[O2] Student perceptions of feedback in science and technology

Paul Joyce and Peter Lumsden

Faculty of Science and Technology, University of Central Lancashire, Preston PR1 2HE
pjlumsden@uclan.ac.uk

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Introduction

The importance of feedback in enhancing student learning has been confirmed in a number of recent studies (Black and William, 1998; Hattie and Jaeger, 1998; Weaver, 2006). These all reinforce the earlier work of Hattie (1987), who carried out an in-depth review of 87 meta-analyses of the factors that influence student achievement and found that *'the most powerful single influence is feedback.'*

At the same time, though, feedback continues to be identified by students as an area of weakness. This was highlighted in the sharing good practice report from the QAA, 'Learning from Subject Review 1993 - 2001', where feedback was often found to be 'perfunctory….. with a lack of constructive comments'. More recently the National Student Surveys in the UK (2005 - 2008) highlight students' relative dissatisfaction with feedback compared with other aspects of their higher education experience. Similar findings have occurred in subject reviews carried out here at UCLan. It does seem appropriate therefore for institutions to invest some effort in exploring practice in this area, and indeed several studies have been made within disciplines (Duncan, 2007; Scott *et al*, 2009) as well as those at institutional level referred to above.

The work reported here is somewhere in between the discipline level and the Institutional level. It began as a pilot in one school in the Faculty of Science and Technology, and was then expanded to encompass all five schools. Students have been surveyed during 2006 and 2008. The approach was based on the 'Formative Assessment in Science Teaching' (FAST) project at Sheffield Hallam and the Open University (Open University and Sheffield Hallam University, 2006).

The same questionnaire was used for both 2008 and 2006, and will be repeated again in 2010, with the aim of identifying specific aspects of practice which might be school specific. A more detailed paper will be then published encompassing all of the data collected. Here we are describing the results obtained in 2008, focusing on how appropriate data analysis can reveal important and detailed information, and for that reason have included tables with statistical outputs as part of the commentary.

Methodology

We collected quantitative data using the feedback questions from the FAST project's 'Assessment Experience Questionnaire' (Brown *et al,* 2003). One second year module was selected from each of the Departments / Schools. Table 1 shows the numbers involved from the different Schools, referred to as 'groups', and coded A – E. We approached staff, who allowed us to carry out the exercise during a formal lecture period; students were asked to complete the 'Feedback Experience Questionnaire' at the start of lectures during semester two of 2007 / 08. Respondents were instructed to answer all questions based on their whole degree experience to date (rather than the module during which that lecture session happened to fall). The questionnaire had six sections; exploring **type of feedback** (section 1), **quantity and timing** of feedback (section 2), **quality** of feedback (section 3), **use of feedback** (section 4), **electronic feedback** (section 5). There was also a space for students to add extra comments on the quantity, quality, timing and the use made of feedback. Each section had up six questions.

The data was analysed using a mixture of qualitative and quantitative techniques, including the statistical software SPSS and the qualitative data analysis programme NVivo, to generate a deeper understanding of student perceptions of feedback.

Further manipulation of data

In order to make the statistical analysis of the data more robust, and simpler to digest, the individual question responses in each section were combined to create an overall section score, the average of all question responses in that section. This was done firstly by re-coding the responses from 1 to 4 (4 being the most positive), and eliminating 'don't know' replies. In addition, a number of questions were omitted from the scoring process. These include the 'what if' question types, questions 2e and 4d, and question 3a, concerning learning outcomes, which had a very high number of 'don't know' responses.

To test that combining the questions for each section would represent a coherent and valid scoring process, a simple bi-variate correlation was produced which showed a statistically significant relationship for each question within each section.

Investigating cohort size

Having made all the necessary transformations and re-coding, the results are set out in table 1; for each of the five groups of students (one per school), a collated score is shown for sections 2, 3 and 4. Results from sections 1 and 5 have not been included in this report.

Group	Number of students	Quantity and Timing (Section 2)	Quality of Feedback (Section 3)	Use made of Feedback (Section 4)
A	15	2.98	2.75	2.80
B	95	2.53	2.67	2.84
C	59	2.33	2.38	2.79
D	32	2.42	2.65	2.91
E	12	3.09	2.92	3.00

Table 1. Mean scores for Feedback experience for five different student groups

Looking first at the *quantity and timing* category (section 2), it appears that students from courses with smaller numbers (A, E) gave more positive responses than those on other courses. However, there is no clear relationship between score and size of group for larger groups. A similar pattern is apparent for the *quality of feedback* section (section 3): students from the two courses with smallest numbers gave the highest satisfaction ratings, and there is no clear-cut relationship between size and score for the three largest groups. The scores for section 4, on the *use made of feedback* are more compressed and there is no clear relationship between size and score.

These data allow the use of further standard statistical techniques to investigate in more detail the relationship between group size and response scores. Table 2 shows the result of a one-way ANOVA (analysis of variance) looking at the relationship between the groups for each feedback section. This indicates that for the sections relating to the quantity and timing of feedback (section 2) and the quality of feedback (section 3) the difference in mean scores between groups is **significant** ($p<0.05$),. However, for section 4 on the use made of feedback, the differences in ratings are not statistically significant.

Section	Comparison	Sum of Squares	df	Mean Square	F	Sig.
Quantity and Timing (Section 2)	Between Groups	9.711	4	2.428	12.131	.000
	Within Groups	41.427	207	.200		
	Total	51.139	211			
Quality of Feedback (Section 3)	Between Groups	5.041	4	1.260	7.103	.000
	Within Groups	36.548	206	.177		
	Total	41.589	210			
Use made of Feedback (Section 4)	Between Groups	.661	4	.165	1.193	.315
	Within Groups	28.700	207	.139		
	Total	29.361	211			

Table 2. ANOVA for scores for sections 2, 3 and 4

This analysis can then be extended using an additional statistical method, post hoc Tukey's test. One of the outputs of this test is to produce sets of homogeneous groups; i.e. groups that share the same characteristics in relation to each other. The results for each section of the questionnaire are set out in tables 3, 4 and 5.

The output in table 3 reinforces the initial analysis that for quantity and timing there are two distinct subgroups; the respondents from the smaller groups and the rest, with the smaller groups' scores being significantly higher.

	Number	Subset for alpha = .05	
Group		2	1
C	59	2.3251	
D	32	2.4177	
B	94	2.5337	
A	15		2.9844
E	12		3.0889
Sig.		.491	.928

Table 3. Tukey test for homogeneous subsets for Quantity and timing of feedback

The analysis for quality of feedback (table 4) reveals a greater degree of complexity. There are two subsets, but they overlap, with the only real differences apparent at the ends of the score range.

	Number of responses	Subset for alpha = .05	
Group		2	1
C	59	2.3751	
D	32	2.6458	2.6458
B	93	2.6697	2.6697
A	15		2.7500
E	12		2.9167
Sig.		.114	.175

Table 4. Tukey test for homogeneous subsets for Quality of feedback

From the analysis of responses for Use made of feedback, no subsets emerge (table 5). All the responses are placed in the same grouping, suggesting that for this aspect of feedback there is no group (school) related influence.

Module	Number of responses	Subset for alpha = .05
	1	1
C	59	2.7870
A	15	2.8033
B	94	2.8367
D	32	2.9135
E	12	2.9986
Sig.		.286

Table 5. Tukey test for homogeneous subsets for Use made of feedback

The implication of this homogeneity is explored in the analysis of the written comments in the following section.

Qualitative data: student comments

The questionnaire had space for students to add extra comments. An initial analysis divided these into positive and negative, and as shown in table 6, only a quarter were coded as positive.

Extra comments, written feedback	A	B	C	D	E	Total
Number of comments	3	35	24	12	3	77
Positive comments	2	7	5	2	3	19

Table 6. Number of comments per module and number of positive comments

Whilst we might dismiss the negative comments as coming from disgruntled students, a further analysis of the data does not support this. What we have done is to group all respondents together, and then to separate them into those who did and those who did not give extra comments. Mean scores for each section were then determined, and these are shown in table 7. This shows that the individuals who added a written comment on the questionnaire gave lower scores for the quantity, timing and quality of feedback than those who made no comment. However, these individuals also gave a higher score for the *Use made of feedback* than non-respondents. We might reasonably conclude that these students are the ones who engage with the feedback experience the most and who therefore are better able to provide a critique of the process, including identifying shortcomings.

	Extra comments made	N	Mean	Std. Deviation	Std. Error Mean
Quantity and Timing (Section 2)	no	135	2.6143	.48049	.04135
	yes	77	2.3587	.47292	.05389
Quality of Feedback (Section 3)	no	134	2.6607	.43822	.03786
	yes	77	2.5039	.44196	.05037
Use made of Feedback (Section 4)	no	135	2.8007	.37652	.03241
	yes	77	2.9123	.35824	.04083

All above results significant p<0.05

Table 7. Group Statistics giving mean scores for students who did and did not give extra written comments

This is also apparent when reading the comments. There is a depth and clarity of understanding that adds weight to the interpretation that these students are those that are critically engaging with

the feedback process. Further support for the notion of a separate, 'critical engagement' group, is indicated in the figure below (figure 1). Here we have re-visited the scores for question 2e, 'I would learn more if I received more feedback', and plotted them against those for question 2a, 'I get plenty of feedback on how I'm doing'.

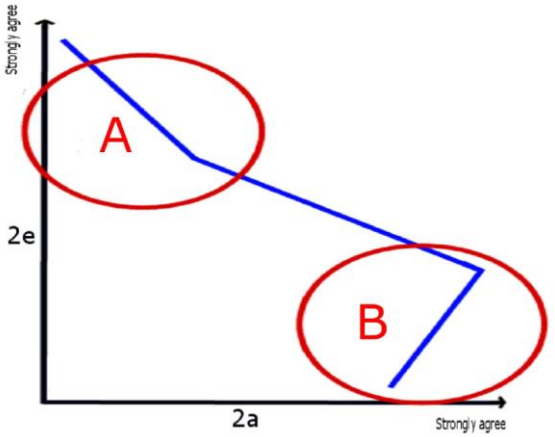

Figure 1. Relationship between scores for 'learning more if I received more feedback' (2e) and 'amount of feedback received' (2a), showing two groupings into which students fall

This figure indicates that respondents who are more satisfied with the amount of feedback they receive (scores approaching 4) do not feel they could make use of more feedback, and vice versa, i.e. they are getting sufficient so that they would not learn more if they got more. Conversely if the score is lower on question 2a, then there is an awareness that more would lead to greater learning. One might intuitively expect this, so it is reassuring that the actual data bear this out.

However, this analysis also reveals that the students who commented and those who did not form statistically significant groups which align to different parts of the figure. Those who made comments tended to occupy area A of the graph, with lower scores for the amount of feedback and higher scores on learning from more feedback. In contrast the non-comment students gravitated towards the B area of the graph, with higher satisfaction with the amount of feedback and lower scores for learning more if provided with more.

Again the inference, taking the qualitative and quantitative data together, is that the students who make comments are less satisfied with the quantity, timing and quality of feedback, and they are also the students who would welcome and would make use of more feedback. They are likely to be the students whose views would be most useful in gauging the impact of feedback and assessment on the learning process.

A number of common themes emerged from the written comments, which fitted into six categories:

Amount of feedback	either an absence of any kind of feedback or feedback is minimal.
Timing of feedback	the return of feedback is not as soon as it should be and interferes with revision planning and future assignments.
Vague or generic feedback	feedback lacks detail, is not individual and carries limited amounts of useful information.
Inconsistent feedback	the content of feedback varies across courses and modules, and within them, and is often contradictory.

Understanding feedback feedback is hard to understand, there is a lack of clarity in the language in which it is stated. There are also issues of legibility.

Guidance/ constructive feedback not providing enough information with which to make improvements or make progress on to the next level of learning.

Using the above categories the comments where coded and the number of codings per category listed. As there were only a limited number of comments for the smaller groups they have been omitted from this analysis.

Category for comments	Student group D n	D %	B n	B %	C N	C %	All n	All %
Amount	5	15.2	2	3.7	11	22.0	18	22.0
Timing	4	12.1	13	24.1	10	20.0	27	20.0
Vague/Generic	5	15.2	2	3.7	7	14.0	15	14.0
Consistent	5	15.2	20	37.0	4	8.0	29	8.0
Clarity/Understanding	6	18.2	8	14.8	5	10.0	19	10.0
Guidance/Constructive	8	24.2	9	16.7	13	26.0	31	26.0
Total	33		54		50		139	

Table 8. Number of codings per category per module, as a total and as a %

The results in percentage terms are set out graphically below (Figure 2)

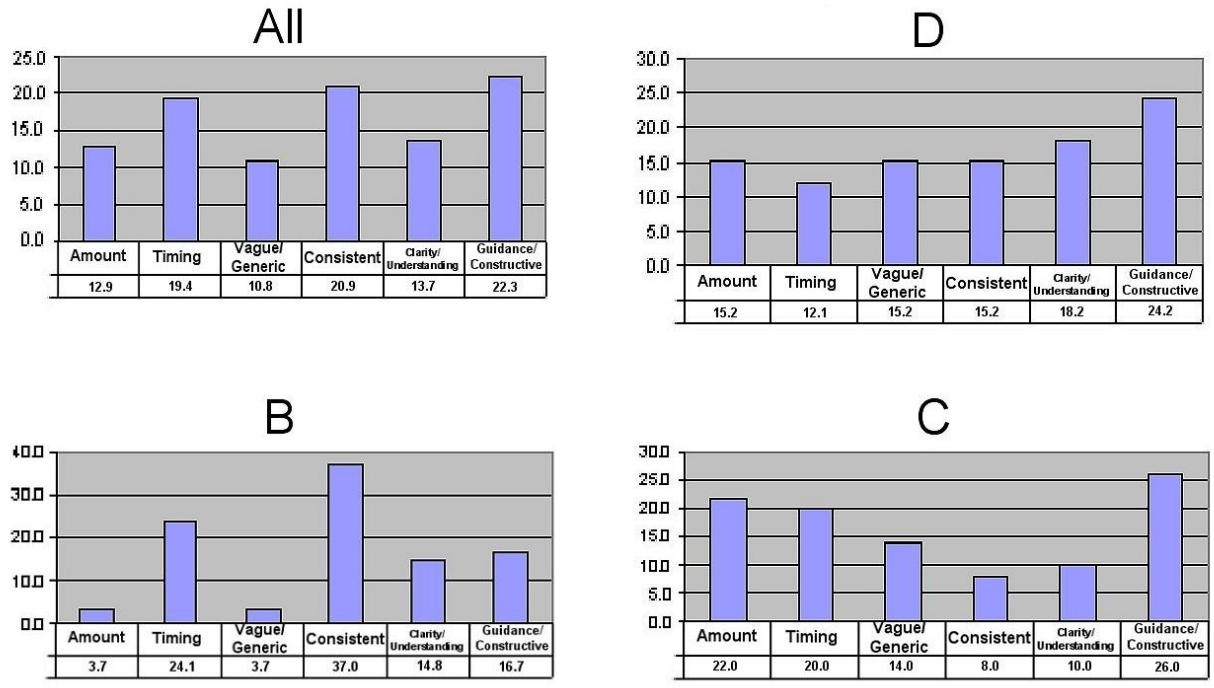

Figure 2. Frequency of different categories of comment for the three largest groups (schools) and for the whole faculty

The pattern of these profiles is clearly different. This suggests that the experience of feedback is not uniform across courses and that aspects identified by students in their comments are characteristic of a particular learning environment (school or course). For example, group B appear to highlight an issue of consistency and timing, illustrated by the following examples of comments:

- *Feedback on assignments only seems to relate to what the individual marker is looking for, e.g. subheading in certain places not always required by all markers. Inconsistency between markers.*
- *Inconsistency of tutors and how to write lab reports. Tutors not always available to talk back over marks received. Limited time available.*
- *It is difficult to use feedback for subsequent assignments because there is so much inconsistency between markers, based on each marker's personal preferences rather than what is in the marking criteria. Sometimes feedback is barely legible. Feedback should be received quicker, for it to be useful.*

For group C respondents the pattern is different, with the main issues being around the amount of feedback, its timing and lack of guidance. In particular, problems associated with feedback for subject x are mentioned.

- *More feedback! We cannot see where we are going wrong to make changes to our next assignment/exams. Lateness of feedback during last semester (subject x) was horrendous as the same/similar questions cropped up in the exam as for the assignment and so we have not understood the question or topic, we don't have a clue. But even then when we did receive our assignments there was no feedback so I don't know where I have gone wrong for next years module! We never have meetings with tutors and these would be very useful!*
- *More detailed feedback would be useful. Discussing it in class would help. The feedback I have received has never been useful. Especially in x, feedback was late. No helpful feedback unable to improve if don't understand it.*

Conclusion

In this paper we have shown that a combination of qualitative and quantitative data analysis can reveal a rich picture of student perceptions of feedback, based on a sample of students from five different schools. There are significant differences in perceptions of quantity / timing and quality between these schools, and in the types of comment which students make. The analysis also suggests that students who made comments on feedback are a sub-group who are critically engaged with the feedback process. This analysis should help staff to critically evaluate and examine their practice in the area of providing feedback to students.

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