The Role of Attention in Classroom Practice: Developing a Methodology

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We offer a novel theoretical model of how experienced teachers deal with the enormous complexity of classroom environments through the use of attentional skills, and report on the development of a methodology to explore the empirical basis for this model in a study of experienced mathematics teachers. In particular we address issues of the nature of the knowledge base that enables teachers to operate effectively in the complexity of the classroom, and of the challenges of researching this aspect.

In this paper we offer a novel theoretical model of how experienced teachers deal with the enormous complexity of classroom environments, and report on the development of a methodology which would allow us to explore the empirical basis for this model within a small-scale study[1] with experienced teachers of mathematics. In particular we address questions of the nature of the knowledge base that enables teachers not only to plan good lessons, but also to operate effectively in the complexity of a class of 30 pupils.

We argue that descriptions of the knowledge base of teachers in terms of subject knowledge, and general and subject-specific pedagogical knowledge (e.g. Shulman, 1987) offer tools for analysing particular aspects of practice, but fail to provide an adequate account of what is required to function effectively minute by minute in the classroom.

Studies which have attempted to give accounts for the ways in which teachers make choices about how to act *in the moment*, for example, in terms of decision trees (Peterson and Clark, 1978), or the balance of the influence of knowledge, beliefs and goals (Schoenfeld, 1998) offer detailed models with high levels of complexity. In contrast we offer a relatively simple hypothesis: much of what experienced teachers know is what we call attention-dependent knowledge. This attention-dependent knowledge not only is not reflected in what is written down in lesson plans, but cannot be written down. However, we conjecture that it is this knowledge that enables teachers to respond effectively to what happens during the lesson, and that understanding the performance of experienced[2] teachers requires an account of the interplay between the subject and pedagogic knowledge that will be articulated in learning objectives and lesson plans, and attention-dependent knowledge that can only be revealed in the classroom.

Theoretical Model

It is commonplace to note that perceptual knowledge plays an important role in the performance of experts in a number of domains (Dreyfus & Dreyfus 1986, Eraut 2000). The key theoretical challenge is to give a satisfactory account of this knowledge that both

[1] *Attention and the knowledge bases of expert practice*, funded by an Arts and Humanities Research Board Innovation Award. A full report of this project can be found at www.warwick.ac.uk/fac/soc/philosophy/research/akbep

[2] By 'experienced' we mean those who have developed their expertise through experience; this is not the same as simply counting years in the classroom.

accommodates the idea that this is contextualised knowledge and the notion that it is transferable to a wide range of contexts. The theoretical innovation of the model we offer is that a good part of what experienced teachers know is knowledge that is contextualised and *attention-dependent.* This is knowledge available in situ through the operation of specialised *attentional skills* which are transferable to other contexts. If the teacher attends appropriately to aspects of the classroom environment, this makes contextualised short-lived items of propositional knowledge available. It is knowledge of such contextual attention-dependent propositions that is critical in understanding the development of experienced expert behaviour. Such knowledge concerns both the cognitive and affective aspects of classrooms and can both causally explain, and figure in the justification of, the resulting behaviour (Luntley, 2002, 2003, 2004).

The idea of knowledge that depends on specialised attentional skills highlights the role of contextualised knowledge that cannot be prefigured or articulated in general rules governing expert performance. Such knowledge is highly particular and, given the role of attention, requires active perception by the subject. The theoretical model emphasises the role of the expert teacher as an agent whose activity helps shape the environment they manage, rather than as a consumer of rules for expert behaviour. It thereby provides a theoretical framework for making detailed sense of the idea that expert performance draws upon judgement, rather than the application of rules.

It is well documented that experienced teachers can find it difficult to articulate what it is that they do successfully in the classroom, other than in highly situated accounts of particular pupils or aspects of the curriculum (e.g. Brown & McIntyre, 1993, Edwards & Collison, 1995). Indeed, this difficulty is not confined to the teachers themselves. The lack of a shared vocabulary with which to describe and discuss expert teaching within teacher education may account for the relative lack of attention paid to learning from the practice of experienced teachers in initial teacher education (Edwards & Protheroe, 2003). As Brown and McIntyre (1993) comment, in a study which attempts to describe and theorise the *professional craft knowledge* of teachers,

> while we recognise that there are those with mastery of some aspects of teaching, we have no coherent account of what they are masters of or how they achieve what they achieve (p.13)

The lack of an articulation of such mastery may partly account for the relative invisibility of minute-by-minute practice in the classroom amongst the features of teaching which are assessed (and hence valued) within current regulations governing initial teacher education in the UK and the relatively high importance placed on those aspects of practice which are more easily observable and more clearly articulated, such as lesson planning and record keeping. We argue that this emphasis presents an impoverished view of what is involved in the expert practice of teaching since it does not appear to recognise or value the skill of teachers to act in the moment in response to classroom events. Placing so much emphasis on detailed planning (and by implication on the *delivery* of such plans) fails to take account of the ways in which expert teachers adapt their teaching in response to events, and indeed may have the effect of discouraging teachers from exercising judgement and flexibilily in this way.

Developing a Methodology

In a small scale study, carried out in 2003-04, we set out to develop a methodology which would allow us to explore the empirical basis for this theoretical model. This

methodology needed to enable us to provide evidence that teachers are acting on the basis of attention-dependent knowledge, which is accessed via attentional skills, and also to allow us to explore the nature of those attentional skills and the role of attention-dependent knowledge in classroom practice.

The challenge was that it is not possible to gain direct evidence for attention-dependent knowledge, since we cannot have direct access to teachers' thought processes (Calderhead, 1984). We have therefore drawn on the different, but linked, perspectives and voices of observers and teachers in a two stage approach to data collection. The remaining sections of this paper discuss the development of our methodology, and present some snapshots of the data to illustrate this. We also offer thoughts on how the methodology may be further refined within a larger study which is currently being planned.

The First Stage of Data Collection: Observing Lessons

The study was carried out with a group of experienced teachers, two teaching 10-11 year olds in the last year of primary school, and four teaching mathematics in two secondary schools (pupils aged 11-16 years). This was an opportunistic sample, as the teachers were already involved in another project lead by one of the research team. Amongst other advantages, this meant that they knew and trusted one of the researchers, and that they and their pupils were used to having observers in their classrooms.

The first stage of data collection was the observation of lessons. We observed two mathematics lessons from each teacher on separate occasions. The lessons were chosen by the teachers. We had no preference in terms of the age group or topic we saw, and hoped to see typical lessons, rather than ones prepared for our benefit. We did not ask the teachers to give us written lesson plans, as this would have be imposed an additional pressure. One of the researchers had a brief discussion with the teacher about their plans immediately before each lesson. In a larger study we would collect this information more systematically by audio recording this discussion and by asking, at the end of the lesson, if we could make a copy of whatever written planning the teacher had made.

The lessons were video-recorded, with the camera focussing on the teacher throughout. A radio-microphone was used to obtain a good quality audio recording of the teacher. The audio tape was transcribed in full straight after the lesson, and later the transcripts were annotated to add in non-verbal behaviour and contextual detail from the video recording. The video and transcript provided a shared record of aspects of the lesson, but the key element of this stage of data collection was the observations made by researchers during the lesson.

Lessons were observed by both researchers. Their task was to look for episodes in the lesson where they saw the teachers' actions as (potentially) being driven by attention. The words have been carefully chosen here. At this stage the observers could only make conjectures, some stronger than others, about the teacher's actions. In some cases the connections between the teachers' attention and their actions was relatively clear. For example, in one lesson Judith was talking to the whole class, but paused in mid-sentence to speak sharply to a pupil sitting close to her who was having a whispered conversation with his neighbour. In other cases the observers' conjectures were built on less solid evidence; it was clear that the teacher is acting in a way that could not have been planned (changing the direction of questioning, initiating a new activity, a disjunction or pause in a sentence), but it is less clear where their attention is focused.

Any lesson might contain a large number of such episodes, but not all of them will be visible to observers. Some will be extremely subtle, such as changes in pace or emphasis, or eye contact with a particular pupil. The observers' task was not to try to capture every possible episode, but to identify a range of examples. Observation in situ was crucial here. The video and audio recordings do not capture the full complexity of the classroom since the focus of the camera necessarily leaves out some aspects of the context. At the most pragmatic level, the quality of recording which we were able to make did not allow us see both the teacher's face and the faces of most of the pupils. The presence of observers in the lesson was therefore an important feature of our methodology.

The use of two observers was also valuable in providing different perspectives on a fast moving situation. Initially, there were some interesting differences in the ways in which each of us attended to the progress of the lesson, which we might attribute to our differing professional backgrounds. The teacher educator attended mainly to the behaviour of the teacher; the philosopher often focussed more on the pupils. As our experience of the individual styles of the teachers increased, and we developed a clearer picture of the kinds of episodes which were proving interesting, there was an increasing level of agreement in the examples we identified as worth exploring at interview. However the dual perspective, both in observing lessons, and later in interviewing the teachers, continued to be an important strength of our approach.

The Second Stage: Interviewing Teachers

The next stage of our approach was for the researchers to meet to discuss and identify episodes which would be used as the focus for an interview with the teacher. Access to the video recording as a common reference point was important here, and because of poor sound quality on the video recording we also found it essential to have at least a rough transcription of the audio recording. There was a pragmatic tension here. On the one hand, we needed to have a gap between the lesson observation and this discussion in order to have this transcript available. On the other hand, we wanted to interview the teacher as soon as possible after the lesson, while their memory of it is still relatively fresh. In practice we generally held interviews two days after the lesson.

In this discussion, the observers compared and refined their identification of particular episodes, supporting choices both with our own conjectures, and with the evidence captured in the recordings. This discussion ensured that we were grounding our decisions in the observable data. In a larger study we might find it valuable to record these discussions.

Clearly the fact that we, as researchers, chose to make the selection of which parts of the lesson would be discussed with teachers is a significant feature of our approach, and to some extent privileges our voices over those of the teachers. In the pilot study we chose to do this because of the developmental value of the discussions described above, and for the pragmatic reason that the time required to look at the whole lesson with each teacher would be too long. In a longer study, when we have the opportunity to observe more lessons from each teacher, we could make the choice to include episodes selected by the teachers as they become more confident with the interview context.

The episodes which were chosen varied considerably. Some were relatively clear events which everyone recalled, but others were very short, and may have appeared relatively insignificant in terms of the whole shape of the lesson. We have identified some

typical kinds of episodes (when a pupil gave an unexpected response, or was unable to respond, when a pupil asked for help) but many others did not fall into such categories.

It is important for our approach that the teacher's perspective is used both to triangulate and to add to the observers' views. The interviews therefore had two primary functions:

- to provide opportunities to test out the observers' conjectures about the episodes, and
- to provide opportunities to access further information which was not available to the observers; for example, what it is that the teacher was attending to, what the teacher's purpose was in taking a particular action.

It is tempting to assume that what we are engaged in here is establishing a true account of what happened during that episode of the lesson, but that clearly is not the case. The accounts given by teachers in the interview may not correspond to any account which they might have given at the time (Calderhead, 1984), any more than the observers' accounts provide an objective record of what *really* happened. In order to try to get some access to the teachers' patterns of attention during the lesson, we used a number of strategies to encourage teachers to imaginatively re-enter the lesson context through stimulated recall:

- talking through the progress of the lesson, with prompts from one of the interviewers
- viewing video extracts and the availability of the transcript
- using neutral, open questions such as "what's going on here?"
- using more focussed questions, such as "what made that feel right?" "is that something you often do?"

Of course, none of these strategies is unproblematic. In some cases viewing the video materials prompted the teachers to critique their performance ("Did I really say that?" "I should have done that differently") or to offer justifications for their actions. The perspective of the video camera does not correspond to what the teacher was actually seeing during the lesson, and in some interviews the effect of watching the video was to draw attention to aspects of the classroom that they had previously been unaware of, rather than to help to recall their perceptions of the lesson.

However, many of the teachers' comments did add to the picture that was being built up of each episode, both by supporting or contradicting our conjectures, and by adding perspectives which were not available to us. For example, in one lesson we noticed that when Teresa posed a question to Colin and he seemed unable to answer, she said "Don't worry", and passed the question to another pupil. We were surprised by this action, because in a previous, very similar, incident with Lauren, Teresa had continued to ask further questions and scaffolded a response, even though Lauren appeared to be uncomfortable. In the interview, Teresa's account of the episode filled in detail which was not accessible to the researchers.

> Teresa: It's Colin. He doesn't know. [*pause*] oh, love him. [*pause*] He was alright on the carpet actually. Again, he's incredibly lacking in confidence. He's actually a lot better than Lauren at maths. Urm, I don't know why I didn't keep going with Colin but I didn't. I went to Hilda and got her to do it, didn't I? And then I went back to him. I didn't want to leave him without knowing what to do, but I didn't want to draw attention to the fact that he didn't know. So I must have decided quickly to get Hilda up there and then go over it with him. But he was okay actually and often he [*pause*] He was almost there. He was almost there, but not quite there. [*pause*] So, I suppose it was that I didn't want to draw attention to the fact that he didn't know, but I wanted to make sure he did. So I went back to him afterwards. Must have been. I didn't even know that I had done that.

Int: … what we are interested in was what it was you were picking up on that made [that] feel right ...

Teresa: I suppose it was that I could sense a sort of panic in Colin that I didn't want to make worse. And yet I banked on Hilda knowing it. I just knew she would be fine and she'd be able to do it. So I could reinforce it for everybody at that point and then I could go back to Colin and ease that worry that he was having. That panic that he was feeling. He won't say that he is struggling. Lauren will tell me. She'll say: I'm beginning to panic now. He won't but you can see it in him. There is this sort of rising panic.

Teresa's comments indicate that she had been attending to clues in Colin's expression and body language which prompted her action. These clues had not been accessible to us as observers during the lesson, or from reviewing the video recording. However, even if we had been able to share Teresa's physical viewpoint, we would not have shared the background knowledge that she had about Colin which apparently enabled her to attend to these subtle clues.

A challenge for us was to pick out comments from the interviews which represent *accounts of* the teacher's attention during the lesson, rather than retrospective *accounts for* their actions. Often the comments in which we are most interested are characterised by being given quickly in response to viewing a video extract, or to a particular question, and by their hesitant and often unstructured nature. In Teresa's comments above we can see both initial, rather disjointed comments which seem to offer accounts of the focus of her attention during the episode, and more considered and fluent accounts for her actions ("So I must have decided quickly …", "I just knew she would be fine and …"). More detailed conversational analysis may provide tools for making these distinctions more clearly.

Analysing the Data

In the pilot study we worked broadly through a grounded theory approach. Data collection and analysis were, to some extent, interwoven during the project, and interview techniques were developed and refined as we worked on the initial data analysis. This was done through codings in which the classroom episode was the unit of analysis. Various levels of coding emerged during the pilot study, through discussion between the researchers. From these the following reasonably robust codings were produced. These are drawn from both the observation data and the interview data, balancing the voices of observers and teachers.

The underlying focus of the episode was coded as *cognitive* or *affective*. The majority of the episodes we identified were cognitive, and we sub-divided these into *cognitive problems*, where pupils were showing differing understandings of mathematical ideas and the teacher was trying to address this, and *cognitive opportunities*, where the teacher was trying to extend the pupils' thinking. This coding was done almost entirely on the basis of the observers' perspective, although on a few occasions, such as the one described above from Teresa's lesson, the teacher's comments offered some additional information. The episode with Teresa and Colin was thus coded as *cognitive problem/affective*.

A second coding was used to indicate whether or not the teacher seemed to have been aware of making a (*conceptual*) choice in that particular episode. This categorisation can only be made on the basis of the teachers' perspective revealed in the interviews. Within Teresa's comments the phrases "So I must have decided quickly …" "So, I suppose it was that …" "Must have been. I didn't even know that I had done that." led us to code this episode as *non-conceptual*.

However, the distinction is not always clear cut. In some cases it may be difficult for a teacher to re-enter an episode which we would categorise as *non-conceptual*, since if they did not conceptualise the situation at the time, they may be less likely to remember it clearly. Teachers may also be reluctant to reveal that they do not recall what they were thinking or know why they acted in a particular way (Calderhead, 1984).

A third coding of the episodes related to the teacher's actions. We distinguish between occasions when the teacher seemed to be *reacting* to the classroom context by using a familiar strategy, and those when the teacher was *responding* in a novel way[3]. This categorisation was made by drawing on evidence from both observers and teachers. In some cases it was clear within a particular lesson that certain actions are repeated. For example, observing Mary questioning the whole class, we noticed that when a child gave an answer, Mary often said "Is that right?" to encourage other pupils to contribute, whether or not the original answer was correct. In cases where we were did not observe this kind of repeated behaviour, we asked teachers at interview "Is that something you often do?" in order to test our conjectures. For example, when Judith had a situation in which pupils were offering different answers to a particular question, she asked the whole class to vote on which they thought was correct. Our conjecture was that this was a novel *response* to help to move the lesson forward, but in the interview Judith reported that this was a technique she regularly used to help pupils to focus on justifying and explaining their thinking, and so we coded that episode as a *reaction*.

The fourth coding emerged from analysis of interview transcripts in which we noticed teachers talking explicitly about what they thought underlay particular actions on the part of pupils. This seemed to indicated that they had been attending to the focus of pupils' attention, which differed from the focus which the teacher had intended. In the episode with Teresa and Colin, described earlier, we categorised Teresa as *noting* that Colin was not able to attend to the content of the question in a way that enabled him to give an answer. However, she did not attempt to *interrogate* the focus of his attention, but used a different approach.

We contrast this episode with others in which the teacher's comments suggest that they were *interrogating* the focus of pupils' attention to find a way to move their thinking forward. A clear example comes from an interview with Judith. At the end of a sorting activity, Judith had made a list of shape names on the whiteboard which contained the names of several quadrilaterals and two triangles. As the focus of the lesson was to be on quadrilaterals, she asked "Can you work out which two of those words don't fit with the rest?" The first pupil suggested "Rhombus and arrowhead", which was clearly an unexpected answer. Judith asked for other suggestions before re-directing the focus of the activity. Her comments after viewing the video extract reveal that she was interrogating the focus of the pupils' attention.

> I had no idea what it was that [he] was trying to say. I couldn't see any link between the two he had given me. I couldn't think, arrowhead and rhombus? What are the [*pause*] Apart from the fact that the words themselves may be as opposed to the shape. And I had no idea. And when the next person said the same two things, I was beginning to think: Oh God! There is something I am missing here. [*laughter*] Something that is obvious to them but not obvious to me. Because you know sometimes with child's eyes you see something. Then I realised that they obviously didn't even look at those words and think, 'oh that's a three sided, that's a four sided'. They obviously didn't have that connection as an obvious connection between the number of sides and the actual words. There was

[3] We are grateful to John Mason for offering us the vocabulary for this distinction.

obviously something else they were looking at, if you know what I mean. Which is why I then thought I am going to have to try and pull out here how many sides do these things have.

Judith made this comment spontaneously after viewing the video, and this, together with the hesitant and disjointed nature of the comments suggests that this is a reasonable account of her attention at the time, rather than a rationalisation of her actions. Although as observers we could often conjecture that teachers were noting or interrogating the focus of pupils' attention, combining these conjectures with the teacher's perspectives was essential in making this coding with any confidence. In a further study we would use prompts such as "Did you have a sense of what the pupils were thinking about?" within the interview to offer opportunities to access this.

Conclusion

In this small-scale study we have developed what we believe to be an appropriate and robust methodology which has provided limited evidence of teachers using attentional skills which enable them to read the activity of the classroom, and that they use the knowledge they gain by and from this attention in making judgements about how to act. We argue that the recognition of attention-dependent knowledge is significant in explaining and justifying why experienced teachers act in the ways they do, and may have significant implications for teacher education. We are currently planning a more extended study in which we will use this methodology to further explore the practice of both experienced and novice teachers.

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