ELABORATING THE TEACHER'S ROLE – TOWARDS A PROFESSIONAL LANGUAGE

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As part of a larger project on effective numeracy teaching practice[1] a number of teachers took turns to teach a small group of students in front of their peers who were located on the other side of a one-way window. Observing teachers were asked to comment on what they noticed 'in-the-moment' and suggest labels or metaphors that captured the essence of the teacher's acts to support learning. Twelve scaffolding practices were identified as a result of this activity suggesting that it is a valuable tool for making explicit what teachers know and exercise intuitively in the context of primary mathematics classrooms. Here, we describe the activity and illustrate its potential for building a meaningful, accessible language that teachers can use to actively reflect on their practice.

BACKGROUND

The emergence of professional standards to document and celebrate quality mathematics teaching (e.g., National Council of Teachers of Mathematics, 1991; Australian Association of Mathematics Teaching, 2001) has focused attention on the role of the teacher and the need for an accessible professional language to articulate not only what it is that effective teachers *do* but also how they *think about* what they do and *why* they do it (Doerr, 2003). Recent work on the connections between theory and practice (e.g., Evan & Ball, 2003) suggest that this will only be viable if teachers are recognised as co-researchers in the enterprise.

Current interactionist perspectives on the teaching and learning of mathematics (e.g., Voigt, 1995; Lerman, 1998;) point to the need for a deeper understanding of the ways in which teachers contribute to the shaping of classroom cultures and interactions that occur within them. While the notion of a reflexive relationship between classroom culture and the individual construction of meaning views teaching and learning as inherently interrelated, Bauersfeld (1995) acknowledges that the teacher has a special role to play within this environment.

> As an agent of the embedding culture, the teacher functions as a peer with a special mission and power in the classroom culture. The teacher, therefore, has to take special care of the richness of the classroom culture – rich in offers, challenges, alternatives, and models, including 'languaging' (p.283)

[1] The *Researching Numeracy Teaching Approaches in Primary Schools Project* was funded by the Department of Education, Science and Training, the Victorian Department of Education, and Training, the Catholic Education Commission of Victoria and the Association of Independent Schools of Victoria.

One of the ways in which the teacher's role has been conceptualized is through the use of the metaphor of scaffolding which according to Anghileri (2002),

> was first used by Wood et al (1976) to explore the nature of adult interactions in children's learning, in particular, the support that an adult provides in helping a child to learn how to perform a task that cannot be mastered alone (p.49)

This is consistent with Vygotsky's (1978) notion of the Zone of Proximal Development (ZPD) which suggests an inverse relationship between teacher support and student independence. Different levels of scaffolding have been identified in the situated cognition literature. For instance, Rogoff (1995) identified three qualitatively different 'planes of socio-cultural activity' in an out-of-school setting which she referred to as *apprenticeship*, *guided participation*, and *participatory appropriation*. The different levels trace the development of an individual within a socio-cultural enterprise from dependent novice to independent practitioner. A similar three stage model was proposed by Brown, Collins and Duguid (1989) to describe students' progression from embedded activity to generality.

In her seminal analysis of teachers' scaffolding practices in mathematics, Anghileri (2002) also distinguishes three levels of teacher support. Level 1 scaffolds tend to refer to those environmental prompts and stimuli that serve to support students' mathematics learning. Level 2 scaffolds involve the types of interaction patterns commonly found in 'traditional' classrooms, where the teacher retains control, structures conversations, elaborates, and explains, but it also includes two categories of practices that involve students more directly in reviewing and restructuring. Level 3 scaffolds aim to make connections between students' prior knowledge and experience and the new mathematics to be learned. These include developing representational tools and generating conceptual discourse where,

> students are likely to engage in longer, more meaningful discussions and meanings come to be shared as each individual engages in the communal act of making mathematical meaning. (p.56)

In Anghileri's (2002) framework, teacher support appears to be conceptualised in a different way to that evident in the situated cognition literature where learners are much more clearly recognised as inductees into a specific socio-cultural practice (e.g., making cookies, or learning how to become a tent-maker or a problem solver). The practices outlined in Levels 2 and 3 of Anghileri's framework tend to be focused much more directly on qualitatively different interaction patterns. This is perhaps not surprising given the diversity of practices embraced by school mathematics, but it offers another, possibly more useful, way of talking about the nature of the teacher's role in shaping classroom communication and culture.

Wood (1994,1996) has written extensively about the *funnelling* and *focusing* 'patterns of interaction' observed in Year 2 mathematics classrooms. She makes the point that these patterns of interaction are alternatives to the traditional I-R-E interaction. Both operate to enhance rather than constrain student learning and "serve the teacher's

central intention of trying to create learning situations which enable students to construct mathematical meaning for themselves" (Wood, 1994, p.159).

In common with the scaffolding levels described earlier, these interaction patterns can be seen to be representing different levels of teacher support. However, the nature of this support is much more clearly framed in terms of teacher-student interactions and described in ways that teachers can access, contribute to and utilize.

The Project

The *Researching Numeracy Teaching Approaches in Primary Schools Project* was concerned with the identification, description and evaluation of effective numeracy teaching practice. For the purposes of the project, numeracy teaching approaches referred to the communicative acts engaged in by teachers as they sought to scaffold primary students' numeracy learning. The research question addressed in part by this paper is how can these teaching approaches in numeracy best be described to support teachers to implement them effectively.

The project was conducted in 16 Victorian primary schools including a special school between October 2001 and December 2002. It was essentially set up as an action research study (see Sullivan & Siemon, 2003) where teachers were expected to focus both individually and collectively on the nature of their communicative practice as they supported students making connections in their mathematics learning. An interactionist model developed by Clarke and Peterson (1986) was used to frame the data collection. This involved a range of task-based activities, surveys and interviews, as well as field notes of classroom observations, case-studies of individual teachers and the records of a 'Behind-the-screen' (BTS) activity, which involved the structured observation of up to 16 teaching episodes by a group of teachers facilitated by members of the research team. This paper will report on one aspect of this data collection, the BTS activity.

DATA COLLECTION

The Behind-the-Screen activity was adapted from a technique used in Reading Recovery training (see Clay, 1993) to support a much more finely-grained, intensive study of the communicative acts engaged in by teachers. In this case, teachers took turns to engage with a small group of students in front of their peers (who were literally 'behind' a screen or one-way viewing window). Observing teachers were introduced to a range of possible approaches at the outset, for example, Wood's (1994) *funneling* and *focusing* patterns of interaction, but were also encouraged to use their own words, labels or metaphors 'in-the-moment' to capture the essence of the observed student/teacher interaction or scaffolding practice. The essential purpose of this technique was to arrive at ways of describing teachers' communicative acts that resonated with teachers' experience.

Two clusters of 3 research schools were selected to participate in the BTS activity based on their proximity to one another and access to a suitable venue. This resulted in a metropolitan cluster and a regional cluster. A special school was included in the

regional cluster. Three teachers from each school participated in the BTS sessions. As far as possible, this involved one K-2 teacher, one Year 3-4 teacher, and one Year 5-6 teacher. A relatively remote school was also selected to participate in this activity based on their willingness to explore a video-based adaptation of the BTS activity. In this case, one teacher from each grade level was involved in the BTS group.

Members of the BTS groups met for 3 hours on 8 occasions over 12 months. For the two cluster groups, the BTS sessions occurred in a Reading Recovery facility behind a one-way window. The students, usually 4 students of 'near' or 'mixed ability', were transported to the facility for the duration of the teaching episode. For the 'remote' group, a digital video camera was used to film the teacher in his/her classroom. A 'live' signal was sent through the school's intranet to the library where the remaining teachers observed and discussed the teaching episode on a large monitor.

Observing teachers recorded their labels and/or metaphors on a record sheet together with what they regarded as evidence of the particular act observed. Each teaching session was preceded by a briefing session and followed by a reflective discussion which concluded with the facilitator asking the group to comment on the perceived levels of teacher support and student independence evident in the teaching episode. The written records were collected and summarised by a member of the research team who was also a member of the group. The summary was reviewed by the group the next time it met for clarification and confirmation. At least two research team members attended the cluster group sessions. One research team member worked with the remote group. Audio-tapes of the teaching episodes were collected at the Reading Recovery sites. Digital video-tapes of both the teaching episodes and the related discussion were collected at the remote site.

The summaries from all BTS sessions were collated to provide an emergent list of practices or interaction patterns, supported by a range of exemplars. To be included on the list, a particular practice (or something deemed by the group to be synonymous) had to have been observed and reported by at least two BTS groups on at least three occasions. As the practices emerged they were documented and circulated to all research schools. A *Sorting Task* and *Project Impact Report* completed by all teachers at the end of the project were used to inform the refinement and elaboration of the final list of scaffolding practices.

RESULTS FROM 'BEHIND-THE-SCREEN'

A total of 46 teaching episodes or lessons were observed between March 2002 and March 2003 (16 at the regional centre, 15 at the metropolitan cluster and 15 at the remote rural primary school). The lessons were fairly evenly distributed over Year levels with approximately 30% at Years K-2, 37% at Years 3-4 and 33% at Years 5-6. The majority of the lessons were on Number (51%), but all other curriculum strands were represented with 20% on Measurement, 13% on Chance and Data, 9% on Reasoning and Strategies, and 7% on Space.

Inevitably, the Behind-the-screen activity evolved over the course of the 8 sessions. In part, this was due to the exploratory nature of this approach to researching teachers' practice, but it also evolved as a consequence of the accumulating knowledge, shared language and increasing confidence of the participants. Due to space limitations, it is only possible to include a small extract from the summary of one teaching episode here, but it will serve to illustrate what was noticed, how it was described, and the evidence that was seen to support the observations made.

Rhonda

The teacher and her four, 'near ability' Year K (Prep) students were from a primary school located in a regional centre. The aim of the lesson was to move the students on from using a 'count-all' strategy to using a 'count-on from' strategy for numbers less than 10. In the following excerpt from the summary of Rhonda's lesson, the labels or metaphors assigned by observing teachers are indicated on the left, the evidence offered in support of their claims is included on the right.

Discussing	T: Do you really want to start at 1? Would you like to start at 10? S: OK! [counted from 10 to 28] …
Reviewing	T: Let's count backwards from 10 S: 10, 9, 8…1 T: What would be here? S: 0 [T covered 9 on the 1-100 number chart] T: What number have I covered? Only one number is missing. S: 9
Show me/ Convince me/ Asking	T: How do I know that 9 goes here? S: Because there's a straight line of nines…19, 29, 39 and 9 goes on top. [T repeats this with 5 and 12, asking each time for Ss to justify their response] T: How do you know?
Noticing/ Drawing attention to	[T showed numeral or dots cards one at a time … Ss 'read' each number as it appeared… there is some hesitation when 5 dots are shown] T: How do you know its 5? S: Because its 4 here and a dot there [pointing these out] T: Good, there's a 4 there and a 1 there [repeating the pointing action]. What else can you see? … K? S: A 3 and a 2 T: Good I can see a 3 and a 2 too … What can you see J?
Modelling	[This session continues with the teacher drawing attention to what children see in the dot representations, reinforcing more efficient 'readings', eg a 3 and 3 for 6. When Ss count 8 dots by ones, T says: "I can see a 3, a 3 and a 2 for that one" but continues on, doing this for 7 and 9 as well when they come up. T proceeds to dice activity. A 3 and 5 are thrown, T asks students to say what the numbers are, then covers 3]

Focussing	T: Is there a different way we could count? … How many altogether? [S pointed to 3 and covered the 3 with her hand – counting on.]
	T: Is there a different way you could have done that? S: 1, 2, 3… T: That's counting all.[The dice are thrown again. A 5 and a 4 result].
	T: How many there now? S: 5
Modelling, Making explicit	T: How many altogether? [points to both dice covers one die with a card that has the numeral 5 on it to encourage counting on]. T: Say 5 and count on. S: 5 … 6, 7, 8, 9

Observing teachers commented on Rhonda's reference to explicit strategies, the way she covered smaller then larger numbers to demonstrate the 'counting on' strategy (*modelling, noticing*), her use of different activities to demonstrate the 'counting-on' idea, and the way she remained focused on the main point of the lesson (*focusing, drawing attention to*). The lesson was seen to involve a fairly high level of teacher support and relatively low level of student independence overall. However, within this, the level of teacher support was also seen to vary according to learning needs.

The derivation of scaffolding practices

At its peak, the list included up to 60 words or phrases that teachers in the BTS sessions had used at some time to characterise an observed interaction pattern or communicative practice. By the end of the project this list was collapsed to twelve discrete categories for which the team felt there was fairly consistent evidence and the patterns of interaction came to be referred to as *scaffolding practices*, that is, practices engaged in by teachers to support student's mathematics learning that might ultimately be removed when the learner can 'stand alone'.

In elaborating and exemplifying the list, it is acknowledged that the practices described are not necessarily new. Indeed, they will be recognised widely by many teachers as something they "already do". However, the list provides the beginnings of a professional language to describe what it is that teachers do and why in a way that is meaningful and accessible to teachers. An example of one of these is given below.

> **Excavating** - *drawing out, digging, uncovering what is known, making it transparent*
>
> The teacher systematically questions to find out what students know or to make the known explicit. The teacher explores children's current understanding in a systematic and persistent way. For example, in a Year 3-4 lesson on polygons, the teacher systematically investigates what students know about terms such as corners ["where 2 lines meet"], edges, faces etc, building on students responses, "Do we have a mathematical name for that?" [vertex] "How can we remember this? ..."

Excavating has something in common with, but is different to another practice, *Reflecting/Reviewing*, which was seen to involve pressing for a generalization or an insight beyond where the students were 'currently at'.

DISCUSSION AND IMPLICATIONS

The BTS activity has been shown to be a useful research tool in helping to identify and describe key aspects of teachers' communicative practices. Its value and uniqueness resides in the fact that classroom teachers were actively involved as codifiers of practice in real time. In many studies of classroom communication (for example, Cobb & Bauersfeld, 1995; Clarke, 2001), researchers from similar or differing perspectives work on the analysis of transcript and/or classroom video data to identify and label specific classroom interactions. Inevitably, the sense that is made of these 'after-the-event' analyses reflects the particular perspective of the researcher(s) concerned. While these different interpretations add to the collective understanding of classroom communication, they and the language that frames them are generally removed from the everyday experience of teachers and the language that they use to describe their practice.

The emergence of a common and expanded professional language to describe mathematics teaching was consistently nominated by research school teachers, coordinators and principals as one of the most significant outcomes of the project. This outcome is important as it contributes to the development of a coherent and consistent way of enacting and talking about the complex practice of teaching mathematics in a variety of settings. The advantage of having a language is that it then becomes possible to subject these practices to further scrutiny in order to improve and refine the quality of classroom interactions (see Evan & Ball, 2003).

While the BTS activity clearly has potential as a professional development tool, it is important to recognise the key role of the facilitator in supporting teachers to see for themselves and articulate what it is they see in order to facilitate further professional discussion, planning and reflection. As such we believe the BTS activity has the potential to make public what Hiebert et al (2002) refer to as *practitioner knowledge*, the "kinds of knowledge practitioners generate through active participation and reflection on their own practice" (p.4), that is otherwise largely personal and unshared.

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