OBSERVING SUBJECT KNOWLEDGE IN ACTION: CHARACTERISTICS OF LESSON OBSERVATION FEEDBACK GIVEN TO TRAINEES

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This paper outlines the main findings of a small-scale study in which the relative frequency of comments about elements of mathematics teaching found in written feedback given to primary trainee teachers by school-based mentors, university mathematics tutors and university tutors of other subjects was investigated. Further issues are raised regarding the awareness of some observer groups about 'contingency' elements of trainees' mathematics teaching.

INTRODUCTION

Shifts in Initial Teacher Training Requirements

'Teaching: High Status, High Standards' (DfEE, 1998) which required teacher training providers to audit and address perceived weaknesses in trainees' subject knowledge assumed a 'deficit model of teacher's knowledge: highlighting what they appear not to know and deducing that improving teachers' own subject knowledge would lead to better teaching' (Poulsen, 2001, p. 43). More recent requirements state that 'evidence of secure subject knowledge and understanding is most likely to be found in trainee teachers' teaching, particularly in how they present complex ideas, communicate subject knowledge, correct pupil errors and in how confidently they answer their subject-based questions' (TTA, 2002, p. 19). This shift in approach is based upon a new perception that subject knowledge is highly situated in classroom practice and can therefore be best acquired and assessed in this context.

Shifts in Research: The Nature of Knowledge

A similar shift exists in research-based literature. Much work on teacher subject knowledge has been based on Shulman's identification of three aspects of knowledge: subject matter knowledge (SMK), pedagogical content knowledge (PCK) and curricular knowledge. Shulman suggested that teachers 'transform' their personal knowledge (SMK) into a form that is meaningful to learners using their pedagogical content knowledge (PCK) (Shulman, 1987, p. 15). More recent work suggests that teacher subject knowledge is 'pedagogically situated within the socio-cultural community of practice of primary school teaching' (Poulsen, 2001, p. 44), is grounded in, and constrained by, classroom experience, values and beliefs (Aubrey, 1996, Meredith, 1993) and is therefore more complex than Shulman's model. A framework developed by Huckstep, Rowland and Thwaites (2002, pp.5-6) for their videotape study of 24 lessons prepared and conducted by trainee primary school teachers represents a recent approach to categorizing teachers' mathematical knowledge as evidenced in the classroom. They identified 18 categories of mathematical knowledge which have been grouped within 4 broader 'dimensions' known as the 'Knowledge Quartet': '*foundation, transformation, connection and contingency*'. A subsequent pilot project (Ainley & Luntley, 2005) develops the last of these dimensions, *contingency*, further by suggesting that it is situated '*attention-based knowledge*' which enables teachers to respond effectively to what transpires within lessons and that their evaluations of the outcomes of their contingency-related actions inform their selection of future responses in such situations.

Research about Feedback given to Trainees

Even experienced teachers find it hard to articulate what it is that they do successfully in the classroom other than in highly situated accounts (Edwards & Collinson, 1995) so review meetings following lesson observations may be crucial opportunities for developing those aspects of trainees' practice which are subject knowledge-related. However, in a recent USA-based study, only 2% of oral lesson feedback was concerned with subject-related issues (Strong & Baron, 2004, pp. 52-53). For many trainees their school placement mathematics becomes 'completely subsumed by pedagogical concerns' (e.g. classroom management) and this may be why review meetings between school-based teacher-mentors and trainees tend to focus on generic pedagogical skills rather than mathematical aspects of lessons (Brown, McNamara, Hanley & Jones, 1999, p. 309).

METHODOLOGY

The contents of 57 lesson observation proformas completed by university mathematics tutors, university tutors of other subjects and school mentors (19 proformas from each of the 3 observer groups) during their routine observations of primary trainee teachers' mathematics lessons were analysed in order to identify different elements of subject knowledge-related practice that had been judged worthy of comment. The proformas selected related to trainees from different stages in initial teacher education programmes and from a range of such programmes. A range of different observers were included within each observer group.

The different comments made by observers were assigned to one or more of the 18 categories from the 'Knowledge Quartet' framework of Huckstep *et al.* (2002: 5-6) who regard this as a comprehensive 'framework for lesson observation and for teaching development' (Rowland, 2005). For this reason, this particular framework has been used as the basis for this study. Further categorization according to the type of observer followed in order to look for differences between the quantity of feedback offered by each observer group in relation to each element of subject knowledge-related practice. Those elements which were frequently or rarely mentioned in feedback were then identified. In total, 256 observer comments were assigned to one or more of the 18 categories. Thus, a notional 'average' category would attract approximately 14 (or 5·56%) of the total number of comments.

In addition, two school mentors and one mathematics tutor were interviewed (in a largely unstructured manner) in order to explore their perceptions about the nature of subject knowledge, how it was evidenced in trainees' teaching of primary school mathematics and which aspects they were likely to comment upon in their feedback.

FINDINGS AND DISCUSSION

High Frequency Elements

There was clearly a perception that overt subject knowledge should be treated as significant and this is probably unsurprising given the Teacher Training Agency's focus on this element in recent years. All of the interviewees dwelt at length on this. The high frequency of the other categories shown in Figure 1 probably reflects the observers' awareness of the strong emphasis given to these particular aspects of mathematics teaching by the National Numeracy Strategy.

Category	Mathematics Tutors	Other Tutors	School Mentors	Overall	% of Total
Overt Subject Knowledge	11	9	9	29	11·33%
Demonstration (Teacher)	10	12	7	29	11·33%
Identification of Errors	5	9	11	25	9·77%
Choice of Representation	8	6	10	24	9·38%
Use of Terminology	7	10	4	21	8·20%

Figure 1: High Frequency Elements

Low Frequency Elements

Figure 2 below indicates the categories which occurred least frequently. The very low frequency of comments about trainees' adherence to textbooks and concentration on procedures may be the result of university tutors discouraging this type of practice during university-based training. It is perhaps more likely, however, that all observer groups tend to accept these as common practices in schools and refrain from challenging them. The limited number of comments about theoretical underpinnings suggests that all the observer groups tend to treat the theoretical and the practical as disjoint elements of initial teacher training.

Mathematics is learned principally through engagement with examples (Watson and Mason, 2001) so trainees' selection of examples would appear to be an important aspect of their teaching to monitor. Indeed, Rowland, Thwaites and Huckstep (2003, p. 8) suggest that selection of examples appears to be a 'significant indicator' of mathematics content knowledge for teaching. However, in the content analysis undertaken very few observer comments were made about the trainees' choices of examples and none of the interviewees mentioned it. It would appear from the data that all of the observer groups fail to appreciate its importance.

Category	Mathematics Tutors	Other Tutors	School Mentors	Overall	% of Total
Concentration on Procedures	1	0	0	1	0·39
Adherence to Textbook	0	0	2	2	0·78
Deviation from Agenda	3	0	0	3	1·17
Theoretical Underpinning	1	1	1	3	1·17
Choice of Examples	1	1	2	4	1·56

Figure 2: Low Frequency Elements

The Contingency Dimension

Consideration of the distribution of observer comments revealed that little written feedback is provided to trainees about any of the three elements of the '*contingency'* dimension of the 'Knowledge Quartet (Huckstep *et al.*, 2002) (see Figure 3).

Category	Mathematics Tutors	Other Tutors	School Mentors	Overall	% of Total
Deviation from Agenda	3	0	0	3	1·17%
Responding to Children's Ideas	6	3	0	9	3·51%
Use of Opportunities	4	3	1	8	3·13%

Figure 3: The Contingency Dimension

Of the 20 comments made about the '*contingency*' dimension, 13 were made by university mathematics tutors. This suggests that other observer groups either attach less value to these aspects of teaching mathematics or are less aware of this dimension when observing trainees. In the interviews, only the mathematics tutor commented (favourably) upon these elements of a trainee's practice:

> Tutor: "The children made a tangential link and the student enabled them to make links to previous learning. It wasn't planned, just a response to something that the children said."

In contrast, the school mentors interviewed strongly associated sound subject knowledge with delivering planned lesson objectives, achieving learning intentions and adhering to schemes of work, an emphasis would seem to discourage the effective use of ad-hoc learning opportunities which may arise from children's responses since this would require some deviation from trainees' planning:

> Mentor 1: "Everything is objective-led isn't it? And unless they've got to grips with the Numeracy Framework and know what they are intending to get out of the lesson and what success criteria they are looking for ... then it doesn't matter how many elements of teaching they've got ... "

> Mentor 2: "I look for it in the planning, making sure that they are following the schemes

> of work the school has put in place, making sure that they are National Curriculum-led, ensuring that they are 'tied into' what the [class] teacher has done before".

This stance might also inhibit the development of trainees' ability to respond appropriately to unplanned learning opportunities which may arise in their lessons. Thus, the relative paucity of feedback provided by some observer groups in relation to the different elements of the '*contingency*' dimension appears to be a significant gap in the overall feedback provided.

CONCLUSIONS

The interviews undertaken indicate that written feedback given by observers of trainees' mathematics lessons may be affected by a number of factors such as the limited time available, observers' perceptions about relative importance of different aspects of teaching and the perceived need to be selective and to balance positive and negative comments. Moreover, the content analysis does not determine the quality of the written feedback offered about aspects of subject knowledge-related practice. Nor does it indicate the nature of any oral feedback which may be given in addition.

However, the data does indicate that certain key elements of trainees' teaching of mathematics (such as their choice of examples) are rarely mentioned in written feedback by any of the observer groups and these elements may benefit from more careful monitoring. Also, while university mathematics tutors seem to value and recognise the contingency-related elements of mathematics teaching when observing trainees' lessons it seems that school mentors and university tutors of subjects other than mathematics are less likely to do so and may even inhibit trainees' development in this respect. If Ainley and Luntley (2005) are correct in asserting that such '*attention-based knowledge*' is highly situated and is developed only through teachers' reflection upon the outcomes of their own responses to contingency-type events then it seems reasonable to conclude that these aspects of trainees' teaching need to be developed primarily within the school placement context. Thus, raising the awareness of university tutors of subjects other than mathematics and school mentors about this dimension of trainees' practice would appear to be advisable.

Additionally, it may be that an observer's ability to recognise the contingency dimension in action may also be highly situated and may only be developed through experience of observing mathematics teaching. This may perhaps explain why the majority of comments relating to the contingency dimension in this study were made by mathematics tutors and why the university mathematics tutor was the only interviewee to demonstrate some appreciation of this dimension. However, more research is needed to investigate this particular hypothesis further.

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