

## **Revisiting students' perceptions of feedback on one Mathematics Enhancement Course**

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A Mathematics Subject Knowledge Enhancement Course (MEC or SKE) is designed for non-mathematics specialists to bring their subject knowledge to the required level prior to commencing training as a mathematics teacher. Having previously found, with one cohort, that over the length of the course students' reliance on teachers and correct answers decreased whilst reliance on feedback increased, I was left with unanswered questions as to what it means to rely on either correct answers or feedback. I am now reporting on my research with another cohort, which was undertaken to discover if the same patterns occurred and the same questions raised. This second cohort also appeared to move away from correct answers. The outstanding questions are whether correct answers and feedback are viewed by the students as external influences on their decisions or whether they are taking responsibility for next steps themselves.

**Keywords: feedback; understanding; assessment; mathematics enhancement; SKE.**

### **Introduction**

The Mathematics Enhancement Course (MEC) is a course designed for postgraduates who need to increase their mathematics subject knowledge in order to take up a place on an Initial Teacher Education programme. As such the MEC, for which I am the course leader, is designed to build a depth of understanding of the fundamentals of mathematics and its interconnectivity through discussion based group work.

The assessment regime used on our MEC has been created to attempt to assess understanding. What is meant by understanding is a complex question that I will not address here, other than to say that Pirie (1988) considers it would be impossible to describe understanding using a single model. Neither can understanding be assessed by a single method (Hiebert and Carpenter, 1992), therefore our assessment regime uses a range of assessment tasks.

Students' approach to learning has been shown to be influenced by their view of how it is assessed (Struyen, Dochy & Janssens., 2005). Our assessment tasks are designed to not only allow for but to encourage learning to take place through engagement in assessment (Newton, 2007). In addition, since formative assessment, when done well, has been shown to encourage students to form better learning practices (Black and Wiliam, 1998) students receive written (and verbal) feedback on their work from the tutors.

I have previously reported (Stansfield, 2012) on a small study, undertaken as part of my PhD, exploring how students' perceptions of assessment changed during the MEC. The study left unanswered questions from my analysis of an early cohort which I shall call Cantor. By repeating the same research process with another cohort (Zadeh) in the same manner as the Cantor analysis I hoped to see if the same issues

and questions would arise as for Cantor. My aim was to give myself a secure grounding from which to make sensible decisions about the next actions that are necessary to form the main study. In particular, I need to ensure that the methods used are allowing me to access the students' views on assessment.

Below I give a summary of the original analysis of Cantor, followed by a summary of the analysis of Zadeh and the resulting decisions these analyses enabled me to take.

### Summary of Cantor study

The Cantor study was undertaken using pre- and post-course open question questionnaires in order to get responses from as many students as possible, followed by in-depth semi-structured interviews to allow for freedom of expression (Cohen, Manion & Morrison, 2011, Gray, 2009). Two questions were analysed using thematic analysis based on Rapley (2011). They are,

Q1: Describe how you knew how well you were doing in mathematics (on the MEC)

Q3: What do you think is the most useful for you to know how well you are doing in mathematics (on the MEC).

Table 1 below shows the number of responses coded under each theme for each question pre- and post-MEC.

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

Table 1: Prevalence of themes from Q1&3 of questionnaire (Cantor)

The original Cantor study focussed on the themes highlighted in bold in the table. Some themes, highlighted in italics in the table and only mentioned by one student, are considered not to be important on a cohort level, although they may be of immense importance on an individual level.

The number of course participants was small (17 pre-MEC and 13 post-MEC). Despite the low number and difference in sample sizes patterns could be observed. For example, taken together, reliance on "Correct answers"/"Marks" fell. At the same time reliance on "Teachers" also decreased. This could be because marks and answers are given by the teacher. However, taken separately, reliance on "Marks" stayed steady, whilst reliance on "Correct answers" fell, which could indicate that reliance on teachers is still high since marks are given by the teacher whilst correct answers may

be determined in different ways. It is not clear from the Cantor study whether there is a difference between “Marks” and “Correct answers” or not.

The second notable difference is “Feedback” which was not mentioned pre-MEC, but post-MEC is mentioned by one third of the participants.

Furthermore, contrasting how you knew (Q1) with what is most useful to know (Q3) a much wider range of themes was needed pre-MEC than post-MEC. This could be because the MEC tutors are giving clearer indication via marks and feedback than students had previously encountered, or it could be that the students are becoming more independent. However, I must also consider the alternative that MEC tutors are in some way restricting methods available to students for knowing how well they are doing. Whichever interpretation is chosen, there does appear to be a shift in students’ thinking from reliance on external factors such as teachers to more reliance on themselves. This shift is further illustrated by looking at comments made by individual students. For example, student A described how well she knew how well she was doing prior to the MEC as being from end of year exams, whilst post-MEC she valued the opportunity to take home assessment tasks which allowed her to continue learning and to recognise her own learning and understanding. A similar view was expressed by student K who said that prior to the MEC he had simply crammed for exams and then forgot everything, whilst post-MEC he found that opportunities to discuss his thinking with others useful, as well as being able to use assessment tasks to check his own understanding.

In summary, there appears to be a shift from reliance on external to internal factors. The outstanding questions from the Cantor study are what is meant by correct answers and marks, are they the same or in what ways do they differ? Who decides if an answer is right? What is meant by reliance on teachers and how does reliance on teachers contrast with self-help?

### Zadeh cohort

I have purposely repeated the same study as far as possible in the same manner with the Zadeh cohort.

Table 2 below shows the corresponding table of results for the Zadeh cohort.

Theme	Q1 (Pre)	Q3 (Pre)	Q1 (Post)	Q3 (Post)
<b>Correct Answers</b>	<b>3</b>	<b>1</b>		
<b>Marks</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>1</b>
Easy/ability		1	1	
<i>Enjoyment</i>				
Understanding	3	2		1
<b>Teachers</b>	<b>1</b>			
Confidence			2	
Comparison with others	2		1	
<i>Self-help?</i>			1	
Reliance on method?				
<i>Lack of fear (student insisted this is not any of above)</i>				
<b>Feedback</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>
<i>Comparison with self</i>		1		1

Table 2: Prevalence of themes from Q1&3 of questionnaire (Zadeh)

The table reinforces my view that some themes are of importance on an individual basis but not on a cohort basis since those that had low prevalence for Cantor (“Lack of fear”, “Enjoyment”) also do for Zadeh, whilst “Reliance on method” and “Easy/ability” appear to join this group too.

With Zadeh pre- and post- MEC samples are the same size. The same 7 students appear in both. With only half as many participants in the Zadeh cohort as Cantor cohort it is even more difficult to draw any firm conclusions. However some patterns can be identified despite the small numbers.

As with Cantor, Zadeh demonstrates a reduced reliance on “Correct answers” and “Marks” post-MEC compared with pre-MEC. It is not possible to see whether there is any link with a decrease in reliance on “Teachers” since teachers were only mentioned once. However if “Self-help” and “Confidence” have increased post-MEC for Zadeh it could be taken to mean an increase in self-reliance as reliance on the teacher drops.

There is a mixed message on “Feedback” and “Understanding”. It is hard to say whether reliance on feedback has changed since taking Q1 and Q3 together it stays constant, and, taking them separately can a change of one person be taken as meaningful? Reliance on understanding has decreased, but as I have not yet explored what the students mean by understanding, it could be that their interpretation of what it means to understand has changed, or that they have simply written a different description. For example I have added an extra line at the bottom of the table because one student wrote comparison with self as the most useful way to know how well he was doing. This could mean comparison with his own previous understanding for example. Without more in-depth knowledge of the students’ intentions I cannot say more.

As yet individual interviews have not taken place with the Zadeh cohort therefore only the questionnaire responses can be analysed. Looking at the questionnaire responses on an individual level, pre-MEC student N said “I did enjoy getting good grades as this told me I was getting things right”. Post-MEC he said “The most useful is personal reflection on how I have developed and progressed. When I sit down and read my reflective log I will be able to see this progression.” This shows a shift away from marks and towards his own self-assessment.

Another student who also gave evidence of a changing view was student H who pre-MEC said “I knew I was doing well from the feedback I received in the lessons as well as the grades I achieved in assessments.” and post-MEC “I assessed my own ability based on how well I did in assessments.” The way these statements are written leads me to believe that this student is also showing a shift towards self-reliance, albeit from a different start and end point, since the pre-MEC statement has a sense of passivity of ‘this is being done to me’ whilst the post-MEC statement is more active ‘this is what I am doing’.

Not everyone shows the same shift in their thinking. Pre-MEC student F says she knew how well she was doing because “I can follow the teacher’s instructions and complete the examples given.”, as well as “marks/grades given for homework and tests.” Post-MEC she says, “when I am able to do the work before others or quicker than those around me.” F seems to have made some changes in her thinking and is perhaps less reliant on the teacher. Having broadened her outlook to comparison with those around her, she appears to be still reliant on external factors and not yet on herself.

The same issues appear to be arising in the Zadeh cohort as in Cantor. Students appear to be shifting their views away from reliance on external factors such as the teacher towards reliance on themselves although their starting points and the amount by which they shift varies. Further insight is needed into what is meant by each of the factors such as correct answers and reliance on teacher or self.

### **Where next?**

Repeating the Cantor study with the Zadeh cohort has highlighted several issues that need to be considered before moving forward. Firstly, the cohort size has decreased by half between Cantor and Zadeh, and is likely to be even smaller with the next cohort, so this method of analysis involving counting is going to be less likely to show up any meaningful patterns in future. Moreover, I have a large number of themes for a small number of students, whereas looking at each student's answers gives a sense of changing or not changing.

In the Cantor cohort, reliance on teachers seems to decrease along with reliance on correct answers. Overall there appears to be a shift during the course from reliance on external factors such as teachers and marks towards reliance on self.

One possibility to consider is re-analysing both Cantor and Zadeh by looking for a shift from reliance on teacher through comparison with others to comparison with self to give a sense of the what is happening to the cohort, and then possibly subdivide statements into types of external factors and types of internal factors for example as a secondary step. In which case it may be better not to include the 4 from the pre-MEC sample for whom there is no post-MEC data to make direct comparison easier.

My analysis so far has only looked at themes which occur several times and where there is a change in numbers pre- and post-MEC. Referring to table 1 and 2 there are several themes highlighted in italics which are only mentioned by one student (or none with Zadeh), since I did not consider these important on a cohort level I have not done anything with them. However these themes could be of huge significance on an individual level and so need to be captured and retained.

According to Braun and Clark (2006) what becomes a theme is down to the researcher's judgement. It is not necessarily the most frequently occurring themes that are most important but those most related to the research question. Whilst I agree with this to some extent, I am trying to get a sense of what is important to the cohort at a cohort level and therefore need to include only those themes that appear cohort wide. The individual themes need to be addressed individually.

Buetow (2010) suggests saliency analysis as an extension of thematic analysis. As well as assessing recurrence of themes, it is also necessary to assess the importance of the theme. He says, "Saliency analysis identifies and keeps visible what stands out from qualitative data." (ibid, p123)

Some of the students' responses to the questionnaire questions are quite short and so lack depth. Individual interviews with Cantor students allowed issues to be explored in more detail. Since interviewing is time consuming and is focussed on a subset of the cohort, in order to get more depth from the whole cohort I need to consider how to get fuller written responses at the outset. So far I have only analysed Q1 and Q3. It may be that by removing the other questions and presenting the students with a shorter overall questionnaire whilst increasing the amount of space available for responding to these two questions will elicit longer more insightful responses.

Another issue to consider is that it proved very difficult to code the Zadeh data in the same manner as done for Cantor. With Cantor I used a naïve coding method of if the word occurred e.g. understanding then that statement was coded as understanding, whereas now I am finding it difficult to do this since my own thinking seems to have become more interpretative in the intervening time and I had to force myself to simply code using the occurrence of the key word. Re-analysing both cohorts at the same time would ensure that the data is coded in the same manner for both.

## Conclusion

The same issues are being raised in Zadeh as with Cantor. The method used so far is giving some insight into the students' changing perceptions but is not going to continue to be useful with smaller cohort sizes, so a new method needs to be developed. It would appear sensible to start by reanalysing Cantor and Zadeh cohorts by looking for changes from external to internal factors and tracking the change in some form. More depth is needed in order to understand what students mean by terms such as understanding, correct answers or feedback. Individual interviews do provide this depth on an individual basis but not necessarily on a cohort level. Other avenues need to be considered to encourage fuller written responses to the questionnaire.

## References

- Black, P., and Wiliam, D. (1998). *Inside the black box: Raising Standards through classroom assessment*. London Kings College.
- Braun, V. and Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research In Psychology*. 3 (2): 77-101.
- Buetow, S. (2010). Thematic analysis and its reconceptualization as 'saliency analysis' *Journal of Health Services Research & Policy*. hsr.sagepub.com accessed August 20 2014.
- Cohen, L., Manion, L. and Morrison, K. (2011). *Research Methods in Education (7th Ed.)* Oxford, Routledge.
- Gray, D. (2009). *Doing Research in the Real World*. London, Sage
- Hiebert, J. and Carpenter, T.P. (1992). Ch4 Learning and Teaching with Understanding in Grouws, D.A.(Ed.) *Handbook of Research on Mathematics Teaching and Learning (Ch4)*. Macmillan.
- Newton, P. (2007). Clarifying the purposes of educational assessment. *Assessment In Education* 14: 149-70.
- Pirie, S. (1988). Understanding: Instrumental, relational, formal, intuitive...How can we know? *For the Learning of Mathematics*. 9(3): 7-11
- Rapley, T. (2011). Some Pragmatics of Qualitative Data Analysis. In Silverman, D. (Ed.) *Qualitative Research* London, Sage.
- Stansfield, J., 2012 'Feedback on feedback on one mathematics enhancement course' *Proceedings of the British Society for Research into Learning Mathematics*. 32 (3): 173-178.
- Struyven, K., Dochy, F., and Janssens, S. (2005). Students' perception of evaluation and assessment in higher education: a review. *Assessment & Evaluation In Higher Education* 30(4): 325-41.