

TEACHERS' THEORIES AND STRATEGIES IN PRACTICE OF CLASSROOM ARGUMENTATION

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We examine case studies (in progress) of teachers engaging with reflective practice on argumentation. The data comes from three sources i) audio taped meetings where all the teachers share their work with their colleagues, ii) videotaped lessons and iii) interviews of the teacher after each lesson. The aim is to identify the connection between the teachers' stated strategies and intentions (or 'espoused theories') and their 'theories-in-use' (what they actually do). The interviews and the group meetings enable the teachers to reflect on their practice and discuss their 'espoused theories' whereas the video taped lessons give us the opportunity to search for instances of their 'theories-in-use'. In this paper data from one case study will be presented and discussed.

INTRODUCTION AND BACKGROUND

Day (1999) suggests that most of teachers' actions are based on implicit, tacit knowledge. Argyris and Schon (1974) explain that integrating action with thought is a difficult task. They thus draw a distinction between peoples' 'espoused theories' and 'theories-in-use'.

'When someone is asked how he would behave under certain circumstances, the answer he usually gives is his espoused theory of action for that situation. This is the theory of action to which he gives allegiance, and which, upon request, he communicates to others. However the theory that actually governs his actions is his theory-in-use, which may or may not be compatible with his espoused theory; furthermore, the individual may or may not be aware of incompatibility of the two theories.' (Argyris and Schon, 1974, p.6-7)

Teachers need to make explicit their espoused theories and theories-in-use and discover the inconsistencies between the two in order to increase their knowledge of teaching and of themselves as teacher- inquirers (Day, 1999).

In this article we will briefly describe the methods we have used to explore teachers' espoused theories and show how these may connect to theories-in-use as evidenced through video clips of classroom practice.

ALAN'S CASE STUDY

The first teacher is Alan. His story of teaching is based on observations of three year 9 (Set 5) lessons, meetings and interviews with Alan and colleagues, and Alan's own comments and corrections. We connected to Alan because of a mutual interest in problem solving, pupils' errors and misconceptions and especially classroom discussion and argument. Prior to these lessons we had provided some analyses of children's misconceptions in the context of ratio and Alan planned his lessons with

this topic in mind. In fact the ‘mixing paint’ problem came from our previous diagnostic research, (see eg Misailidou & Williams, 2002) and from this Alan was led to expect a number of different responses to the following ‘open task’:

Sue and Jenny want to paint together. They want to use each exactly the same colour. Sue uses 3 cans of yellow paint and 6 cans of red paint. Jenny uses 7 cans of yellow paint.

Expected wrong answers: **10** (add 4 or add 3), **13** ($7=2 \times 3+1$, $13=2 \times 6+1$), **2** ($3+6=9$, $7+2=9$)

This paint problem was still being discussed and argued about by the class at the end of the three lessons, on the topic of teaching ratio. This contrasts strongly with the impression given in many teaching videos we have seen distributed recently as models of good teaching, and we suppose that many teachers will feel this is not ‘good practice’, and that it is important for children to be given correct answers and methods and have these reinforced.

But this story is not just, or even mainly about effective teaching of ratio. We were interested in seeing how an experienced teacher could teach a whole class ‘argumentatively’ and through ‘discussions’ of children’s errors and alternative methods. The aim was to identify the strategies teachers use to enable discussion and also encourage them to write their story, an account which would be easily disseminated to and understood by other teachers. Our research questions are:

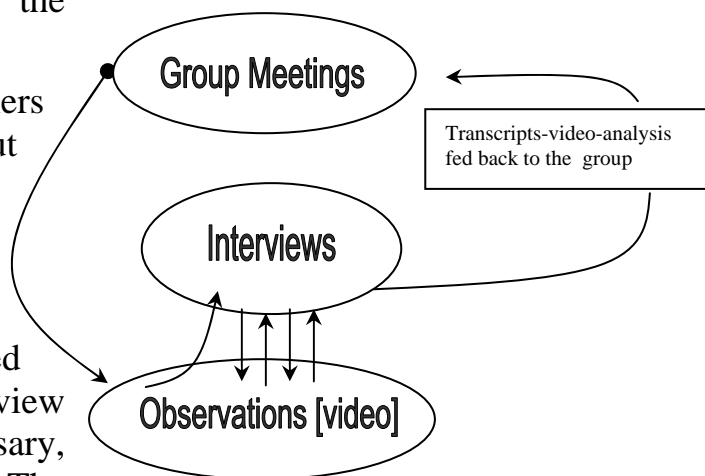
RQ1. How can/do teachers develop strategies which enhance Mathematical dialogue and argumentation in their classroom discussion?

RQ2. Can we describe and account for these through video, narrative and case studies in ways which help our colleagues?

METHODOLOGY

The figure below shows the three different sources of data: i) audio taped *group meetings* where all the teachers share their work with their colleagues ii) *observations* (videotaped lessons) iii) *interviews* of the teacher after each lesson.

We began meeting with groups of teachers where we were discussing about engaging pupils in discussion and argumentation using diagnostic items. Some of the teachers offered to use some items in their practice. Those lessons were videotaped for detailed observation. After each lesson an interview with the teacher followed. If necessary, another observation was scheduled. The



interviews and clips of some video data were transcribed, analysed and fed back to the group of teachers for discussion. During the group meetings we had the opportunity to ask the teacher to elaborate on his espoused theories or even ask him to use some of the video data to demonstrate his theories-in-use.

In the section below we are going to show transcripts of interview and video data in order to demonstrate how it was analysed .

ANALYSIS: AN EXAMPLE FROM ALAN’S CASE

This is part of the interview we had with Alan after observing one of his lessons:

Alan: One of the strategies mathematically for me is **pinning kids down to detail**. So someone will say ‘I just do this’ and I will say ‘Can you say that again’...to make a point to touch the others [...] I suppose it’s not uncommon for children to want to say it and then get out of this quickly. [...] It’s very difficult to add an explanation.

Alan: I feel very comfortable to **leave things unresolved**. It doesn’t seem to be an issue. I suppose, I’ve got a confidence that children return to it. That is not... that it’s also a creative tension. When you leave children...it doesn’t go away from them...there are a number of times that a child still [thinks about it] even when they leave the room...you know...so...I don’t take total responsibility, that’s their business. It’s unresolved business.

[cut]

Alan: I feel quite comfortable with it [*leaving things unresolved*] and I know that other teachers don’t. I will not often be seen as the teacher that will move in to the board and take the explaining space. That’s not my space. I go there to make general statements. That’s why I move there. But **they do the maths**.

Pinning kids down to details... ↓
to make a point to touch the others

Leave things unresolved ...



to make them do the maths

Alan had the opportunity to explain these espoused theories to the rest of the group. Table 1 shows some of his most important strategies together with their intentions as extracted from the interview and group meeting transcripts.

A transcript of a video episode where we thought that Alan was actually ‘pinning kids down to detail’ is shown below. After spending two lessons on the ‘mixing paint’ problem Alan decided to leave things unresolved and introduce two intermediate ratio problems to the class. One of them (the apples problem) is shown in the transcript below (3 apples cost 90p, how much for 7 apples?):

Lesson 3: This episode starts 8 minutes into the lesson / T: Teacher	
[<i>Len is on board to answer to the problem below</i>]	
T: Now watch this please.	

<p>[Len writes where the empty box is: 1.90].</p> <p>3 apples 90 pence</p> <p>7 apples <input type="text"/> pence</p> <p>Len: 1.90</p> <p>T: Now... just the same way as when did that one [<i>showing the mixing problem</i>], there are different answers around, around the classroom. And one of the challenges was how do we know which is the right? Go on Len talk us through.</p> <p>Len: How I got £1.90 ...</p> <p>T: Hang on. Wait a second...Emma?</p> <p>Len: I got £1.90 because em, I looked at that one first [<i>pointing at the 1st row – 3 apples 90 pence</i>] and I noticed that there's three... 30's in 90, so I got two 30's and then I added another 10.</p> <p>T: Take us through this again! Hang on... Could you take us through that again Len?</p> <p>Len: I got two 90s because there's 3 apples there that cost 90 pence, so you double it and add one ...10. So you got 2 times 90 which is £1.80 and you get an extra 10 and that add up to £1.90.</p> <p>[<i>Rebecca and other pupils have their hands up</i>].</p> <p>T: Hang on, hang on... Can I say... Excuse me? Hang on a minute... Our resp...[<i>pause</i>] our responsibility here is to sort out Len's method. I know some people got different answers but I want us to concentrate on Len's. Len take us... Now if you think you got a different answer, what is it that ... What is it that Len is doing that is giving this one? Now, I've already spotted it! You follow the details on what he is doing so you can spot what's happened. Now take it once again slowly...Go on Len. Listen to this...</p> <p>Len: You've got 3 apples which is ... just under half of that [<i>pointing at 7 apples</i>]...So if you double that [3] which means doubling that [90] you got 1.80 and then you add another 10 for the one that goes into the 6 if you double that [3 apples].</p> <p>T: Now what's going on?</p> <p>[<i>Various pupils have their hands up</i>]</p> <p>T: Wait. Hang on...Just be patient. Bill what is going on?</p> <p>Bill: He hasn't divided the 3 apples and the 90 pence properly.</p> <p>T: Go on.</p> <p>Bill: It should be 30 pence not 10 pence.</p>	<p>Focus class attention</p> <p>Pinning Kids (Len) down to detail.</p> <p>Draw attention of class to Len's method/error</p> <p>Pinning Kids (class) down to detail.</p> <p>Making class 'listen'</p> <p>Check Bill sees the detail</p>
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<p>T: Listen to this...Don't let the, don't let the discussion jump around too quickly...Bill say it again. You spotted where you think he's made a mistake. This is not Len now...this is the maths? So what's going on? Go on.</p> <p>Bill: The 3 apples divided by the 90 pence should be 30 pence instead of the 10 pence.</p> <p>Rebecca: Where did the 10p come from?</p> <p>T: Len take us through... and you [<i>to Bill</i>] be quite rude and interrupt (at) the point, you say 'now, it's there' [<i>the mistake</i>]. Len take us through again and you know what I mean...you try to say 'it's there, it should be 30 not 10'.</p> <p>Len: Because the 7 apples on the bottom one...so, there's 3 apples there...then there's em, 30 goes into 90 pence 3 times so you got the 90 pence... so you can double it and add the extra 10 pence for the 7th.</p> <p>Bill: That's wrong.</p>	<p>Pinning kids (class) down to detail (Bill's).</p>
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In this extract Alan appears to enact 'pinning kids down to detail' by asking Len to detail his method until the rest of the group can follow the argument and spot the mistake (or as Alan himself puts it in the above interview, *to make a point to touch the others*). We thought that this episode is one which reveals a connection between Alan's espoused theory (as mentioned in the interview) and his theory-in-use.

RESULTS

The complete set of espoused strategies we identified in interviews is summarised in Table 1. The table describes the behavioural strategies together with their intentions:

	Behavioural Strategy (BS) to achieve...	The Aim (A) or Intention
1	BS1: 'Pinning kids down to details' in their explanations	A1: Everyone is following the explanation/strategy/method/Focus attention
2	BS2: One minute discussion	A2: Raise/harness the energy
3	BS3: Leave tensions unresolved	A3: Make them do the Maths
4	BS4: Conflict strategy	A4: Induce a change of method/potential conflict
5	BS5: Summarising and Clarifying	A1: Everyone is following the explanation/strategy/method/focus attention
6	BS6: Working with one method	A1: Everyone is following the explanation/strategy/method/focus attention
7	BS7: Working with multiple problems	A7: Making connections (previous lessons)/

	methods	introduce generality
8	BS8: Slow the pace	A8: To take everyone along

Table 1: A summary of Alan’s espoused theories of his classroom practice

Using our video data we hope to be able to attach to most of the above behavioural strategies a video clip which either supports, or even contradicts the teachers’ espoused theories, and taking these back to group meetings provides opportunities for Alan and other teachers to contest and refine this analysis.

CONCLUSION

This is work in progress. Our aim is to help teachers account for their practice in ways that can be meaningfully communicated to colleagues. We gave above an account of a linkage between an element of Alan’s espoused theory and an element of his practice. We note that:

- 'Strategies for developing argumentation and discussion' as a unit of espoused theory has to be subdivided into 'behaviour' and 'intention'.
- There may be a number of strategic behaviours which relate to the same intention: i.e. intentions are relatively stable and related to beliefs, whereas behaviours are situationally contingent. Thus strategies are (maybe complex) functions of the situation as well as the educational aims of the teachers.

In addition, however, we add (based on data not here presented in this short account) that:

- 'Teachers espoused theories' appear to be co-constructed with the researcher who is intervening and asking the teacher to reflect. Even the most articulate of our teachers appear to us to be inventing and re-inventing the strategies they claim to use. Thus the strategies we see the teachers espousing are not stable, clear expressions coming from within their own professional discourses, but co-constructions with us the inquiring researchers.
- We speculate that the confrontation of the teachers with their own video also presents them with a novel factor which may be unsettling their beliefs about what they do.

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