Identifying Effective Scaffolding Practices Through Structured Peer Observation and Review

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As part of a larger study aimed at identifying and evaluating a range of numeracy teaching approaches in a structured sample of Victorian primary schools, three groups of teachers participated in an activity referred to as "behind-the-screen". Teachers took turns to teach a small group of children from their own class in a room with a one-way mirror. Observing teachers were asked to comment on what they noticed and suggest labels or metaphors that captured the essence of the teacher's communicative acts. Preliminary analysis suggests that this technique is a valuable tool in identifying and describing scaffolding practices in mathematics teaching and enhancing teacher's understanding of their professional practice.

The considerable growth in understanding about how children learn mathematics (e.g., Cobb & Bauersfeld, 1995; Lerman, 1998) and changing perceptions of what should count as school mathematics has prompted a renewed interest in the role of the teacher in the mathematics classroom (Anghileri, 2002; Wood, 2002). First, it has focussed attention on the critical importance of classroom cultures conducive to social interaction and the negotiation of meaning. Second, recent curriculum advice explicitly values explanation, discussion and argumentation as part of what is referred to as working mathematically (e.g., the *National Statement on Mathematics for Australian Schools* and the NCTM's *Principles and Standards for School Mathematics*). As a consequence of this interest, there is a growing need to develop a professional language around what it is that effective teachers do as they seek to support student learning in these new social settings and context (Wood, 2002).

The *Researching Numeracy Teaching Approaches in Primary Schools Project*[1] is aimed at identifying and describing effective numeracy teaching practice in a range of Victorian primary schools. The possibility of studying numeracy teaching approaches was prompted by the widespread use of differentiated teaching approaches in literacy (e.g., Crevola & Hill, 1998; State of Victoria, 1998). While three of the more generic of these approaches have been adapted for use in Victorian schools as *modelled mathematics*, *shared mathematics* and *guided mathematics* (see State of Victoria, 2001), there was a need to evaluate the efficacy of these in practice. More generally, researching numeracy teaching approaches was felt to be important as it had the potential to contribute to the development of a much-needed, coherent, and consistent way of enacting and talking about the complex practice of teaching mathematics in a variety of settings to meet a range of different learning needs.

Given echoes of something akin to numeracy teaching approaches in the mathematics education literature, for example, Rogoff's (1995) generic planes of socio-cultural activity which she described as *participatory appropriation*, *guided participation* and *apprenticeship*, Wood's (1994) work on *patterns of interaction*, and recent work on scaffolding in mathematics (e.g., Anghileri, 2002; Holtan & Thomas, 1995), all of which emphasised the role of social interaction, the notion of numeracy teaching approaches was broadened to encompass the communicative acts teachers engaged in as they supported students making connections in their mathematics learning.

The 20 month project was essentially set up as an action research study (e.g., Kemmis & McTaggart, 1988) where teachers in the 16 research schools were expected to focus on the nature of their communication as they supported students making connections in their mathematics learning. The research team was responsible for working with teachers from the research schools as they enacted their action plans aimed at implementing a range of approaches in a structured way. Student data in the form of sample-based interviews were collected by commissioning authorities at the beginning and end of the project from both the research schools and a matched set of reference schools in order to evaluate the effectiveness of the proposed numeracy teaching approaches. In an effort to better understand the nature and effectiveness of the teaching approaches or communicative acts, data were collected on teachers' beliefs and understandings, their perceptions of opportunities and constraints, and their teaching intentions and actions, using a range of task-based activities, surveys and interviews. In addition to this, information was also derived from field notes of classroom observations, six case studies of individual teachers and the records of a "Behind-the-Screen" (BTS) activity that involved the structured observation of a group of teachers by their peers facilitated by members of the research team. This paper will report on the preliminary analysis of one of these data sets, the data derived from the BTS sessions.

Methodology and Analysis

The BTS activity has its origins in *Reading Recovery* training (see Clay 1993) where a trainee *Reading Recovery* tutor works with a student behind a one-way mirror, while up to twelve other trainee teachers observe and listen to a commentary provided by a certified trainer. The trainer labels important aspects of the teacher's practice and asks questions of the group such as "How would you describe what was happening there?", "What else could she have done at that point?", and "Why did she pause?" Unsolicited observations are made from time to time by some of the trainees. To the naïve outsider, the session is very intense, with a significant amount of specialist terminology used to describe the teacher's actions and perceived intent.

For the purposes of the project, a modified version of the BTS activity was developed to support a much more finely-grained, intensive study of the communicative acts engaged in by teachers as they sought to scaffold students' numeracy learning. 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). In common with *Reading Recovery* training, this was not meant to be a critique of the teacher, but an in-depth, focused exploration of the nature of the specific teaching and learning processes embodied within a particular teaching approach or set of communicative acts.

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, there was one teacher from P–2, another from Years 3–4, and a third from Years 5–6 from each school. Another research school in a relatively remote coastal town was also selected to participate in this activity based on their willingness to explore a video-based adaptation of the BTS activity for schools without access to "Reading Recovery" facilities. In this "remote" case, one teacher from each grade level was involved in the BTS group.

Members of the BTS groups met from 9:30am to 12:30pm on seven occasions over the course of the 2002 school year and on one additional occasion in Term 1, 2003. For the

two cluster groups, the BTS sessions occurred in a Reading Recovery facility behind a one-way mirror. The students, usually 4 students of "near ability" or "mixed ability" were transported to and from the facility by a parent or a senior member of the presenting teacher's school. For the remote group, the BTS activity was adapted using digital video of the teacher in his/her classroom being transmitted through the school's intranet to the library where the remaining 6 teachers (one from each grade level in this instance) observed and discussed the teaching episode displayed on a large monitor. Each teaching session was preceded by a briefing session and followed by a reflective discussion. Observing teachers were expected to comment on what they noticed and to suggest labels or metaphors that captured the essence of the communicative act observed. These were recorded on a specially designed form, the *BTS Observation Record*, together with what the observer regarded as evidence of the particular act observed. Table 1 outlines the procedure that was followed by each BTS group.

Table 1
Structure of a Behind-the-Screen Session

Time	Description	Record
9:30	Briefing - A *Summary of BTS Observations* from the previous session was distributed and discussed briefly. The two teachers scheduled to teach in front of their peers distributed a summary of their lesson using the *Teacher Intentions Form*, briefed the group on key aspects of the lesson (e.g., focus, rationale, group composition and background, summary of planned events, connection to what is being done at school, resources), and answered any questions.	Summary of BTS Observations TIS Forms
10:00	First teaching episode - Observing teachers commented on what they noticed, responded to facilitator's questions, offered labels, metaphors or descriptions, and recorded terms and evidence for key interactions.	BTS Observation Record 1
10:30	Debriefing 1 – The facilitator and teachers discussed what they liked and explored particular interactions with the presenting teacher. Participants recorded what was noticed and what was learnt. At the conclusion of this session, the facilitator asked the group to comment on the level of teacher support (high, medium or low) and the perceived level of student independence (high, medium, low).	BTS Observation Record 1
11:00	Break	
11:30	Second teaching episode (as per first teaching episode above)	as above
12 :00	Debriefing 2 (as per Debriefing 1)	as above

Observations were discussed both at the time and after the event, and the records were collected and analysed to form a synthesis of the group's views by a member of the research team who was also a member of the group. This was reported back to 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. Audiotapes of the teaching episodes were collected at the Reading Recovery sites.

Digital videotapes of both the teaching episodes and the related discussion were collected at the remote site.

Preliminary Results

The preliminary analysis of the Behind-the-Screen process suggests that it is a valuable technique for elaborating the communicative acts teachers engage in as they seek to scaffold student numeracy learning. Unfortunately it is only possible to do justice to one teaching episode here, but it will serve to illustrate what was noticed and described and the evidence that was seen to support the observations made.

Trudy

Trudy is a Year 1 teacher at the remote primary school. For her BTS session, Trudy worked with a group of six children of mixed ability to develop more efficient counting strategies for larger collections. The children were able to skip count using a 1–100 number chart but they did not have much experience in applying this to count larger collections. Table 2 provides a summary of Trudy's lesson.

Table 2
Summary of Trudy's Lesson on Skip Counting

Segment	Length (min)	Description
1	4.5	Children took turns to demonstrate skip counting by twos, fives and tens using 1 to100 number board
2	18.0	Chicken Scramble – Children took counters from a central pile, then counted their 'food'. This was done twice. The first time they were asked to count by ones. The second time they were asked to find an easier/quicker way to count. Counting strategies were discussed explicitly after each count. Collections ranged from 28 to 50
3	10.5	Children worked in pairs on counting tasks involving larger collections, paper plates were variously used to organize the count. Collections ranged from 85 to 118.
4	7.0	Group review of each pair's counting strategy, teacher summarized lesson and emphasized the value of counting by 5s or 10s and organising the count to "make it easier" to keep track of the count
Total	40	

As Trudy conducted this lesson, the observing teachers and the facilitator discussed, described and recorded what they noticed. The terms that the teachers used to describe the observed interactions were terms that emerged in-the-moment. A condensed version of the summary observation record is given in Table 3 below (the interactions have been numbered for ease of reference, they were not numbered in the original records). Where multiple terms were offered these have been included. In some cases, where one term clearly incorporated or was a synonym of another only one term was used. Many of the terms had emerged in earlier BTS sessions both at this site and at the other two sites. Progressive lists of these with brief illustrations were circulated to all research schools via a project newsletter. These complemented the terms described earlier in the project based on the Numeracy Program materials, that is, *modelling* (high teacher support, low student

independence), *sharing* (medium teacher support, medium student independence) and *guiding* (low teacher support and high student independence), and terms derived from the literature, for example, *funnelling* and *focussing* (Wood, 1994).

Table 3
Excerpts From Summary of BTS Observation Records for Trudy's Lesson

Observed Interaction	Evidence (this is not a full transcript)
1. Reviewing prior knowledge	T: Who can tell us what we mean by skip counting?
2. Inviting, (Instructing), Sharing	T: Who would like to come and show us how they would like to count …. to show us a counting pattern? Someone else? (child turns over numbers, T records pattern on the whiteboard)
3. Focusing, challenging	T: Make sure it's a different pattern. …
4. Modelled error, monitoring	T: What's your pattern Jackson? (1, 11, 21, 31) Jackson: Counting tens from 1. T: And what comes next? Jackson: 41 (T wrote 40). Ashley: It's 41. T: Good, I was just seeing if I could trick you, but I couldn't trick you could I?
5. Reinforced social norm	T: Remember chickens we are not greedy chickens are we? … We try to make sure that all members of our barnyard get fairly equal numbers … Go chickens! …
6. Directing	T: Count by ones …
7. Reflecting, drawing attention to, noticing (inefficient strategy)	T: Did anyone notice anything as you counted by ones? …You know what I noticed, you were taking a long time to count by ones, did anyone else notice? Jackson: It wasn't easy because I was counting by ones and I got muddled up. T: Can you count in a better way? ….(Jackson's second attempt was grouped in fives)
8. Valuing, pointing to strategy	T: Remember what Caitlin and Jackson were doing? (organised in rows and in groups of 5 respectively)
9. Shaping, refocusing	T: See if you can count your food in a better way so that you don't get mixed up … so how are you organizing it? …
10. Apprenticing	Ashley: I need an extra one? …(to make another group of 10). T: Jackson can you help Ashley …
11. Funnelling	T: Ashley, so how much do you have if you have 10, 20 and 9 more?
12. Sharing	T: Let's see how much food you've got this time? How much have you got Jaiden? (45) Can you count it for me? (5, 10, …45) … Jackson? (50) Can you count them out? (10, 20, 30..) …
13. 'Convince Me'	I'm just wondering, Jackson. Is anyone else wondering about Jackson's piles? …Are they piles of 10? … Two children: Yes (count one pile by ones, 1, 2, 3, 4, 5) Oh no, five. … T: We haven't always got equal groups have we? (referring to Ashley's 2 groups of 10 and a 9) So, we have to count on …

14. Apprenticing	T: How many have you got Caitlin? …C: I got stuck? T: So, what did you do to help you ..? C: Count by twos …90?. T: Jackson's saying it couldn't be … So, who can help Caitlin … Let's all help her …(count by twos to 38) T: Well done Caitlin
15. Focussing, reflecting	T: Have a look at what Caitlin has done, what makes it easier to count? (count along rows) … How have you grouped yours Ashley? …Do we always need equal groups to make it easier to count? …(mixed replies, extended discussion) …
16. Reviewing, reinforcing, (Instructing)	T: Think about what we did with *Chicken Scramble*, think about the quickest and most efficient way to count my collections (dog food, pasta, paper clips) … think about grouping … think about how you are going to do it … You can use the paper plates if you want to …
17. Focusing, monitoring	T moved around groups asking task-focussed questions …T: Do you want Chris to help you? What do you want Chris to do? ….I like the way you are moving the plates Jackson. Why are you doing that? ...
18. Reviewing, reflecting	T: Do you think it was easier to count in fives or tens? What have we found out today? What have we learnt about our skip counting Jackson? (Learnt how to use skip counting in a different way)… Ashley? (We learnt how to count how much stuff we've got) ... Think about what we've just said about Justine's collection? … Yesterday I gave you a collection of icypole sticks and you counted them by ones. Do you think you would do that again? (No) what if I gave you a big collection? (Count by fives or tens) and how would you set them out? (In rows, like Caitlin and Ashley)

In the debriefing session that followed this teaching episode, it was agreed that the children had learnt that arranging equal groups in an ordered manner (e.g., arrays) and skip counting were more efficient ways to count larger collections than counting by ones. It was also apparent that a valuable connection had been made between oral skip counting and the application of this in practice. The paper plates were recognised by the group as a "physical reminder of the count" and as an important scaffold in their own right that helped the children to "trust the count" (Willis, 2002). The inquiry-oriented nature of Trudy's questioning was also a focus of the conversation contributing to the view that although they had seen high teacher support, "it was not modelling" (i.e. direct instruction, teacher telling or showing students what to do). Student independence was seen to vary throughout the lesson and across individuals.

Discussion and Implications

A major consequence of the observations and discussions associated with the BTS sessions is the further shift in our thinking about numeracy teaching approaches. While we have not seen clear evidence of the type of broad teacher behaviours described in literacy, we have seen a number of quite consistent practices across different teachers, year levels and sites. Given that these are more accurately described as interaction patterns that serve to scaffold student learning (e.g., Wood, 1994), we have come to the view that they would be better described as *scaffolding practices* (after Anghileri, 2002). Further work is needed to refine the list of practices and test the extent to which they resonate with teachers' experience. But some that appear to be robust at this stage include *excavating*—a series of

interactions aimed at uncovering or making explicit what it is that learners know; *convince me*—a series of interactions where the teacher presses for evidence in support of a claim; and *apprenticing*—where the teacher invokes more learned peers to operate in a student-as-teacher capacity. Although we have seen examples of *modelling*, *sharing* (collaborating) and *guiding*, further analysis is needed to clarify when and how these are most generally used. The two patterns of interaction referred to as *funnelling* and *focussing* by Wood (1994) have been observed widely.

There are three key differences between the *Reading Recovery* version of Behind-the-Screen and the BTS activity as it was used in relation to the project. The most important difference is that it was not used for training purposes but as a research tool with the intent to identify and describe key aspects of teachers' communicative practices. As facilitators, we did not go in with a clear picture of what we might see or a language to describe it. While there was an expectation that teachers would purposefully engage in scaffolding student numeracy learning, it was not our intent that teachers adopt a prescribed set of practices. A second, related, difference is that teachers were actively involved as codifiers of practice in real time. In many studies of classroom communication (e.g., Cobb & Bauersfeld, 1995; Clarke, 2001), researchers from similar or differing perspectives work on the analysis of transcript and/or classroom video data, either individually or collaboratively to identify and label specific classroom interactions. In this case, teachers were required to identify in-the-moment aspects of another's practice that they believed to be of significance in scaffolding student learning. In a sense, this requirement worked to ensure that the aspects noted resonated with practitioners' experience and readings of the teaching and learning situation. However, it also served to identify labels or descriptors which were meaningful to the group that constructed them. These were shared between groups and between research school teachers more generally as a further test of their applicability. A third point of difference with the Reading Recovery version of Behind-the-Screen is that project teachers worked with small groups (slightly larger groups at the remote school) of "near ability" or "mixed ability" as opposed to an individual with highly identified learning needs in relation to reading. This was an important difference as it allowed the groups to observe and reflect upon the importance of peer interactions and the different ways in which teacher's communicative acts were modified in response to different student's learning needs.

The Behind-the-Screen activity appears to be a valuable research tool as well as a richly rewarding experience for those involved. The opportunity to observe other teachers teach is widely recognised as one of the most valuable professional development experiences (e.g., Garet, Porter, Desimone, Birman, & Yoon, 2001; Jacobs & Morita, 2002). A view that was widely endorsed in this instance, for example,

> This has been the best professional development experience I have ever had … I've learnt so much about my maths teaching, I now realise how important it is to remain focussed and I have so many more ideas now about how to do this thanks to the other teachers … It's been the best thing for us, we are going to continue it ourselves with other teachers from the school, we've already booked the room … (A sample of unsolicited views expressed at the end of the last BTS session, March 2003)

While there is clearly benefit in both forms of the BTS as it was used here, the videotaped sessions conducted at the remote site have the advantage of being more closely associated with the classroom teaching and learning environment and provide an on-going record for more extended and reflective discussions. This is an important feature as there is clearly much more that can be observed in any teaching episode than the nature of teacher's communicative acts. Three key features that warrant further analysis in terms of the data

collected here are the obvious importance of a clear understanding of student learning needs and trajectories, task selection (the mathematical focus and how it is represented) and the specific nature of the classroom culture that clearly serves to shape and is shaped by the interactions that occur within it.

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