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Progressive Discourse, *Neriage*, and Some Underlying Assumptions

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Greeno (1992) argues that the task of school learning in mathematics and science should be to enhance children’s thinking and that, in order to achieve this, classroom activities should be organized as mathematical or scientific discourses. According to Bereiter (1994), classroom discourse can be progressive in the same sense as science, with the generation of new understandings requiring a commitment from the participants to work towards a common understanding based on a growing collection of propositions which can or have been tested. In a similar vein, Cobb, Wood and Yackel (1991) contrast discussion in traditional mathematics classrooms, where the teacher decides what is sense and what is nonsense, with genuine dialogue, where participants assume that what others say makes sense, but expect results to be supported by explanation and justification.
While there is evidence from many research projects (see, for example, Cobb, Wood & Yackel, 1991) that it is possible to engage students in genuine dialogue, teachers in the wider education community often adopt only superficial features, resulting in what is merely “show and tell”.

Cross-cultural comparative research provides a powerful means of achieving better understanding of one’s own practice and looking for ways of extending its boundaries. Clarke (2002) describes the purpose of studying international classroom practices as not merely to mimic them, but rather to support reflection on our own practice. In Japanese classrooms, presentation and whole class discussion of student solutions in the neriage (“kneading”) stage of a lesson, allows students to compare, polish and refine solutions and so is not merely a sharing of solutions or “show and tell” (Sekiguchi, 2005). Of course, there are teachers in non-Japanese countries in whose classrooms whole class discussion shares many of the features found in the Japanese neriage. One such teacher is the teacher referred to as Barbara in Groves and Doig (1998).

In this paper, we examine and attempt to code the dynamics of classroom interactions in the neriage phase of two lessons conducted by “veteran teachers” in the first year of school in Australia and Japan – the Australian teacher is “Barbara”, who, co-incidentally, was again teaching the Fireman’s Ladder lesson. We will then use our collaborative analysis to reflect on some of the underlying assumptions that appear to shape Australian and Japanese whole class discussion.

Methodology

Two lessons were chosen from the Talking Across Cultures project that investigated children’s mathematical explanations during the whole-class discussion phase in the first year of school in Australia, Hungary and Japan. After repeated viewing of the lessons, two segments were chosen for detailed analysis from the neriage phase as representative of the type of discussions that occurred. Linked transcripts of the video segment were produced that included not only the speaker (actor) and text (action) but also to whom the speech (or actions) were directed. The Japanese transcript was translated into English for collaboration purposes.

![Figure 1: The dynamics of discussion in a community of inquiry](image)

A number of detailed coding schemes have been proposed, based on theoretical frameworks including socio-cultural theory and the notion of classrooms as communities of inquiry (see, for example, Inagaki, Hatano & Morita, 1998; Truxaw & DeFranco, 2007; Nathan & Knuth, 2003; Wells & Mejia-Arauz, 2006). In this paper, we will use a modified version of a global depiction of patterns of classroom interaction based on diagrams such as the one proposed by Splitter (1998) to contrast the dynamics of discussion in a community of inquiry (on the right in Figure 1) with a typical IRE (Initiation-Response-Evaluation) whole class discussion (see also Nathan & Knuth, 2003 for the use of a similar diagram).

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The Australian Lesson

This lesson took place around the middle of the children’s first year at school. The major focus of the lesson was the Fireman’s Ladder problem: “A fireman was standing on the middle rung of a ladder. He goes up three more rungs to get to the top. How many rungs are there altogether on the ladder?” They could then replace three rungs with five or any other number.

The lesson began with children sitting in a circle on the floor, taking turns to throw a die and double the number thrown. After about 10 minutes, the teacher introduced the Fireman’s Ladder problem. During the introduction, she spent about 10 minutes eliciting from children what they understood by “the middle”. Children then worked by themselves or in small groups for about 25 minutes to solve the problem and its extensions. The lesson ended with a 30 minute discussion where children explained their solutions and engaged in considerable debate about their different answers.

The segment chosen for this analysis focuses on a discussion of Megan’s own extension problem where the fireman needed 10 more rungs to get to the top. This segment was approximately 8 minutes long, after excluding a 6 minute portion where a different child’s solution was discussed while Jonathon completed the task of representing the ladder with coloured sticks. Essentially it is a discussion between the teacher, Megan, Jonathon and the Whole Class (WC), with a few asides of a management nature to Andy and Daniel interspersed. The discussion is summarized in Figure 2, where the numbers attached to each arrow indicate the line numbers in the transcript of the segment. However, the categorization of the flow of the discussion is not as clear-cut as it appears from this figure as the 24 children are sitting in a circle on the floor and, while the teacher often clearly.directs her comments to the whole class, in almost all cases the interchanges between the teacher and individual children is intended to be shared with the class – and in fact, it is obvious from the way that the children behave that there is indeed a whole class discussion in progress.

Figure 2: The pattern of classroom interaction in the Australian lesson segment
The segment begins with the teacher asking Megan how many rungs from the top in her problem, but then raising her voice to involve the class, starting with "Now do you know what Megan did?" (Line 7). After a short interlude with Andy about manners, she focuses back on Megan's problem and the fact that she had asked Megan to guess the answer (Lines 12 to 16). As happens throughout the discussion phase of her lesson, the teacher continually interweaves to whom she addresses her comments: the Whole Class, Megan, or other children such as Jonathon. When Megan responds "21" she asks the Whole Class, and then Jonathon in particular, whether they think this is correct (Lines 17 to 21). Jonathon thinks it is "nearly correct" but it should be 20 "because 10 plus 10 is 20" (Lines 22 to 33). The teacher asks Megan what she thinks and she says that Jonathon has forgotten the one in the middle (Lines 34 to 37). She than asks Jonathon to do it with the coloured sticks, but in the meantime, who thinks that 21 is correct (many children) and who thinks that 20 is (a few children) (Lines 38 to 45). After Jonathon has finished putting out the sticks, the teacher returns to Megan's problem and asks Jonathon what he found out and why he changed his mind that it should be 21. Jonathon says "because I included the one in the middle" (Lines 51 to 60).

The Japanese Lesson

This lesson was part of a sequence of lessons on subtraction with regrouping. The lesson began with the problem "There are 13 persimmons. I have eaten 0 of them, how many are left?" The teacher started with the number eaten as 2 and 3, then moved on to 9, at which point some children responded that they could not subtract 9 from 3. The teacher stated that the problem for today is 13 - 9. After about ten minutes, the teacher identified three different solution strategies used by the children and moved on to a discussion of each strategy - the neriage phase. The first strategy was counting down. The second was subtraction-subtraction and the third was subtraction-addition. During this part of the lesson, individual children came up to the blackboard at the front of the class to describe their own, or another child's, strategy or to demonstrate it with magnetic blocks.

Figure 3: The pattern of classroom interaction in the Japanese lesson segment
At the end of the explanation of the subtraction-addition method, the teacher asked each child to use their own blocks to demonstrate this method step by step. In a way, the lesson emphasised the subtraction-addition method by letting children experience this method with concrete materials. During the last part of the neritage phase the teacher asked children the similarity between the last two methods. Children responded that both methods used 10 as a unity. Children also said that they could use their previous knowledge.

This paper focuses on the discussion of the second strategy, subtraction-subtraction, which lasted for about 9 minutes. The discussion involved four children, who are shown in Figure 3. It started with Ogawa, who explained that 13 - 3 = 10, and 10 - 6 = 4, so the answer is 4. Kita then asked where the 3 had gone and Okazaki explained Ogawa’s solution again using a “cherry diagram”. Some children called out “I get it”. Finally Oshimizu explained again using magnetic blocks. In Figure 3, the arrows to the Whole Class indicate that the teacher asks children to come to the front to speak to the Whole Class, during and after which he summarizes children’s ideas on the blackboard. The blackboard is literally the place where the Whole Class’s ideas are gathered and relayed back to the Whole Class.

Discussion

Our analysis revealed a number of similarities between the two lesson segments. Firstly, while Figures 2 and 3 do not look like Splitter's (1998) community of inquiry diagram, they also do not represent a typical IRE pattern of interaction. Student utterances represent a high proportion of all utterances and there are many examples of sustained interactions between the teacher and students, with both teachers trying to get the students to expand and clarify their ideas. When asked about his picture of the pattern of interaction in his class, the Japanese teacher produced a diagram where student to student interactions were mediated through the teacher, saying that, for such young children at least, this is necessary (Nakano, 2008). Moreover, as Nathan and Knuth (2003) found, direct student to student interaction does not necessarily guarantee greater student learning.

A critical difference between “progressive discourse” and “show and tell” is the role of the teacher (see, for example, Groves & Doig, 2004). In both of the lessons analyzed here, the teachers elicited and identified children’s ideas that had the potential for forming the basis for progressive discourse during kikan-jyunshi – the individual problem solving phase of the lesson. These ideas became public statements during the teacher-orchestrated discussion when they were written on the blackboard in the Japanese lesson or explained verbally in the Australian lesson. Unlike “show and tell”, where the activity ends up with a possibly unrelated collection of ideas, public statements become the vehicle for progressive discourse.

Our analysis however also threw into sharp contrast some of the underlying assumptions that shape classroom practice in Australia and Japan. Firstly, Japanese lessons are supposed to have a summary phase, matome, where the whole class end up in agreement about some mathematical aspect of the lesson and not just praise children for their contributions, as often happens in “show and tell”. While the Australian lesson was not an example of “show and tell”, it demonstrated a typically Australian commitment to open-endedness, where the aim is for each child to extend the problem as far as they can. As a consequence, while children in both classrooms were expected to listen, understand, and build on each other’s ideas, in the Australian context it is recognised that not all children will be able to understand everything – which is a frequent source of tension for teachers.

The diagrams of the classroom interactions clearly demonstrate another difference in the underlying assumptions behind classroom discourse in that in Australia children need to seek the
teacher’s permission to publicly address the teacher or students, while in Japan this is not always the case, as can be seen by the fact that there are six instances where an arrow starts with a child without any previous arrow going to the child.

Another important difference between Australian and Japanese classroom practice in the early years is the importance attached to written recording of mathematics in Japan, both on the blackboard and in children’s notebooks where, even in the first year of school, children are expected to keep records and take notes during individual work and the whole class discussion. Children often refer back to what they have learned in previous lessons.

Conclusion

Despite the similarities in the two lessons, our collaborative analysis revealed in stark contrast some of the underlying assumptions that shape whole class discussion in Australian and Japanese mathematics classrooms. However, our analytic tool, representing the classroom interactions by means of a directed graph, failed to capture the essence of the dialogue and, even in this brief paper, we have needed to rely on descriptions of the discussion to support our analysis. We are in the process of developing a more complex framework that will better capture and describe key features of progressive discourse in mathematics classrooms.

References


