

BAR 04684

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Paper presented as part of the symposium
“Social Positioning Theory as an Analytical Tool”
at the Annual Meeting of the Australian Association for Research in Education,
Melbourne, November 28-December 2, 2004.

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In this paper I report on a study of collaborative learning in senior mathematics classrooms in which Positioning Theory was used as the principal analytical tool. A major objective of the study was to develop a better understanding of factors that promote or inhibit effective collaboration among students at this level. Small groups of learners in three different classrooms were videotaped while working collaboratively on open-ended mathematical tasks. Analysis of the interactions among students during these discussions centred on identifying the different ways in which students were positioned at various times during each interaction. A major outcome of the study was the identification of a range of positions available to students during collaborative work. A study of these positions, focussing on which positions were accessible to different individuals, may help to provide guidance for teachers seeking to implement collaborative activities in their own mathematics classrooms.

Positioning Theory

My purpose in writing this paper is to demonstrate the use of Positioning Theory in the study of classroom processes. Positioning theory has been described as “an analytic tool that can be used flexibly to describe the shifting multiple relations in a community of practice” (Linehan & McCarthy, 2000, p. 441). This makes it useful for dealing with the complexities of interactions in classrooms and other learning contexts, as well as in the workplace and social settings.

According to Harré and van Langenhove (1999a), positioning theory is based on social constructionism, and assumes among other things that human behaviour is goal-directed and constrained by group norms, and that human subjectivity is a product of the history of each individual’s interactions with other people. It also draws on Vygotsky’s ideas about the cultural imbeddedness of thought and language, and on Wittgenstein’s concept of “language games” (Howie & Peters, 1996).

The concept of *positioning* was first used in the social sciences by Hollway (1984), who described women’s and men’s subjectivities as “the product of their history of positioning in discourses” (p. 228). Poststructural feminists have built on Hollway’s ideas, (see Davies, 1994) as have Harré and his colleagues (e.g., Davies & Harré, 1990; Harré & van Langenhove, 1999b; Howie & Peters, 1996). Harré argues that during conversational interactions, people use narratives or “storylines” to make their words and actions meaningful to themselves and others. They can be thought of as presenting themselves as actors in a drama, with different parts or “positions” assigned to the various participants. The storylines “can be taken from a cultural repertoire or can be invented” (van Langenhove & Harré, 1999, p.30). Positions made available in this way are not fixed, but fluid, and may change from one moment to the next, depending on the storylines through which the various participants make meaning of the interaction.

Positioning is thus understood in terms of a triad of interrelated concepts: storyline, positions, and actions-acts. The *storyline* is the narrative which is being acted out in the

metaphorical drama. Within it, the *positions* are the parts being performed, possibly only fleetingly, by the participants. The *actions* (including utterances) of the participants are given meaning by the storyline and the positioning of those involved, and once given meaning become social *acts* (see van Langenhove & Harré, 1999). For an interaction to be meaningful to all participants, the storylines must be jointly constructed, and the need for a joint construction means that positioning theory can help to illuminate issues of power:

The meanings of a person's actions are the acts they are used to perform. But those acts come into being only in so far as they are taken as such by conversational partners. ... I don't and indeed can't decide what my actions mean. Only you and I can do that. The investigation of the devices by which some people can manage to get you to give my meaning to what both of us say and do is the study of power. (Harré, 1997, p. 182)

Different participants in an interaction may, however, position themselves and others present in distinctly different ways. By drawing on different storylines, the same set of words or actions may be given very different meanings. Davies and Harré (1990) gave the example of a man and a woman visiting a strange city, and looking for a pharmacy to buy medicine for the woman, who was sick. When they failed to find one and abandoned the search, the man's apology "I'm sorry to have dragged you all this way when you're not well" was construed in entirely different ways by each of them. The man positioned them as carer and patient, within a storyline of caring for the sick. To him, the healthy had a taken-for-granted obligation to look after the sick, so he saw himself as responsible for the woman's welfare. The woman found the apology offensive because from her perspective it positioned her as incapable of looking after herself, and the man as masterful and in control. Thus it evoked a paternalistic storyline that marginalised women by treating them as lacking in agency.

This example succinctly illustrates a key aspect of positioning theory—the rights and duties associated with a position. Being positioned in a certain way carries obligations or expectations about how one should behave, or constraints on what one may meaningfully say or do. Positions may also carry rights, such as the right to be heard, the right to be taken seriously, the right to be helped, or the right to be looked after. In the example above, the man felt responsible—he had a duty to care for the sick. The woman, on the other hand, speaking from a feminist storyline, asserted her right to be treated as autonomous, capable of looking after herself and making decisions. The constantly changing system of rights, duties and obligations of the participants in a social interaction constitute what Harré calls the "local moral order". Such rights and duties are usually tacit, but may be made explicit if someone challenges the way in which s/he or others have been positioned. Participants in an interaction may actively seek to adopt a position, or one may be assigned to them by others. And if a position is assigned, they may "acquiesce in such an assignment, contest it or subvert it." (Harré & van Langenhove, 1999a, p. 2)

As an illustrative example, within a school, both teachers and pupils have recognised rights and duties, constituting a reciprocal system of obligations that Brousseau (1986) called the Didactic Contract. Here, "teacher" and "pupil" are not positions, but roles—long-term, not easily relinquished, and with a profound influence on the lives of those who occupy them. But during a classroom episode in which two students are working

together, one may for a short time take a position as “teacher” with the other as “pupil”. The “teacher” may assume a duty to explain, and a right to issue instructions, ask questions and evaluate answers. If the other student acquiesces to this positioning, he implicitly acknowledges an obligation to listen to the explanations, carry out the instructions and answer the questions. In the process, the two jointly construct a “teacher helping pupil” storyline. On the other hand, the second student may contest his assignment to the position of student. He may do this tacitly, for example by arguing about the content of the explanation and thereby implicitly claiming superior knowledge, or explicitly, by saying something like “What gives you the right to tell me what to do?” Or he may subvert the process by changing the storyline, for example by initiating off-task activity, thereby changing the available positions and the associated system of rights and obligations. Linehan and McCarthy (2000) explain that in a school, “both students and teachers have a degree of agency in how they position themselves in interactions but this agency is interlaced with the expectations and history of the community, the sense of ‘oughtness’” (p. 442). This sense of oughtness constitutes the “local moral order”.

How people are positioned in any situation depends both on the context and community values and on the personal characteristics of all the individuals concerned, their personal history, their preferences and their capabilities. Duties, for example, cannot be assigned to someone who is incapable of carrying them out. Jones emphasises this individual dimension of positioning alongside the normative one:

People act as if positioned in certain ways in relation to various aspects of their world, as having certain rights and duties ... But the implicit rules, in accordance with which people act and interact within the normative dimension, reflect selective attention to specific terms of their own engagement in events ... Memories, already meaningful, combine and re-combine in a perpetual search for relations among phenomena ... In this way, the immediate event is constructed with personal meaning, both fresh and consistent with past experiences, sometimes infusing the joint construction of the present conversational interaction with novelty, humour, even misunderstanding. (Jones, 1999, p. 56)

To identify positionings it is therefore necessary to look at the detail of each interaction, at what is said and done, and how others respond, and make inferences about the rights and duties that are being presumed by the participants. Later interviews with the participants may help, by uncovering storylines, personal memories, goals and values, but care may be needed to avoid being misled by possible *post hoc* rationalisations of what was happening.

Collaborative learning

My research was an investigation of senior students’ experiences of collaborative learning in mathematics. By *collaborative learning* I mean forms of classroom organization in which students work in small groups on unfamiliar, open-ended, challenging tasks. These tasks can generally be approached in several different ways, which lead to a variety of alternative solution paths. The students have not been taught in advance a routine solution procedure, nor has the teacher presented an exposition of relevant theory. Instead, students are asked, in their groups, to recall their prior

knowledge, combine and apply it in new ways and, through discussion and negotiation, develop new mathematical concepts, and construct shared understandings.

My objective was to investigate the dynamics of such small-group interactions. Although much recent research on collaborative learning has studied student-student interaction (see, for example, Forster, 1999, 2003; Goos, 1998, 2000; Williams, 2000, 2001) the main emphasis has been on cognitive and meta-cognitive processes and less attention has been paid to social processes. It is clear, however, that effective collaboration requires good communication and good social relationships within groups and, conversely, that poor communication and social relationships can impede cognition. I therefore sought in my analysis to foreground the social aspects of interactions, without losing sight of cognition. Positioning Theory proved to be a particularly appropriate tool for this purpose. It allowed me, for example, to identify possible dominance by some students or exclusion of others, and to attend to both harmony and conflict.

There are no general rules that can be applied to make sense of social interactions such as group discussions. The verbal and non-verbal behaviour of participants must be interpreted in the light of specific details of the context, the history of the interaction, and the norms, values and expectations of the classroom community. For a mathematics class using a collaborative learning approach, these will include behavioural norms for group work that the teacher has negotiated with the class, such as a duty to listen attentively to what other group members have to say, and an obligation to justify assertions.

A major motivation for the study was the desire to develop a better understanding of factors that promote or inhibit effective collaboration among students at this level. By identifying how individual students are positioned during small-group discussions, teachers may be assisted in planning and implementing collaborative activities. In particular, consideration of positioning might be beneficial in establishing behavioural norms for collaborative work, in deciding how to arrange students into groups, in designing good group tasks, and in interacting with groups while they are working.

The study

A process of purposive sampling was used to select three senior classes for a multi-site case study. Essential criteria were that the class should be coeducational, and the teacher experienced in using collaborative methods. To facilitate comparisons, I wanted to observe all three classes working on similar content, and since I had prior experience in research on learning calculus, I chose introductory calculus, which is part of the normal curriculum for more able Year 11 mathematics students in Victoria. Subject to these constraints, I incorporated into the sample as much variety as possible. The three classes chosen were drawn from metropolitan and rural areas, and included government and independent schools, small and large classes, male and female teachers, and varied ethnic and social class backgrounds.

To facilitate the detailed study of the students' interactions during collaborative learning, every lesson was videotaped, which made it possible to return to the video as often as needed to check interpretations. During small-group discussions the camera focused on one group and their speech was captured by a desk microphone. Additional data included interviews with teachers and selected students, field notes, worksheets,

and copies of student written work. Prolonged engagement with each class was necessary to gain an understanding of the routines of classroom life, and to assist in interpreting the nuances of meaning embedded in the interactions among students and between the students and their teacher—such as unspoken assumptions, shared understandings and references to past events. For these reasons, I observed each class for two periods of about three weeks. A gap of a few weeks between the observation periods allowed for reflection and preliminary analysis.

Positions identified

Analysis focused on the small-group discussion segments of the videotaped lessons, and proceeded by stages: an in-depth study of a single lesson, a slightly less-detailed analysis of nine more lessons, and then an overview of all the remaining lessons. In the first lesson analysed, a group of four students worked for 35 minutes on a complex calculus problem. The analysis focused first on the flow of ideas and the enactment of power. Each idea introduced in the discussion was traced throughout the lesson, noting who first mentioned it, whether it was adopted or ignored, who supported and who rejected it, whether it recurred later in the lesson, and who reintroduced it. This revealed that the adoption of an idea had less to do with its usefulness or even its correctness than with who proposed or supported it. As a result of this analysis, it was possible to identify a range of ways in which students positioned themselves, or were positioned by others, during the discussion. A list was drawn up, with a description of empirically-observed behaviours for each position, and the rights and duties inferred from observing the interactions.

Excerpts from nine further lessons were then selected for further detailed study. At this stage I looked for evidence of positions not so far identified, and sought to elaborate the descriptions of positions already found. The final outcome was a list of fourteen different positions. These are shown in Table 1, with a brief description of each.

The next step was to apply the descriptions of positions to all remaining lessons. This was done directly from the video record, and not from transcripts, so that facial expressions, body language and other contextual cues could be taken into account along with what was said. No new positions emerged during the analysis of lessons from the third school. Given the differences between the schools, this was taken to indicate probable theoretical saturation. Finally, information derived from interviews with the students and their teachers was taken into account, and related to the ways the student was observed to position himself or herself in class. This provided a degree of triangulation of the data and also helped to explain some of the behaviours observed.

Getting down to work

The first two positions in the list have to do with the organisation of the group's work.

A student takes up the position of *Manager* when he or she calls the group to attention and suggests that they begin work, or recalls them to work after a diversion. A student may do this by saying something like "Let's get started" or simply "Okay?", or by reading aloud from the worksheet, or by picking up a pen and looking round at the group. Another way of taking a position as *Manager* is to ask other members of the group to carry out certain tasks. In some groups the position of *Manager* is taken up by different people at different times, but in other groups the same student occupies the

position during each episode of collaborative work, often because other group members look to them for leadership.

Table 1: List of identified positions with descriptive indicators

Position	Indicators
Manager	Initiates work, invites ideas, interprets instructions, gives orders or makes suggestions about who should do what, or how to tackle the task.
Helper	Carries out routine tasks when asked to do so by another group member. Acts in a subordinate position, under the other person's direction.
Facilitator	Acts to keep the group functioning smoothly, gives social support, ensures that nobody is ignored, tries to avoid or resolve conflict.
Humorist	Makes an amusing comment, gesture or facial expression—but it is brief, is related to the group's activity, and does not distract significantly from it.
Spokesperson	Speaks to the teacher on behalf of the group, to explain what they have done, to clarify what is wanted, or to ask if they are "right".
Expert	Makes authoritative mathematical statements, and decides what is correct, <i>or</i> is asked for help by others who accept the answers as authoritative.
Outside Expert	Introduces specialized expertise, from outside the classroom, and uses it to give examples, contextualise the task. Expertise acknowledged by others.
Critic	Seeks explanations, looks for alternative methods, disputes other people's assertions. May point out flaws in reasoning or errors in calculations.
Collaborator	Works closely with others, uses collaborative forms of talk (speaking in chorus or completing another's sentences), engages actively in discussion.
In Need of Help	<i>Either</i> claims not to understand, and explicitly or implicitly asks for help, <i>or</i> accepts an offer of help from another and attends to the explanation.
Entertainer	Initiates and sustains off-task activity—talk, gossip, banter, singing, or play, causing a significant distraction from the group's work.
Audience	Is willing to be amused by an Entertainer. May contribute to the conversation initiated by the Entertainer or join in activities.
Networker	Monitors events in other parts of the room, or listens to the talk in other groups. Joins with other groups in off-task activity, or mathematical talk.
Outsider	<i>Either</i> tries to join in the discussion, but is interrupted or ignored; <i>or</i> says nothing for long periods, and gives no sign of seeking to participate.

In contrast to a *Manager*, a *Helper* acts in a subordinate position, carrying out routine tasks at the request of a *Manager*, and usually under their direction. A *Helper* may be asked to complete a calculation, check an answer, fill out a table, draw a graph, or keep a record of the group's work. Sometimes students volunteer to undertake such tasks. This is often a way of engaging with the group while avoiding responsibility and risk-

taking. Dalin, for example, said in interview that she felt she needed time to take in new ideas, and could not work out solutions as quickly as some other students. She regularly positioned herself as Helper, saying to a student who was acting as Manager “Tell me what to write”. She then had an excuse for asking the other students to explain things again more clearly. She did not have to admit failing to understand, but could say “I need to get it down right”.

Adam presented an interesting combination—he regularly took up a position as Manager, reading out the questions and looking to others in his group for ideas about what to do, but at the same time positioned himself as Helper, writing down what they suggested. When interviewed he said that he found it “too easy to tune out in class”. By adopting the Manager/Helper combination he forced himself to concentrate and to participate actively but avoided having to do too much thinking.

Maintaining group cohesion

The next two positions listed have to do with keeping the group functioning smoothly and maintaining good relationships and good humour among the members.

A student takes up a position as *Facilitator* when he or she attends to the social relationships among group members, gives support or encouragement to someone lacking in confidence, ensures nobody is ignored or left out of the discussion, or tries to avoid or resolve conflict. Some Facilitators avoid confrontation by yielding to a more dominant member of the group. But others can be assertive when necessary, resisting attempts to dominate or distract. For example, when Sam repeatedly and rudely interrupted Natasha, Alicja turned to him and said firmly and emphatically “Let her say what she wants.”

In one group both Martin and Olivia suggested ways of solving the problem they were working on. Others in the group preferred Martin’s idea, and worked on that. But after they had found an answer by Martin’s method, Grace asked, “What was your way, Olivia?” Thus she acknowledged Olivia’s input and showed concern that she should not feel left out.

The student who takes up a position as a *Humorist* can also play an important part in promoting group cohesion. Light-hearted humour, such as a brief amusing comment, gesture or grimace, can break the tension of concentrating on a difficult task or a long and complex calculation, and help to relieve any frustration group members may be feeling. Laughing together can thus help to create a bond among group members, but such episodes need to be brief and related to the group activity. Anything that significantly interrupts the group’s work comes under the heading of Entertainer (see below).

For example, two students played around briefly with the pronunciation of the word parabola. Grace said “Purr-abola” and Diana added “I was going to say para-bo-la. But then I remembered it wasn’t para-bo-la, it was parabola.” They laughed together, and then returned to what they had been doing. Another example occurred when a group had just finished what they saw as a long and difficult calculation. One student said “Whew!” and made a grimace and the others laughed, before going back to work.

Speaking for the group

The position of *Spokesperson* is specialised, because it only becomes available when the teacher joins a group. The Spokesperson speaks to the teacher on behalf of the whole group. If the teacher has come to check on progress, the Spokesperson explains what they have done. If a group has signalled to the teacher that they want to ask a question, the Spokesperson poses the question. They may be seeking to clarify what the question means, or how the teacher wants them to tackle it, or seeking confirmation that what they are doing is along the right lines. Generally, a student assumes the position of Spokesperson by speaking up as the teacher approaches the group. Sometimes the position is contested, when two or more students try simultaneously to explain what they have done. I observed instances where two students, both excited and enthusiastic about their ideas, repeatedly interrupted one another as each tried to explain their solution in slightly different ways, both clearly trying to impress the teacher. At other times, the teacher addressed a question or remark to one particular student, effectively assigning the position of Spokesperson to that student. In this way the teacher was able to give less assertive students opportunities to explain their thinking by taking up the Spokesperson position.

Thinking about mathematics

The next set of positions deal with the ways in which the intellectual work of the group is accomplished. This includes how mathematical ideas are presented and developed, and how they are received by other group members.

A student takes up the position of *Expert* when he or she speaks with authority about mathematics. This includes making mathematical assertions (frequently expressed in a confident manner), announcing what they think is the best way (or the “right” way) to approach a problem, and making decisions about the validity of claims made by other people. Experts are generally quick thinkers, recognised by other students as “good at maths”. They are frequently asked by other group members to give explanations or other forms of help—and their answers are accepted as authoritative.

For example, in one group Lucy, a high-achieving student, quickly decided the best way to tackle the task they had been set, announced her decision to the group and began to carry out her plan quickly and systematically, speaking softly aloud as she worked. None of the other group members questioned her method or her working, but they repeatedly asked her to slow down or explain. This she did willingly and patiently, until they were all satisfied. As far as could be judged from the video record and from interviews, Lucy did not seek to present herself as an Expert, but the others in the group assigned the position to her because of her confident approach to the task and their perceptions of her mathematical authority.

In contrast, in a different group Martin positioned himself as Expert by suggesting how to tackle the task, summarising the discussion that followed, deciding which ideas to accept, and remarking that it was easy. Another group member, Paul, attempted take up a position as Expert in opposition to Martin. He objected to Martin’s arguments, sometimes flatly contradicting him. He made dogmatic assertions and jumped to conclusions, but gave little justification, saying simply “Trust me”. The rest of the group, however, contested his assumed expertise by questioning his assertions and ignoring them when he refused to explain.

Closely related to Expert is the position of *Outside Expert*. A student is positioned in this way when he or she introduces specialised knowledge or expertise from outside the mathematics classroom—from other subjects or from aspects of everyday life—and uses this special knowledge to illuminate the mathematics they are doing, for example by giving practical examples or by contextualising the task. This position is not always available, because outside expertise is not relevant for many mathematical tasks, especially the more abstract ones. But when it is available, it can provide opportunities for students who would not normally be seen as Experts in mathematics to achieve recognition by their peers, and enhance their confidence and self-esteem.

An example arose during a lesson on rates, designed as an introduction to the concept of rate of change. The class had been asked to think of everyday examples of rates, work out what they had in common and try to come up with a definition of a rate. This allowed many students to make use of their knowledge of specialised topics. Sources of expertise from which examples were drawn included a great variety of sports, finance, shopping, music, physiology and agriculture. One of the most illuminating examples was the stocking rate on a farm (sheep per hectare). This provided a timely counter-example to an idea developing in the class that all rates had the form "... per unit time".

The position of *Critic* is an important one. It should be understood in the sense of a "critical friend" who helps to identify weak points in an argument and clarify explanations, and not in the pejorative sense of someone carping and fault-finding. The key indicator of a Critic is asking "Why?" questions. For collaborative learning to be effective, groups need to contain some people who question the usefulness of suggestions or the validity of arguments, look for alternative methods, seek clarification of inadequate explanations, and point out flaws in reasoning and inaccuracies in calculations.

One student who took up a position as a Critic was Natasha. When working on a task that involved finding the maximum or minimum value of a quadratic function she repeatedly brought commonsense to bear on claims made by other group members. When Kofe claimed that he had found a minimum, Natasha asked why he said it was a minimum, it could be a maximum. The other group members then thought some more and decided that the point they had found was indeed a maximum. Natasha said that they still hadn't said why. Later when they were trying to draw a graph, Natasha remarked that it didn't look right, and decided, correctly, that they must have made errors in their calculations.

A student who works closely with others and engages actively in discussion can be described as taking up the position of *Collaborator*. This is not a powerful or high-profile position in a group, but involves being attentive and responsive to other people, expressing support, working closely with them and as far as possible sharing their thinking. Very often, positioning as a Collaborator is indicated by the use of collaborative forms of talk such speaking in chorus with another person or completing their sentences. This can often be observed when students are working on relatively routine calculations, where the next step is predictable.

Finally, a student takes up a position as *In Need of Help* by claiming not to understand or not to be able to do whatever task has been assigned, and explicitly or implicitly asking another member of the group to explain or to tell them what to do. Sometimes one student offers to help another, and in the process that student is assigned to the

position of In Need of Help. They may accept the positioning, by attending to the explanation or contest it, for example by ignoring the explanation, or saying something like “I don’t need help, I can do it by myself”.

In one lesson two members of the same group were positioned at various times as In Need of Help, but in very different ways. As soon as the period of group work began, Con (who had done the homework) positioned himself as Expert and Adam (who had not done the homework) as In Need of Help. Con began by saying “Okay, Adam, we’ll do the next one.” He then prompted Adam what to do, and took him step by step through the solution, telling him what to write at each stage, ending with “Get that, get that, Adam?” Adam eventually began to object and ask awkward questions, and finally said that he wanted to do it by himself. Ruth then took up a position as In Need of Help, beginning by asking Con a series of questions such as “Where do you get the minus six from?” Con then showed her what to do just as he had done with Adam. But when Con became engaged in a discussion with the other group members, Ruth began to demand attention. She pestered Adam to tell her the answers to a series of very simple numerical calculations: “What’s sixteen times four?” “Three times sixteen?” and so on, until Adam finally lost patience and told her to “shut up”.

Being distracted

The next two positions relate to off-task activities that distract a group from their work.

A student takes up the position of *Entertainer* by initiating off-task activity that causes a significant distraction from the group’s mathematical endeavour. This activity can take a wide variety of forms—such as talk, gossip, banter, joking, singing or play, and may be frequent and/or sustained.

Anyone willing to be amused by an Entertainer thereby takes up the position of *Audience*. They may do so by contributing to the conversation initiated by the Entertainer, by joining in the activities, or simply by listening or watching.

The positions of Entertainer and Audience are complementary. Although the Entertainer takes the lead in off-task activities, he or she cannot perform that function without an appreciative Audience. If all other group members refuse to be distracted from their work, there is little the Entertainer can do, and any attempts to entertain are likely to peter out.

Vic, for example, was a frequent Entertainer. When he found himself in a group with two friends, he took up this position at intervals throughout the lesson. As soon as the remote microphone was placed on their table and switched on, Vic began to play with it, and the others joined in, singing into it and talking nonsense in stage whispers. They worked for a time on the problems they had been asked to solve, and then the microphone caught Vic’s attention again. Pointing to it, he said “Let’s do drum music” and they spent about 30 seconds beating (softly) on the table and singing. There were three other such incidents, all initiated when something drew Vic’s attention back to the microphone. Altogether they took up a total of five minutes out of a twenty-four minute period of group work. However, when Vic was grouped with students who were focussed on their work, he was unable to take up the Entertainer position, because they did not respond to his attempts.

Ruth was another frequent Entertainer, but in a slightly different way. She treated working in groups as a social occasion, and made bright conversation, introducing a great variety of topics. These included television programs, events that had happened at school, what she did on her holiday, and the courses people were planning to take the following year. When in a group with boys, she often spoke in a flirtatious manner, and used eye contact and expressive gestures to hold her listeners' attention.

Not fully belonging

The final two positions identified are occupied by people who for some reason do not fully participate in the work of the group.

When a student is positioned as a *Networker*, they do not fully participate in the group they are in because part of their attention is directed elsewhere. They are always looking around, monitoring events in other parts of the room, or listening to the talk in other groups. Sometimes networking involves off-task activity, such as an exchange of banter with friends at the far side of the room. At other times, the Networker listens in to the discussion in a neighbouring group, and may engage with them in task-related talk, for example by asking how far they have progressed with the task, or trying to find out what method they are using or what answer they have found. Sometimes the Networker brings back to his or her own group the information gained in this way. For example "They've got 2.53, same as us" or "They haven't even found the equation yet!"

Finally, a student is positioned as an *Outsider* if he or she tries to join in the discussion, but is frequently ignored or interrupted. Other members of the group may behave as though they do not hear what an Outsider is saying, or do not believe that it could be of any value. Positioning as an Outsider is indicated when a student says something that is clearly heard by others in the group, but evokes no response or is dismissed without being given serious consideration. "Interruptions" are slightly more problematic. When students work together on challenging tasks and become excited about their ideas, simultaneous talk occurs naturally and frequently. While this often takes the form of what I call collaborative talk (speaking in chorus or completing another person's utterances), it can also involve competitive talk, such as one student cutting in or talking over another to ensure that *their* idea is heard by the group. A single instance of such competitive talk may simply indicate enthusiasm and deep engagement in the task, and does not position the second student as an Outsider. But when such talk occurs repeatedly and it is always the same person who is being interrupted, it indicates that they have been assigned Outsider status. Put simply, a student is positioned by the rest of the group as an Outsider if he or she finds it difficult to get the floor in a group discussion. In this form, Outsider is an assigned position. Outsiders may attempt to contest their positioning, but rarely have enough power to change it.

In a more extreme form, some students choose to take up positions as Outsiders. Although physically present, they appear to withdraw mentally from the group, saying nothing for a long time, and giving no sign of seeking to participate. They do not make eye contact with other group members, but direct their gaze down at the table in front of them or out into space. Ruth did this for a short time during one lesson, prompting Adam to comment "And Ruth's in her own little world" which made her laugh and brought her attention back to the group and the task in hand. Melik, however, positioned himself in this way frequently and for long periods, resisting occasional efforts by other

group members to include him in the discussion. Such behaviour is a matter of considerable concern and indicates the need for some form of intervention, to try to increase the Outsider's acceptance and participation in the group.

Discussion

Availability and accessibility of positions

Goffman's concept of an interactive frame is relevant to understanding positioning. Framing refers to "the ways in which participants signal and interpret an activity that they are jointly constructing" (Hoyle, 1998, p. 48). It gives participants and observers a sense of what activity is being engaged in and how to make sense of what is said. Failure to interpret framing correctly can have negative social consequences, as when someone does not realise that another person is joking. In analysing small-group discussions, it is necessary to interpret the framing in order to understand what is happening.

In all, fourteen different positions were identified. Ten of these—Manager, Helper, Facilitator, Humorist, Spokesperson, Expert, Outside Expert, Critic, Collaborator and In Need of Help—fall within a "doing maths in groups" frame. Outsider is also associated with this frame, but describes incomplete participation. The positions of Entertainer and Audience arise when students reframe their activity as "social chat" or "having fun with friends". And finally Networker belongs to the class as a whole: a student occupying this position is not a full member of any one group but may have a footing in several.

The positions I have identified can be considered in terms of their general *availability*, and their specific *accessibility* to particular students. Using an ecological metaphor, we can think of positions as ecological niches, available for students to occupy during group activities. Extrapolating from my study, I postulate that any collaborating group will provide opportunities for people to be positioned as Manager, Helper, Facilitator, Humorist, Expert, Critic, Collaborator, and In Need of Help. Not all of these will be occupied on every occasion, as I found, but the possibility exists. When the teacher approaches a group, a space is immediately created for a Spokesperson, but again, it may not be taken up—I noticed that occasionally a group continued its discussion without interruption when the teacher approached. And a possibility always exists that a student who is unknown or in some way unacceptable to other group members may be positioned as an Outsider, but this does not always happen.

As discussed earlier, the position of Outside Expert is available only if the mathematical task gives students opportunities to make use of knowledge linked to contexts outside the mathematics classroom. Purely abstract mathematical tasks provide no such opportunities.

The availability of some positions may depend on contextual factors such as group composition, classroom social norms, or the nature of the mathematical task. Since an Entertainer needs an Audience (or there is nobody to entertain) availability of the position depends on group membership. If everyone else in the group takes the work very seriously, there may be no niche for an Entertainer to establish her/himself. In such circumstances, would-be Entertainers may instead seek to position themselves as Networkers. For example, Vic regularly positioned himself as Entertainer when with his friends, but when he was in a group whose other members all wanted to focus on the

task, he repositioned himself as Networker, talking and calling out to friends in other groups.

Availability of the positions of Networker, Entertainer and Audience may depend on the extent to which the teacher has established (and regularly reinforces) social norms for behaviour during group work. If the teacher has explained to students his/her reasons for using collaborative learning, and has negotiated with the class a set of rules for appropriate ways of working together, it may be less acceptable for a student to step outside the “doing maths in groups” frame, or try to gain a footing in more than one group. Class size may play a part too, because in a small class it is more noticeable when a student does not conform to established norms.

The *accessibility* of positions to any individual can depend on how their interests and capabilities are perceived by others in the group, and positionings may be contested or resisted on these grounds. In addition, the positions of Expert, Manager and Spokesperson carry authority and influence, so access to them is more likely to be desired and disputed.

Students will not generally be accepted as Experts unless their mathematical capabilities are respected by the other group members, and no-one else in the group is regarded as “more expert”. For example, on some occasions Olivia easily took up the position of Expert because all the others in the group looked to her for ideas and explanations. But when she was in the same group as Martin, the other students appeared to regard Martin’s expertise more highly, and Olivia was unable to access the Expert position. She sometimes attempted to contest this, but generally repositioned herself as Critic.

Similar observations apply to the Manager and Spokesperson positions. For example, in one group Dila, who was gentle and empathetic, attempted to take up a position as Manager by making a suggestion about how they should organise their work. But Lirim, much more assertive and less conciliatory than Dila, ignored him. He was interested in one particular part of the task, and insisted on tackling it. In the end, the group split into two pairs, each working on the parts they thought were most important. In another group, Robert began explaining to the teacher how his group had solved their problem, but was interrupted repeatedly by John, who was clearly dissatisfied with Robert’s explanation and contested Robert’s positioning of himself as Spokesperson.

Access to the Entertainer position may also depend on how a student is perceived by others in the group. In one lesson, when Thasi was working with other girls she knew well, they encouraged her to position herself as Entertainer by laughing at the funny accents she put on, and egging her on to do impersonations. In contrast, when she was in the same group as two high-achieving, hard-working and confident students, who were not her close friends, she spoke little and made no attempts at humour or entertainment. Either the lack of an encouraging audience made the Entertainer position no longer accessible, or she felt too shy to try to take it up.

Finally, some students, especially high-achieving ones, may restrict their own access to the position In Need of Help by being reluctant to admit it when they do not understand something, and trying to avoid situations where a lack of understanding would become obvious. Examples of this are harder to find, because by their nature they are concealed, but it may explain occasional stubbornness in sticking to a familiar strategy, and refusal to listen to other proposals. It seems likely that some students persisted with an

inadequate strategy because they were unwilling to admit that they did not understand the alternatives suggested.

Desirable and undesirable positionings

Questions raised by this research include: Which positionings best support effective collaborative learning and which should be avoided? What is the ideal form of participation in a collaborative mathematical activity?

Research on collaborative learning has shown that gains in student learning arising from small-group discussions arise from such activities as engaging with the task, trying to understand other people's thinking, explaining and justifying one's own thinking, critically monitoring what others are doing, and being supported in carrying out complex tasks. Thus every group member needs to be encouraged to contribute their own ideas, to think about other people's ideas and build on them, link them to other ideas, or critique them, and engage collaboratively in constructing solutions. Goos and her colleagues (Goos, Galbraith & Renshaw, 2002, p. 197) additionally stress the importance of "flexibility in sharing metacognitive roles". From all this I conclude that, for a group to collaborate optimally, positionings should be fluid, with students able to move freely in and out of the positions of Expert, Critic, Collaborator and In Need of Help. Exclusive occupancy of any position by one individual may have negative consequences for both group and individual.

A student who is always positioned as Expert dominates the group and may inhibit others from contributing. Both the Expert and the group lose by hearing only one point of view. Students who are never positioned as Experts lose the opportunity to structure their thoughts by articulating them, and to obtain feedback from others on their thinking and their ability to communicate. Students who regularly position themselves as In Need of Help may be avoiding the effort of thinking. This is clearly detrimental to their own learning, wastes the group's time, and may annoy others. Alternatively, such students may not be receiving explanations that meet their needs, indicating poor communication by other members of their group. As noted earlier, some students may try to avoid being positioned as In Need of Help. This is clearly detrimental to their own learning, and the group may lose the opportunity of discussing a difficult point or exploring alternative methods. Positioning as a Collaborator appears highly desirable, indicating that a student is being supportive and is in tune with others' thinking; but students who are positioned *only* as Collaborators may be avoiding having to think for themselves. If some students are *always* positioned as Critics, it may be that they have not been given an opportunity to express their own ideas and are criticising other people's instead; if some never take up positions as Critics, they may be accepting unquestioningly what others say. And the group loses whenever input from any member is restricted.

Some students may find the position of Expert difficult to access, as discussed earlier. Here the complementary (but infrequently observed) position of Outside Expert is valuable, allowing students who would not normally be recognised as having mathematical expertise to increase their status in the eyes of their classmates, and gain self-esteem, by providing useful knowledge to help their group solve complete the assigned task.

Everybody should also have a turn as Spokesperson. Trying to explain to a critical adult what the group has done helps to consolidate learning and reveal misunderstandings or flaws in reasoning. Access to this position is, as already explained, easily amenable to direct teacher influence.

The positions discussed so far relate to the group's cognitive activities; those of Manager, Facilitator and Helper relate to the organisation of its work. It helps a group to function effectively if the positions of Manager and Facilitator are occupied by people who can ensure that everyone contributes, that no-one dominates, and that dissention (but not constructive disagreement) is avoided. Thus it may be less important for the group for these positions to be shared around (although individual students will benefit from developing the required skills). Difficulties can arise if someone with an autocratic style attempts to take charge. Autocratic managers appropriate decision-making, an important cognitive process in which all group members need to participate. In addition, an autocratic manager may inhibit some students from contributing, annoy others and create dissent. Unassertive individuals are unlikely to attempt to take up positions as Manager, but may be positioned frequently as Helper. Again, it is undesirable for one person to be given all the routine tasks—they may feel resentful, and others avoid gaining useful computational practice. The position of Humorist presents contradictions. Humour can lighten the mood, relieve tension, help to increase group cohesion, and generally make a mathematics lesson more enjoyable, but too frequent humour may distract others, and suggests that the Humorist has failed to take the task seriously. Thus positioning as Humorist is desirable, so long as it is occasional.

Three positions, Entertainer, Networker, and Outsider, are clearly inimical to effective collaboration. Students positioned as Entertainers distract both themselves and others from the mathematical task, but the extent of the negative impact depends on how the others respond. If they ignore the 'entertainment', or acknowledge it briefly and return promptly to the task, the effect may be minimal, but if they join in as Audience they can waste substantial working time. Similarly, when students position themselves as Networkers, they fail to participate fully in their own group and distract members of other groups. This can be destructive of the collaborative effort in all groups involved. Finally, being positioned as Outsider prevents a student from participating fully in group discussions, decreases their opportunity to learn and deprives the group of their input.

While this evaluation of positions may seem speculative, there are examples in my data that illustrate the effects of different combinations of positionings. In one group, only one student was positioned as Expert, but he refused to explain fully, and the other students accepted his answers without fully understanding them. In clear contrast was a lesson in which I noted maximum fluidity of positioning. Every group member was positioned at some stage as Expert, as Collaborator and as In Need of Help, and no-one was positioned as Networker, Entertainer or Outsider. The students were all confused at the start, and as they progressed with the task many misunderstandings emerged, but they remained focussed and by the end of the discussion, had resolved their misunderstandings and felt confident about the concepts they had developed.

Practical implications

A major motivation for my study was a desire to find ways of assisting teachers in planning and implementing collaborative activities. The key issue is therefore how an understanding of positioning can assist with these tasks.

Classrooms are busy places, with many events happening simultaneously, and teachers cannot possibly hear or see everything. Collaborative learning increases the complexity. The names and descriptions of positions and patterns of participation provide a language for thinking about and discussing student interactions during collaborative work. While students are working in groups, it is tempting for teachers to spend all their time engaging with each group in turn. There is, however, a great deal to be gained by standing back for a few minutes, and observing the groups as they work. Attention to positioning can assist in identifying and describing the ways in which students interact with one another. I believe that my findings will help teachers to become more aware of the types of interactions taking place in their classrooms, and to plan ways of improving them.

Change can be encouraged by careful attention to group composition. For example, each group needs if possible to have one person who is able to act effectively as Manager and Facilitator. Shy students or those likely to be positioned as Outsiders need someone in their group who is supportive, encouraging and empathetic. People who always take up positions as Experts need to have a strong assertive Manager who will make sure that others have a say. The same applies to students who frequently position themselves as Entertainers.

Choice of task can make difference too. As discussed earlier, tasks that provide opportunities for someone to take up the position of Outside Expert can boost the confidence and increase the participation of some lower-achieving students. Tasks that lead towards discovery of powerful general results help to develop a sense of excitement and achievement that can draw even Outsiders into greater participation. Tasks that have multiple possible entry points make it easier for everyone to contribute something, and if there are also multiple possible solution pathways more students may have the opportunity to take up a position as Expert by explaining their approach, and there are openings for Critics who can compare and evaluate the different approaches.

Direct teacher intervention can ensure that everyone in a group has an opportunity to be Spokesperson. And insisting that everyone must take a turn at reporting their group's work to the whole class helps to ensure accountability. For example, knowing that she would be asked to report had a dramatic effect on a student's level of engagement in one lesson compared with the previous one. Teachers can also act to make access to the position of Expert more widely available. There are several instances in my data where a teacher explained a concept or technique to one student, and this gave them the confidence to take up the position of Expert and explain the point to the rest of their group. A similar effect occurred when teachers drew attention to good ideas from students not regularly positioned as Experts, and then asked them to explain them to others.

One strategy for change is for the teacher to attend to the discourses within the classroom that help to make undesirable positions available, and to mobilise counter discourses. For example, emphasis on competition and individualism may be countered

by reminding students of their shared joy and delight in a new discovery. Discourses that present mathematics as valuable purely as a credential can be undermined by gently pointing out the elegance of certain ideas or solutions. Similarly, students' emphasis on speed and getting the "right answer" may be countered by explicitly valuing justification and reflection on alternative solutions.

Particular emphasis needs to be placed on discourses about collaborative learning. Reasons for introducing collaborative work should be explained, and classroom norms for collaborative work negotiated with students. Evidence from my study indicates that it is not sufficient simply to establish norms when first introducing collaboration, but that students need to be reminded of them regularly, and given opportunities to reflect on and discuss how well they are collaborating (as happened in two of the schools I studied). Classroom norms can help to prevent students being positioned as Outsiders by emphasising the importance of everyone contributing and being given a hearing by the group. Teachers can explicitly use classroom norms to discourage students from taking up positions as Networkers or Entertainers; they can emphasise that recognising and articulating what it is that you don't understand is an important step towards full understanding, so being positioned as In Need of Help is nothing to be ashamed of; and they can point out the importance of Critics by drawing attention to occasions when a critical question helped to improve a solution or prevent a blunder. Indeed, norms are probably best reinforced by on-the-spot comments about incidents observed in class that demonstrate the benefits of effective collaboration.

Overall, this research has revealed some of the possibilities for the use of positioning theory in the study of classroom interactions. I hope that the list of positions available in student-student discussions will provide a stimulus for further classroom research, and useful guidance for teachers and students.

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