

## **Feedback on feedback on one mathematics enhancement course**

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This paper reports on changes in students' perceptions of assessment during a Mathematics Subject Knowledge Enhancement Course (MEC). Students' views were gathered pre- and post-MEC via an open-question questionnaire with semi-structured interviews for some. Pre- and post-MEC understanding of mathematics features highly in the students' sense of progress, but few had experienced feedback prior to the MEC. Post-MEC feedback is viewed as the most useful aspect aiding their sense of progress.

**Keywords: summative assessment; formative assessment; feedback; understanding**

### **Introduction**

The Mathematics Subject Knowledge Enhancement Course (MEC) is designed for post-graduates whose degrees contain insufficient mathematical subject knowledge for direct entry to Initial Teacher Training (ITT). It aims to provide students with deep understanding of mathematical concepts and their inter-connectedness, as opposed to surface or rote learning.

Understanding cannot be represented by any single or simple model (Pirie 1988). Several models exist such as Skemp's (1979) schema, in which isolated concepts become more connected as understanding takes place. That connections are an important part of understanding is backed up by Mousley (2004), whose literature review demonstrated that development of understanding is focused on 'connected knowing'. Hence I am using the following succinct summary as a working definition of understanding.

A mathematical idea or procedure or fact is understood if it is part of an internal network. More specifically, the mathematics is understood if its mental representation is part of a network of representations. The degree of understanding is determined by the number and the strength of the connections. (Hiebert and Carpenter 1992, 67)

Moreover, Hiebert and Carpenter (1992) point out that a variety of tasks are needed in order to avoid an individual task being done by rote with no understanding.

On completion of the course, I am required to report on students' readiness to progress to their ITT course. Since the inception of the MEC, I have been determined that assessment occurring throughout the course should support the students' learning and understanding and give a sense of progress.

The assessment regime is based on Black and Wiliam's (1998) guidance for using assessment to focus on learning. A wide range of tools are used such as researching and presenting a topic of their own choice; traditional tests; writing their own test and sitting one written by a peer; posters; investigations; and others. Initially, all tasks are used formatively i.e., to aid student learning. Work is returned to students with tutor comments. Students write their response to this and then use a criterion-referenced grid to grade their work. It is only after this process that tutors give grades.

## **Summative, formative assessment and feedback**

Black and Wiliam's (1998) opinion that formative assessment impacts positively on student learning is backed up by Higgins, Hartley and Skelton (2002) who describe how assessment methods influence the quality of learning, saying, moreover, that formative feedback resulting from assessment can lead to deep rather than surface learning and that a positive impact occurs when students 'connect' with the feedback. Deep learning is not an automatic consequence of feedback. According to Struyven, Dochy and Janssens, "students' perceptions about assessment and their approaches to learning are strongly related" (2005, 336) and "a surface approach to learning is easily induced, whereas promoting the deep approach seems to be more problematic". So, it is likely that some feedback methods will be more effective than others. Murtagh and Baker's (2009) analysis of feedback delivery methods, "revealed explicitly that the students much welcome all of the feedback strategies that are employed across the programme" (2009, 24), whilst one-one tutorials were the most highly rated method.

Orsmond, Merry and Reiling (2004) caution that, since the student learning experience is shaped by assessment, the tutor feedback and student learning should be inseparable. If they become separated the formative aspect is lost. Bailey and Garner (2010) highlight some difficulties with feedback such as it can be opaque; its purposes can be ambivalent; and practices vary between tutors. MEC tutors have been working on these issues over several years with assessment planned as an integral part of the course and moderation to ensure consistent standards of feedback.

Ideally, we would use comment-only marking as suggested by Black and Wiliam (1998) but, given that summative assessment is required by the institution, the choice seems to be either to use the formative task in a summative manner or to have formative tasks and separate summative tasks, duplicating effort to find out nothing new. Indeed, Newton (2007) argues that there is no difference between the two forms of assessment, only the use to which the results are put. Taras thinks that the only difference between summative and formative assessment is timing, arguing that all assessment is in fact summative of the learning to that point and "formative assessment is in fact summative assessment plus feedback which is used by the learner" (2005, 466). In Newton's terms, our assessment regime has been designed to prioritise formative over summative assessment, moreover "summative judgements could be derived from an aggregation of judgements made for formative purposes." (2007, 154).

Some tasks on the MEC are accepted by the students without complaint whilst, anecdotally, one in particular is often seen as not 'valid'. This task involves writing a test for peers. Each test is taken by one other member of the cohort, i.e., each student sits a different test. They are assessed on how fully their own test covers the topic and also on their ability to answer the peer's test. In my opinion, this task is the most valid, i.e., assessing that which it is intended to assess, of those used but less reliable, i.e., less likely to give exactly the same result if repeated. Perhaps their use of 'valid' could be substituted with 'fair'. I think this process is fair because we feedback based on what we see individuals have done, need to do and could do. Yet some students perceive unfairness, perhaps because we use the results from this task to form a summative statement, and because as Taras says, this "requires reliability (of grades or classification) to take precedence over validity (of assessment)" (2005, 474).

Hence, I decided to investigate what perceptions students hold of assessment, in particular what their perceptions are at the beginning and end of the MEC, not just of fairness but more generally.

## Research Design/Method

I planned this naturalistic investigation as a preliminary study to attempt to identify what views students hold. I wanted to minimise the effect of my own and others' opinions in order to hear students' views as clearly as possible.

With 19 students starting the course, interviewing all was not practical. An open-question questionnaire was used to elicit views from all. This was repeated at the end of the course, slightly amended to ask about their time on the MEC.

Additionally, permission was requested for use of students' reflective logs; assessment feedback; circle-time discussions; interviews at the end of the course; and possible future interviews.

16 students completed the course of whom 10 gave permission for all of the above; 1 refused use of anything; and the rest gave varying permissions. Of the 10 students who gave full permissions, 5 were interviewed using naturalistic/semi-structured interviews in order to allow opinions to be expressed freely (Gray 2009; Cohen, Manion and Morrison 2011). I attempted to choose these to be representative of the cohort in terms of gender and prior qualifications but, ultimately, the choice was made pragmatically based on who was available and would be easily accessible in the future for follow-up interviews.

The pre-course answers were analysed using a generalised form of thematic analysis based on Rapley (2011). Member checking (Cohen, Manion and Morrison 2011) was performed by asking all students to code their own responses under these themes and my coding adjusted as a result. Post-course answers were then analysed using the same themes.

## Data analysis

My focus here is on the two questions I have analysed at this point: Q1 "Describe how *you knew* how well you were doing in mathematics." and Q3 "What do you think is most useful for you to know how well you are doing in mathematics?" The number of responses coded under each theme is shown in table 1 below.

Theme	Q1	Q3
Correct Answers	8	2
Marks	7	2
Easy/ability	3	0
Enjoyment	1	0
Understanding	8	5
Teachers	4	4
Confidence	3	2
Comparison with others	2	0
Self-help?	1	6
Reliance on method?	2	1
Lack of fear (student insisted this is not any of above)	1	0

Table 1: Pre MEC - Prevalence of themes from Q1&3 of questionnaire

The table appears to show an apparent mismatch between how they knew and how they find it most useful to know. Understanding features highly in both lists. But correct marks and answers, which are highest in how they actually knew, are replaced by self-help when considering what they found most useful, raising several questions that I wish to explore in more detail, for instance who decided if the answers are

correct? The switch to self-help, when thinking about what is most useful, may imply, perhaps, the teachers rather than the students? One student coded “High marks in exams” as ‘Correct answers’ whilst I had coded it as ‘Marks’. It may be that the two categories are in fact one or need to be split in some different way. Only one student mentioned “feedback” which they coded as ‘Teachers’.

### Post-course results

13 students completed the post-course questionnaire. See table 2 below.

Theme	Q1	Q3
Correct Answers	2	0
Marks	6	4
Easy/ability	0	0
Enjoyment	0	0
Understanding	7	4
Teachers	1	2
Confidence	3	0
Comparison with others	1	0
Self-help?	1	0
Reliance on method?	0	0
Lack of fear	0	0
Feedback	4	3

Table 2: Post MEC - Prevalence of themes from Q1&3 of questionnaire

Table 1 included responses from 17 students therefore direct numerical comparison with Table 2 is difficult, however, there are several things that I noticed immediately. ‘Correct answers’ appears to be far less important for how they knew how well they were doing, although ‘marks’ and ‘understanding’ remain important. However, a new theme of feedback was needed in order to code several responses e.g., Assessment feedback, “being regularly assessed and getting assessment feedback”, whilst four themes were not mentioned at all.

Responses to ‘what is most useful?’ are coded under four themes only: marks; understanding; feedback; and teachers. ‘Correct answers’ is no longer a frequently occurring theme, perhaps this indicates that marks and correct answers are either somehow different and dependence on correct answers has decreased, or that perceptions of correct answers has changed. ‘Feedback’ and ‘teachers’ need further exploration since ‘feedback’ is given by teachers and the only response in the pre-course data that mentioned ‘feedback’ was coded as ‘teachers’ by the participant.

### Interviews

In order to try to understand what has changed, the 5 interview transcripts were inspected alongside the rest of the data on a student-by-student basis. I include a brief overview of 2 students below.

#### *Student A*

In the pre-MEC questionnaire, ‘A’ talked about fear; “teacher scared the living daylights out of me” but also of her enjoyment of doing questions if she could understand them. She continued to demonstrate this dichotomy during the MEC. Her reflective logs mentioned understanding frequently. For example, “I just wanted to understand why.... woke up in the morning understanding”. References to fear also

occurred frequently e.g., “Graphs bring me out in a cold sweat. I feel fearful before I’ve even read the question.” Moreover, she raised questions for herself to follow up, e.g., “I’m not really sure what triangle numbers are all about, yet. What’s their relevance?” Fear and real interest are sitting (uncomfortably?) side by side.

The other theme repeatedly coming out of her log was the amount of time she was spending coupled with a sense of failure, e.g., commenting on the pace of lessons, “I understand and can apply *suvat* equations when I work on the questions at home, but in class I feel panicky” or “I’ve spent hours and hours working on this and I feel very deflated”. She continued to work with determination and later reported, “.... I’ve been able to complete the papers...” and I found no more mention of fear.

In the post-MEC questionnaire, ‘A’ described how she, “Didn’t find ‘exam’ results useful at all in school” perhaps implying that now she does? In interviews, she explained that examinations feel like they are testing knowledge but other types of assessment task are more than that. ‘A’ particularly liked tasks that could be taken home and worked on in her own time. I surmised perhaps as a result of the effect of time pressure but actually ‘A’ saw these as a continuation of the learning process (“Every single one I took home I learnt so much more than learning it for an exam”) and therefore useful.

‘A’ compared how she knew how well she was doing prior to the MEC as only from “end of year exams” and “getting the ‘right’ answer in class”, but after the MEC as “understanding. Understood links with other areas. Assessments.” She also said the “staged assessments” were the most useful way for her to know this. Although she does not use the word feedback, in my opinion this is implied because she engaged thoroughly with the feedback process, e.g., “I am happy that I fully understand the concepts of straight line graphs. I can see where I didn’t use precise terminology in part 2 and understand my errors.”

### ***Student K***

‘K’ said that correct answers, marks and understanding were important pre-MEC, describing learning as a feat of memory, “I definitely remember at school cramming before an exam and going in and it’s all just in that short-term memory pull it all out onto the page bang and the examiner says end of the exam pick your bag up and you walk out and you can’t even remember the questions you’ve answered”. Post-MEC he considered understanding and feedback as important. Talking about MEC assessments he said “where you know really having to justify everything from first principles but then actually having reflected on it I say well this is great”

In his reflective log, he talked about feedback from tutors as important but also the ability to explain to others, as he saw this as essential for a future in teaching. He also enjoyed the assessment task and found the feedback useful e.g., “I enjoyed this piece of work as it helped me check my understanding”.

### **Conclusion**

The MEC students’ responses indicate their views on how they know how well they are doing have altered from a reliance on correct answers and marks to feedback, although it is not clear in what ways correct answers and marks overlap or differ. Connection with the feedback is evident. I would argue that subsequent work frequently demonstrates that feedback has been acted on, although evidence of this is not given here. Questionnaires and interview responses describe feedback as useful

with assessment tasks being enjoyable and part of the learning process, indicating a close link is present between the formative feedback and their learning.

Further discussion is needed with this set of participants to clarify boundaries between the themes in order to enable more accurate coding when working with future cohorts. In particular, it is not clear whether 'correct answers' and 'marks' are the same or in what way they differ. Nor is it apparent who decides the answers are correct (students, teachers, book etc.). Where the coding 'teachers' has been used what is the nature of reliance on the teacher and does this include marks and written feedback? Understanding featured highly both pre- and post-MEC. As yet I have made no attempt to analyse what students mean by understanding. Their perception of what it means to understand may be very different to mine. This would be a valuable future investigation.

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