; Ramsden, 1992). There is substantial evidence that feedback can have a powerful influence on student learning and achievement compared with other aspects of teaching (Black & William, 1998; Hattie, 1987, 1999). Feedback on written assignments can be seen as part of the communication and negotiation process between students and their lecturers in which students are apprenticed into the discourse community of their discipline (Swales, 1990). It is through this developmental process that students come to share their lecturer's understandings of the kind of written communication valued by the discipline (Laurillard, 2002; Sadler, 1989, 1998).

Research into students' perspectives on feedback on their written assignments has shown overwhelmingly that feedback - independent of quality or quantity - is highly valued by students (Hartley & Skelton, 2002; Higgins, Orsmond, Merry & Reiling, 2005; Hyland, 2000; O'Donovan, Price & Rust, 2001). The provision of effective feedback, however, is subject to a number of constraints and presents substantial challenges. It has been suggested that students may not read feedback provided (Hounsell, 1987) or, if they do, they may not understand it or use it (Gibbs & Simpson, 2004; Lea & Street, 1998; McCune, 2004). In addition, in a study by MacLellan (2001), most students indicated feedback was only somewhat helpful in their understanding and learning, with nearly a third reporting that feedback was never helpful. In other published studies, students have reported feedback to be too vague or too subjective (Holmes & Smith, 2003).

From a staff perspective, providing feedback is time consuming and to be effective, its delivery is time dependent. With increasing student numbers and resource constraints, in many universities there has been an increase in the use of sessional staff, as well as a reduction in the frequency of assessments, the quality and quantity of feedback and its timely provision (Gibbs & Simpson, 2004). Also, as university courses move towards a modularised semester system, feedback may only occur when assignments are returned towards the end of a semester allowing for little, if any, formative feedback.

Providing written feedback on student report writing in the sciences is an integral part of the teaching-learning cycle. It is essential that to enhance student learning, feedback must be effective. In their model of feedback, Hattie and Timperley (2007) propose that "effective feedback must answer three major questions asked by a teacher and/or by a student: Where am I going? (What are the goals?),

How am I going? (What progress is being made toward the goal?) and Where to next? (What activities need to be undertaken to make better progress?)."

The results presented in this paper are part of a larger investigation into how Science students use feedback in their written assessments and the kinds of feedback most sought, with an aim to developing workshops to assists markers in improving their provision of effective feedback. In this paper, the results will be discussed in relation to Hattie and Timperley's (2007) model.

METHODS

A seven-section questionnaire (sections A-G) was administered to 419 second-year university Science students. The student sample was 62.6% female with a mean age of 20.2 years (range 18-47 years). Questionnaires were completed by students during class. Students were instructed to respond to questionnaire items based on their experience at university in general, not simply in their current unit of study. Sections A and B of the questionnaire focused on students' language background and tertiary writing history. Section C consisted of open-ended questions regarding their perceptions of feedback. The remaining four sections, D-G, consisted of a total of 53 items relating to i) students' perceptions of quantity, timing and quality of feedback (section D), ii) students' attitudes towards feedback (section D), iii) how students used and felt about feedback received (section F), and (iv) what types of written feedback were important (section G). Responses were recorded on a 4-point Likert scale indicating strength and direction of endorsement. To simplify analyses, responses were collapsed to form two categories corresponding to endorsement or rejection of the item; responses corresponding to 1 and 2 on the scale were grouped into "disagree" (or for section G, "not important") and those corresponding to 3 and 4 were grouped into "agree" (or for section G "important"). The number of participants in each category was then compared using Chi Square goodness of fit analyses.

RESULTS

Table 1 summarises students' attitudes regarding the feedback received. Most participants indicated that the written feedback they received was related to the assessment criteria, course objectives and to the marks given but was too brief. Most students considered negative feedback to be constructive and did not ignore it (Table 2) or report negative reactions, such as feeling demoralised or angry, in response to it. Positive feedback was reported to boost confidence (Table 2). The only statistically non-significant result in Table 1 was in relation to verbal feedback. Students were almost equally divided on whether they remembered verbal feedback, although a significant majority indicated that they received verbal feedback.

Table 1: Number of participants' endorsing/rejecting section D items and corresponding chi square analyses

Section D: How do you experience feedback?	**Disagree**	**Agree**	χ^2
1.I receive verbal feedback from teaching staff on my assignment(s)	312	95	115.70**
2.I receive written feedback from teaching staff on my assignment(s)	151	256	27.09**
3.I forget verbal feedback (on my assignments) easily	197	210	0.42
4.I feel demoralised or angry after reading negative feedback	364	43	253.17**
5.I think about giving up when I get negative feedback	357	50	231.57**
6.I see negative feedback as constructive	41	367	260.48**
7.Feedback, when handwritten, is easy to read	131	271	48.76**
8.Written feedback is related to the mark I get	95	311	114.92**
9.Written feedback is related to assessment criteria	73	332	165.63**
10.Written feedback is related to course or unit of study objectives	118	284	68.55**
11.Written feedback is too brief	118	286	69.86**

* χ^2 *significant at .05 level;* ** χ^2 *significant at .01 level*

With regard to how students used feedback (Table 2), the majority reported carefully reading and using feedback to go over the current assignment or revise work, as well as to improve future assignments. More than two-thirds of the students used the feedback even if a high grade was achieved. Students reported that receiving only a mark was unhelpful. All of these results were statistically significant. Although a significant majority of students found markers to be consistent in their application of assessment criteria, there was sizeable non-significant minority who did not find markers consistent.

Table 2: Number of participants' endorsing/rejecting section E items and corresponding chi square analyses

Section E: What do you do with feedback?	**Disagree**	**Agree**	χ^2
1.I read feedback carefully and try to understand what the feedback is saying	24	384	317.65**
2.I use feedback to go over what I have done in the assignment	51	356	228.56**
3.I act on feedback suggestions to improve my future assignments	31	377	293.42**
4.I have good intentions but forget feedback suggestions for improvement on my future assignments	249	160	19.37**
5.I use feedback only when I get a low grade	273	133	48.28**
6.I tend to read only the marks	336	71	172.54**
7.I do not use feedback for revising	293	115	77.66**
8.Positive feedback boosts my confidence	26	383	311.61**
9.I ignore negative feedback	386	21	327.33**
10.Feedback that tells me ONLY my grade does not help me	64	341	189.45**
11.I can't learn from feedback because markers differ in the way they apply the assessment criteria when marking my assignments	265	143	36.48**

* χ^2 significant at .05 level; ** χ^2 significant at .01 level

Table 3: Number of participants' endorsing/rejecting section F items and corresponding chi square analyses

Section F: How useful do you find feedback?	**Disagree**	**Agree**	χ^2
1.Feedback mainly tells me how well I am doing in relation to others	250	160	19.76**
2.Feedback is helpful to explain gaps in my knowledge and understanding	51	361	233.25**
3.Feedback provides me with useful suggestions for improvement in my assignments	47	365	245.45**
4.Feedback helps me to improve my ways of learning and studying	89	322	132.09**
5.Feedback helps me to reflect on what I have learned	130	280	54.88**
6.Once I have read the feedback I understand why I got the mark I did	130	281	55.48**
7.Feedback on assignments given to the whole class helps me to learn	185	223	3.54
8.Feedback to the whole class helps me to understand what I did right and wrong in my assignment	191	219	1.91
9.Individual feedback helps me to understand what I did right and wrong in my assignment	16	394	348.50**
10.I receive feedback on my assignment(s) in time for it to be useful for the next assignment	229	180	5.87*
11.Feedback does not help me with future assignments	349	58	208.06**
12.Feedback prompts me to go back over material covered earlier in the course	171	238	10.98**
13.Feedback encourages me to improve	42	367	258.25**
14.Written feedback is difficult to apply	343	67	185.80**
15.Written feedback is informative	61	348	201.39**

* χ^2 significant at .05 level; ** χ^2 significant at .01 level

The data significantly indicated that students found feedback helpful for improving their work, identifying gaps in their knowledge and understanding the course content (Table 3). Furthermore, students indicated that feedback encouraged reflection on what they had learned, prompted revision and encouraged them to improve. Feedback given to the whole class, however, did not appear to be regarded as helpful by the majority of students, with nearly equivalent numbers finding class-based feedback helpful and unhelpful.

Table 4: Number of participants' endorsing/rejecting section G items and corresponding chi square analyses

SECTION G: What type of written feedback is important?	**Not Important**	**Important**	χ^2
1.Feedback on your written assignments that tells you what you could do to improve	10	377	348.03**
2.Feedback on your written assignments that explains your mistakes in understanding subject matter	16	369	323.66**
3.Feedback on your written assignments that corrects your mistakes in subject matter	30	356	275.33**
4.Feedback on your written assignments that explains your mistakes in your use of language	83	303	125.39**
5.Feedback on your written assignments that corrects your mistakes in using language	103	280	81.80**
6.Feedback on your written assignments that tells you what you have done badly	26	360	289.01**
7.Feedback on your written assignments that tells you what you have done well	50	334	210.04**
8.Feedback on your written assignments that provides you with general comments	190	195	.07
9.Feedback on your written assignments that focuses on the subject matter	46	339	222.98**
10.Feedback on your written assignments that focuses on how you have written critically about a topic/experiment/essay	43	343	223.16**
11.Feedback on your written assignments that focuses on how you have argued in your writing	68	317	161.04**
12.Feedback on your written assignments that focuses on your use of evidence from sources in your writing	66	318	165.38**
13.Feedback on your written assignments that explains your grade	39	346	244.80**

* χ^2 significant at .05 level; ** χ^2 significant at .01 level

DISCUSSION

For feedback to influence learning and student performance, teachers need to convey to students not only the gap between their performance level and the expected level but also how to move towards closing this gap. The model of feedback proposed by Hattie and Timperley (2007) addresses these issues by posing three questions: Where am I going?, How am I going? and Where to next?

WHERE AM I GOING?

This question relates to goals and therefore to assessment criteria. For items D8-10, E5, 11, and G13, students strongly agreed with or reported them to be extremely important (Tables 1, 2, 4). All of these items relate to assessment criteria and explanation of the grade received. This type of feedback informs students as to their progress toward the attainment of learning goals related to particular assessments and is referred to as the "feed up" dimension (Hattie & Timperley, 2007).

HOW AM I GOING?
This question relates to actual progress being made towards the goal, for example the assessment criteria, as well as how to proceed. This feedback is intended to promote reflection on what students have and have not learned (F2, 5) and on what is correct and incorrect in their knowledge (F9, G2-5), as well as encouraging student revision (E2, F12) and indicating their position in relation to peers (F1). Students strongly agreed with all of these items (or for section G, evaluated them as "important"; Tables 2-4). Based on the data, we suggest that students recognise the value of this type of feedback in enhancing their learning and achieving assessment goals. Hattie and Timperley (2007) refer to this aspect of feedback as "the feed-back dimension."

WHERE TO NEXT?
Hattie and Timperley (2007) suggest that this question is best answered by "providing information that leads to greater possibilities for learning." The question relates to applying feedback received to improve future learning experiences and is referred to as the "feed forward" dimension of feedback (Hattie & Timperley, 2007). In our data, students strongly agreed that feedback was helpful in improving their learning, studying and hence performance in future assessments (E3, F3-4, F10-11, G1). Such a perception is encouraging because feed forward is arguably one of the overriding goals of teaching, empowering students to move beyond the context of the current assessment towards enhanced, self-directed learning.

Effective feedback can be both positive and negative (Kluger & DeNisi, 1996). To be effective, both types need to offer students information relevant to the assessment rather than commenting on the student as person (Gibbs & Simpson, 2004; Hattie & Timperley, 2007). In our data, students strongly agreed that positive feedback boosted confidence (E8) and encouraged improvement (F13; Tables 2, 3), while negative feedback was not ignored (E9) but rather viewed as constructive (D6), and did not affect motivation (D4, 5; Tables 1, 2). These data suggest that feedback received focused on the assessment rather than the "self as a person", thus providing information relating to the three questions posed in the Hattie and Timperley (2007) model.

Feedback can have a significant impact on student learning. For feedback to influence learning and performance, teachers need to convey to students not only the gap between their performance level and the expected level but also how to move towards closing this gap. The results of our study indicate that students are getting what they want in terms of feedback, and that this feedback is relating "How am I going?" to "Where am I going?" and pointing students towards "Where to next?" A question remaining for students may be "When will I get there?"

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