Power-sharing in Science Classrooms: utilising CDA for research in science education

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In this paper I begin by proposing a cross-disciplinary model for enhancing access to science literacy for a diverse range of students at the junior secondary school. My goal is to present a new discourse-oriented perspective on the problem of overwhelming alienation from science, which, as indicated in major national reports, still tends to persist at this level in spite of ‘science for all’ policies in most countries. The model has resulted from research in 30 science classrooms, in the majority of which a diverse range of students were engaging with science and had positive attitudes towards their science class. I then illustrate the model, using critical discourse analysis (CDA) and excerpts from a science lesson for special needs Year 9-10 students in a low socioeconomic status area. Underpinned by sociolinguistic and sociological theories, CDA is a particularly useful tool for identifying subtle relational, representational, and identificational aspects of social practice - precisely those I am proposing as most significant for causing or preventing alienation for young science students.

Interest versus alienation in science education

My research focuses on problems of motivation and engagement in science education at the junior secondary level where the literature indicates they begin to become seriously problematic (AAAS, 2000; Blades, 1997; Goodrum, Hackling and Rennie, 2001; Lyons, 2003; Millar & Osborne, 1998). While major curricular reforms designed to arrest and reverse the declining interest in (school) science in recent years seemed to have generally failed to make much impression (cf. Lyons, 2003; Fensham, 2002), my research indicates that some science teachers are successful in engaging and motivating a diverse range of students at this level of schooling. Based on a cross-disciplinary model of literacy teaching, I suggest that this has more to do with the implicit messages these teachers convey to their students than with the disciplinary content of the curriculum, which is common to all teachers.

Using increasingly discourse-focused methods, I have found that these teachers break free of the restrictive communicative norms of the secondary science classrooms (cf. Lemke, 1990) to communicate positive and empowering messages to their students about science, about who and what is valued in the science classroom, and about their students’ roles as learners (e.g., Hanrahan, 1998, 1999a, 2001, 2002). In this paper I aim to demonstrate this by analysing, using the tools of critical discourse analysis, a sample of the discourse practices of a teacher during an introductory stage of a Year 10 science lesson for students who had been classified as having special learning needs.

Major research in Australia, the UK, the USA and Canada in recent years indicate serious concerns generally with the outcomes of school science education, with retention levels beyond the compulsory years, the levels of motivation and engagement in secondary classrooms, and the level of science literacy achieved all being seen as seriously problematic (AAAS, 2000; Blades, 1997; Goodrum, Hackling and Rennie, 2001; Millar & Osborne, 1998).

Research over the past dozen years on classroom learning environments (in which science education researchers incidentally have played a leading role) strongly suggests that interpersonal pedagogical practices play a significant role in student attitudes towards science (e.g., Fraser, 1998, 1999; Hanrahan, 1994, 1998; Waldrip & Fisher, 2000; Wubbels, 1993). Findings from survey studies of both teacher and student perceptions suggest that student
outcomes (both achievement and attitudes) are highly related to teacher-student relationships (Waldrip & Fisher, 2000; Wubbels, 1993).

Given that such outcomes were not found to be similarly related to curriculum factors, Wubbels (1993) suggested that changes in teacher interpersonal behaviour seemed to play a greater role in student outcomes than curriculum. The Goodrum, Hackling & Rennie report (2001, cited above) also suggested that, although various levels of support were also necessary, teacher classroom practices were the key to addressing the problems in relation to science literacy development in schools. Other studies on the quality of student outcomes both within and outside school science have also found evidence that teacher pedagogical practices play the most significant role, with a supportive school environment also being relevant (e.g. Lingard, Mills & Hayes, 2000).

Lingard, Mills and Hayes coined the term “productive pedagogies”, which Education Queensland has adopted as its standard (with several other state education departments having models of pedagogy with similar dimensions). What is notable about the “productive pedagogies” is that, as well as highlighting teacher professional practices that promote intellectual engagement (represented in the dimensions of Intellectual Quality and Connectedness), they also take into account Bernstein’s model (1990, cited in Lingard et al.) that underlines “the interplay between ... three message systems of schooling – curriculum, pedagogy and assessment” and hence include pedagogical practices enhancing equitable access (the dimensions of Supportive Classroom Environment and Recognition and Valuing of Difference). “Student differences need to be respected, catered for and developed within good pedagogical practices.” (State of Queensland, 2001, p. 2 of 9).

Significantly they found that, while they rated most teachers in the 975 classrooms they visited (in Years 6, 8, and 11 in 24 schools) as having acceptable levels on Supportive Classroom Environment, on average they rated them as having low levels of the dimensions of Intellectual Quality, Connectedness and Recognition and Valuing of Difference (RVD), with measures being lowest at the middle school (Year 8) level (all less than 2 on a 5-point scale). While these measures were taken in relation to four areas of the curriculum, English, Mathematics, Social Science and Science, and RVD was rated most poorly of the four dimensions for all four areas, there is some evidence elsewhere that the RVD dimension may be even more significant in the science classroom.

Aikenhead (1996) interpreting in sociocultural terms the widespread findings that most students find little relevance or interest in secondary school science, took the position that when most students entered the science classroom they were entering a potentially alien subculture where a particular way of knowing was likely to be imposed on all students regardless of its (lack of) relevance to their current life-world subculture(s). After reviewing the literature on science education in non-Western settings, including the finding that the problems were not essentially different for Western students from non-science backgrounds, he asserted that “Science instruction becomes a cross-cultural event for most students” (p. 21) “including the majority of Western students” (p. 2). Consequently, he suggested what was needed was a “cross-cultural science curriculum”, one in which “the values, beliefs, expectations, and conventional actions of students’ life-world subcultures assume a legitimate place” (p. 30). School science, in these terms, can be seen as “cultural imperialism” likely to marginalise and alienate most students.

Such a position is also compatible with a model of literacy learning which sees it as the learning not only of new conventions, facts and skills, but also the learning of new values, beliefs and social practices including language practices, all of which many sociolinguists include in the term discourse (cf. Lankshear; Luke; Gee (DATES?)). As long as science is not seen as a specialised discourse practice, clashes between a student’s current cultural practices,
values and beliefs and those assumed in the science classroom are likely to go unrecognised and unaddressed (Hanrahan, 2001). My own research in Year 8 classrooms has led me to believe that this lack of awareness of the discourse specificity of school science has unfortunate effects for both teachers and students. On the one hand it is likely to meet with student resentment and confusion—and, ultimately, alienation—and, on the other, failure to teach (failure even to recognise the need to teach) new discourse practices necessary for academic success in science.

On the whole, however, my research has been more positive, providing compelling evidence that alienation from science can be prevented or turned around by some teachers. I argue that, to a greater or lesser extent, these teachers tend to be aware of science, and more particularly, school science, as a subculture and to be able to see the clash between its cultural assumptions and those that their students bring to the secondary school science classroom. These teachers already know how to use their knowledge of their students’ current interests and needs to help them bridge the culture gap, scaffolding both concept and language development in a learning environment that respects students’ current beliefs and feelings (Hanrahan, 2001, 2002, forthcoming). Other teachers can be helped to understand and respect where the student is coming from by seeking more feedback than is usual from the students (cf. Hanrahan, 1999), or by being helped to become more aware of the language (and other symbolic) practices of (school) science as cultural conventions rather than as ways of understanding, talking and writing that are universally accepted as the Truth (Hanrahan, 2001, submitted). This research has resulted in a pedagogical model that contrasts “access-limiting” with “access-enhancing” teacher talk (Hanrahan, forthcoming, see Table 1 below).

This model was developed by comparing the teacher discourse practices of two teachers who were at opposing ends of the spectrum in terms of motivating and engaging students. One was identified as being successful in engaging a wider range of science students than usual (e.g., not only in terms of current levels of student engagement, but also by having an exceptionally high rate of uptake and subsequent academic success in senior science subjects) and the other was not seen to be very successful in engaging students either in terms of current attitudes or in retention rates in post-compulsory years. However, even though it was constructed on the basis of a comparison of teacher talk in these two teacher’s classrooms, it is a model that accounts in general for my findings more widely as I collected examples of classroom pedagogical practices from a range of teachers in two Australian states. (For a brief summary of the demographics and overall findings, see Hanrahan, 2003, for the model see Hanrahan, forthcoming.)

In this (necessarily) much shorter paper, to test whether the model can also fit teaching in a very different setting, I shall analyse two extracts (one very brief) from the transcript of the teacher talk in science class that was special in a number of ways. It was situated in a school where the use of productive pedagogies and in particular, RVD, was more likely than usual to be low, but where one teacher was recommended to me as being exemplary in terms of conducting inclusive science classes. I shall compare and contrast the discourse practices I found in this setting with the above model of pedagogical practices which enhance or limit access to science education. In this case, rather than analysing extracts from contrasting classrooms, which would be difficult to accomplish in a short article, I shall attempt to highlight my argument by contrasting the sociolinguistic choices made by the teacher (i.e., a sample of her discourse practices) with the discourse practices that the literature suggests are more typical of secondary science teachers, teachers whom I would suspect of being less aware of how alienating science can be for most students.

Methods

I shall first give a very brief summary of the teacher selection process both for this and the larger...
Table 1
Summary of differences between two contrasting sets of discourse practices (taken from Hanrahan, forthcoming) in terms of access to science education

<table>
<thead>
<tr>
<th>Access-Limiting</th>
<th>Access-Enhancing</th>
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<tbody>
<tr>
<td><strong>Representing Science</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Talk about science</strong></td>
<td>Impersonal transmission of technical knowledge that is abstract, dense and low in coherence for students</td>
</tr>
<tr>
<td><strong>Authority</strong></td>
<td>Teacher controls lesson content, pacing, and communication; knowledge is provided by the teacher and the textbook</td>
</tr>
<tr>
<td><strong>Classroom learning environment</strong></td>
<td>Classroom as work-place: learning is about task-completion, getting right answers, and following directions for practical activities</td>
</tr>
<tr>
<td><strong>Acting and Relating to Students</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Teaching style</strong></td>
<td>Teacher exhibits a limited range of non-responsive ways of acting and interacting and is not verbally explicit</td>
</tr>
<tr>
<td><strong>Pacing/sequencing</strong></td>
<td>Rapid: suits advantaged students</td>
</tr>
<tr>
<td><strong>Dialogue</strong></td>
<td>Monologue or triadic dialogue; off-task cross-discussion allowed with teacher talking over it</td>
</tr>
<tr>
<td><strong>Identifying</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Teacher role</strong></td>
<td>To be the authority, make sure that homework and practical activities are completed correctly and that class runs like clockwork</td>
</tr>
<tr>
<td><strong>Student role</strong></td>
<td>To complete tasks, give right answers, deduce teacher’s wishes and comply with them</td>
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</tbody>
</table>

study from which this teacher exemplar was chosen (for more detail see Hanrahan, 2003, and Hanrahan, forthcoming), and then describe the context for the science class which is the focus of the
current analysis. I will then discuss the aspects of CDA which are most relevant to the analysis which will then follow, the analysis being based mainly on two short extracts from the lesson which, while they are generally representative of the interpersonal environment for the entire lesson, are particularly rich in examples of the aspects related to access that I wish to highlight.

The research program

Whereas the literature referred to above suggests that motivation and engagement in learning has generally been found to be poor in junior secondary science classrooms, the “Exploring Motivation in Science” project was designed to focus on the exceptions to the rule, with the aim being to collect exemplars of teaching that were associated with a comparatively high level of student motivation and engagement. My research goal was to study teacher discourse practices to see if they differed in any significant way from those generally known to be typical of secondary science classrooms (cf. Goodrum, Hackling & Rennie, 2001; Hanrahan, forthcoming; Lemke, 1990; Watts & Bentley, 1987). My hypothesis, based on my previous research and the associated literature, was that the differences would be found to be related not so much to the type or substantive content of the curriculum (cf. Fensham, 2002) or the types of activities the teachers engaged in (cf. Hanrahan, 2001) but rather to the implicit messages conveyed to students about the nature of science, about who was included or excluded from learning, and about identities and role relationships (cf. Hanrahan, 1998, 1999a,b). In each school, I watched one (or at most two) science lessons taught by the teacher, audio recording the teacher talk and taking still and video photos. This was followed by an extended teacher interview to discuss the curriculum context of the lesson, and gather demographic and other data about the students, the teacher and the school.

Teacher selection was based on several criteria, including confidence in giving positive answers to questions about students’ motivation and engagement as determined during the initial phone interview and later checked against behavioural indications of the class observed (such as body language and the level of spontaneous student participation and on-task behaviour more generally). Another important criteria given my concern about equity and access in science education, was the suitability of the class chosen by the teacher in terms of student diversity and range of ability levels.

The context

The context of the exemplar which provided the text for the analysis in this paper, was unusual in several respects. The teacher, whom I shall call Mrs W, who had been recommended to me by a deputy principal of the school (who had a history of having a particular interest in equitable access for disadvantaged students), had originally trained and worked as a science teacher, but had more recently retrained as a resource teacher and worked part-time, job-sharing the class’s science lessons with another learning support teacher. It was she who had introduced a science subject into an area that has traditionally focused on literacy and numeracy (usually withdrawing students from science and social science subjects to teach them “life skills”). A science teacher assisted in the classes of both learning support teachers and thus helped provide continuity (and extra legitimacy for the subject in the students’ eyes).

The class also was atypical. In general they were Year 9 and 10 students who were taking the last of four junior secondary core science units, each lasting a semester. The students had been separated from normal classes because (at this particular period at least) they were seen as having special learning needs for any of a variety of reasons that meant that they needed an adapted program. She described some of the students as “ascertained SLIs” (Speech Language Impairment), with low confidence in formulating answers with questions, some as ESL (speakers of English as a Second Language), and the rest as “learning support” students, of which some had “low literacy levels” including three students who just happened to be Indigenous. The class had 11 students on the roll, of whom nine were present during this
lesson, eight boys and one girl. The students were known to be sensitive to being attached to
the “learning support unit” so it is also seen as important that it resemble a normal science
class as much as possible. Mrs MW described the students as seeing themselves “as science
learners rather than learning support students.”

The curriculum for this Year 9-10 science class was atypical, in that it had been designed
to meet the special educational and social needs of these students, being adapted on the one
hand to allow for the likelihood of an increased absentee rate and disrupted family life for
some students (NOTE HERE ABOUT WHY), but on the other hand looking as much like
“normal” classes at the same year level as possible, having the same or text-book, laboratory
setting, practical activities, and reports as regular science students, and a science-specialized
teacher. On the one hand this meant halving the curriculum content to be covered in any
semester and the practice of having the teacher keep both the textbooks and the students’
workbooks between lessons, on the other it meant having what superficially looked like the
rather conventional text-book and teacher-oriented lessons that could be observed in other
science classrooms. However, as I shall go on to argue, in fact the curriculum was much more
student-centred and accessible than is typical in traditional secondary science classrooms.

Methodology

Critical Discourse Analysis (CDA), especially as modelled by Norman Fairclough (2003),
was particularly relevant for my analytic purposes, given its twin goals (Fairclough, 2003). In
the first place it aims to raise awareness of how our subjectivities are generally shaped,
influenced, and constrained by institutional social structures by demonstrating the extent to
which texts construct or position the participants and/or reader (with text, in this context,
being defined broadly to include spoken texts such as classroom lessons).

In the second place, CDA aims to raise awareness of possibilities for creative action, action
that can change the nature of the taken-for-granted representations, relationships, and
identities and which can result from hybridisation of several discourses. CDA achieves both
aims by working at several levels in the analysis of an particular event. At the micro-level it
points out the choices being made (albeit subconsciously) in textual and grammatical
structures and choice of lexis. At the meso-level it shows which genres, discourses and styles
are being articulated together to achieve particular (usually ideologically-bound) effects. And
at the macro-level it looks at the social issue or problem evident in the text more broadly.

In practice, CDA is a form of “explanatory critique” (Bhaskar, 1986, cited in Chouliaraki &
Fairclough, 1999). Table 2 summarizes the various kind of analysis done in this kind of CDA.

The fifth feature, the text analysis, will be illustrated in the following section where I will
select some of the textual cues of most relevance for demonstrating how one teacher has gone
about making science accessible for her students. Based on both sociolinguist and social
theories, the method of textual analysis includes both linguistic analysis and “interdiscursive
analysis” (Fairclough, 2003, p. 3). On the one hand, Fairclough’s model of CDA incorporates
the micro-analytic techniques of systemic functional linguistics (SFA, Halliday, 1994; Martin,
1992) which are effective for “showing language as systematically ‘realising’ social processes
and relations… through its account of the social import of variation in language” (Chouliaraki
& Fairclough, 1999, p. 50). On the other hand, it focuses on social issues, and in particular,
how power is maintained through dominant discourse practices that normalize the social
practices of those currently in power—hence the “critical” in its epithet. Adapting the
Hallidayan contextual model to address a more sociological perspective, Fairclough (2003)
asserts that all communication reveals (i) specific ways of acting and interrelating, (ii) specific ways of representing, and (iii) specific ways of being, operating simultaneously through the formal and/or informal genres of the particular social context, the discourses used and the styles of interacting respectively, with such ways of acting, representing and identifying all being dialectically related within texts (Fairclough, 1989, 2003).

If, as Fairclough (1989, 2003) has asserted, the enhanced awareness resulting from such analyses opens up possibilities for more creative responses to structural pressures, then, as Luke (2003) has argued, CDA should also allow a discourse analyst to demonstrate how actors have resisted hegemonic discourse practices. It should be possible to show how in particular situations, they have created hybridised hegemonic discourse practices that realise new ways of acting, representing and identifying that are more congruent with an alternative ideological position that recognises and values the needs of those previously marginalised. This is the goal of my current research program and the goal of this particular analysis. More specifically I will be looking for linguistic markers (clues in the text) indicating such ideological assumptions being made, including the way “difference” is handled or ignored, the way in which various voices are included or excluded, and the way constructs are represented, styles expressed, and values realized.

Table 2
A CDA Analytical Framework (after Fairclough, 2003, Chouliaraki & Fairclough, 1999; adapted from Hanrahan, forthcoming)

<table>
<thead>
<tr>
<th>Main Features</th>
</tr>
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<tbody>
<tr>
<td>1. A focus on a particular social problem or issue in its semiotic aspect</td>
</tr>
<tr>
<td>2. Identification of possible obstacles to the problem being solved (its network of practices, other elements, orders of discourse)</td>
</tr>
<tr>
<td>3. Identification of the likely function of the problem situation in the network of social practices/social order</td>
</tr>
<tr>
<td>4. Identification of possible ways past the obstacles</td>
</tr>
<tr>
<td>5. Text Analysis</td>
</tr>
<tr>
<td><strong>A Descriptive linguistic analysis</strong></td>
</tr>
<tr>
<td>• Vocabulary (e.g., lexical/reference chains, density, field taxonomies, attitudinal lexis)</td>
</tr>
<tr>
<td>• Grammar (e.g., clausal structure; types of participants, processes, circumstance, connectors; mood, modality)</td>
</tr>
<tr>
<td>• Textual structure (generic structure, written v. spoken mode, cohesive ties, coherence)</td>
</tr>
<tr>
<td><strong>B Interdiscursive analysis</strong></td>
</tr>
<tr>
<td>• Genres (actional meanings): analysis of which genres have been accessed and how they have been integrated</td>
</tr>
<tr>
<td>• Discourse (representational meanings): analysis of discourses that have been accessed and the way they have been articulated together to represent the world, including any assumptions made, and the way difference and inclusion/exclusion are handled</td>
</tr>
<tr>
<td>• Styles (identifying meanings): analysis of styles of being and ways of identifying oneself and others, taking note of the way they have been incorporated</td>
</tr>
</tbody>
</table>
Analysis and Findings

Example texts

I will begin by presenting two extracts (one very brief) from Mrw W’s Year 10 science lesson, that exemplify the ways of representing, acting and identifying that I believe made this Year 10 science lesson more likely to have particular outcomes for her special needs students. I have chosen these extracts because they happen to include a concentration of the features of interest, not because they were exceptional. They show the dialogicality of the teacher both as it inheres in the way she addresses students and as it is demonstrated in actual interactions with students.

It should be noted that because my major focus is on how a teacher goes about producing positive attitudes towards school science (and science more generally), on how the teacher sets up the learning environment for quality student engagement with the content of science, I have not attempted to select passages that would demonstrate the quality of student learning taking place. That has to be taken as a given, having been addressed in the teacher selection process and verified through observation of the lesson as a whole.

The passages come from the early stages of a class on “weathering”, which would fit into the Earth and Beyond curriculum strand. In brief these early stages from the teacher’s point of view could be listed as:

1. Greeting students, bringing students into the classroom and preparing them for the lesson
2. Introducing the new topic at the same time as helping students become aware of the heading structure in the text-book chapter they will be reading, including the first heading of “Wearing away Rocks”, which she tells them is the focus for that day’s lesson, and three related topics.
3. Developing interest in the all four topics by relating to Australian icons and everyday experience.

The rest of the lesson consisted of reading and discussing the first section of the chapter (about weathering), making notes on it, answering textbook questions on the section read, and updating various graphic and vocabulary organisers.

The main extract represents about half of stage 3, covering nearly 4 minutes (counting about half a minute during which there was little public talking picked up by the audiotape). After a short introductory passage to connect the topics represented in the heading structure to what they know about Australia more generally, this extract shows Mrs W attempting to interest the students in the geological features of what she calls Australian icons, beginning with Uluru. This makes a good entrée to the topic both because it should connect with the interests of several Indigenous students in the class and because she sees it as a chance to validate their culture. (They happen to be in the class because of low literacy skills.) It also allows the teacher to personalise the topic by talking about her recent travel to Uluru. The latter part of Stage 3 (not represented here) then gets more specific and more focused with all students looking at a map of the local region and identifying features they are already familiar with because of previous work (Mt Warning and Pumicestone Passage). As such the stage, including the extract, addresses the second of the two goals that the teacher told me, during the interview, that she had for the lesson “to get the nitty-gritty about the kinds of weathering that we were looking at but also to relate it to their own experience as Australians”. That she saw it as being primarily about developing interest, is supported by the additional comment she made at the time, “I think that when it comes to a subject like weathering it is difficult to find a motivator.” (Mrs W, Interview, 7/08/2002).

Extract 1: Paragraph 95

Mrs W Okay, now, just to put us in the picture of where we are at at the moment. We have just started our next section of work. Um, yesterday if you were here we did our title page
Extract 2: Paragraphs 181-220

Mrs W And then Joints and Faults—you're right—on 159. So they're the four main sections [.] of the chapter that we'll be looking at. [. ] And today [.] we're going to focus on the first one, but before we do [.] um, one of the reasons why I find this section of work really interesting is because Australia, our country=

S1 [(Indistinct)]

Mrs W is considered to be—I was born here too, David—Okay?

S [(Indistinct)]

DS It's considered to be [.] the oldest [.] continent, the oldest country on the planet, and for that reason, shh, for that reason, weathering has been happening here longer than it has almost anywhere else. So when we're talking about rocks weathering—right— we're talking about what's been happening to Australia for a very, very, long time. Now, as I said to you, just recently I was out at Uluru.

S2 Uluru.

Mrs W And I brought back some books

S3 Can we have a look?

Mrs W Yes, we're going to have a quick look through these because (. ), all right, Uluru holds a fascination for most Australians and it's there because of weathering, and weathering is one of the things we're going to (. ) to study. [Tape recorder and speaker now closer together.] Okay, so you'll notice, as you look at it that, some of these up-close photos show you really interesting things that have happened, different layers in different directions?. A lot of people don't realise that—if you have a look at this one you can see Ayers Rock. It's got these layers. The layers actually go up and down. Which means something's happened to it

S4 [(Indistinct: Like piece of skins on top of an onion)]

Mrs W [(Indistinct (it's like, a, skins)]

S [(Indistinct (no-o-?)]

Mrs W Mm, so..

S [(Indistinct]

DS It's getting smaller?

Mrs W Ayers Rock? Yes, it is actually. Very, very slowly, because—have, have you seen King's Canyon?

S No.

Mrs W That's another, um, very interesting [sound—perhaps picks up another book] place.

S O-oh! Yeah [indistinct]

Mrs W [.. . Has moved further away from microphone. Seems to have handed out books. Talking with individual students for about half a minute out of range of the tape recorder. Snippets of talk only are picked up]

S Yeah, but they're real=

Mrs W [(Indistinct]

S [(Indistinct]

Mrs W That's Uluru. Yes. (Rises voice.) So have a look through those? Just have a quick look? (.) If you can find a picture of Ayers Rock? (.) have a, have a close look at it. It's quite different? (.)=

S [(Indistinct]

Mrs W =compared to what you would expect? (2) Alright—now here's a map of Australia (.) and it shows (.) [it's actually a series of (.) um =

S [(It's not yours, put it down) (Rose, sitting next to researcher's tape recorder has picked it up]

Mrs W =Shh! Put it down please. It doesn't belong to us. (1).

S (Word) This one doesn't (phrase)

Mrs W No, that wouldn't, it's on King's Canyon, but the one that Hugh has (.) might have something. This one shows you um (.) what Australia looks like from a satellite. (.) And (.) Uluru, and Ayers Rock, is sitting about there (.) right but if you have a look at it it's a =

S [(Indistinct]

Mrs W =, fairly flat continent (.) right, and our, our tallest mountain (.) it's not particularly tall=

S [Mt Kosciusko.

Mrs W Yeah. It's been weathered away an awful long time and it's in a snowy region and we'll see why (.) =

Ss [(Indistinct] Two students have low exchange which continues throughout teacher's turn]
Mrs W: [snowy regions (1) get a lot of (.) have a lot of weathering (.) happen to them (1). Um, like our tallest mountain, basically, has a footpath up the side of it (.)—it’s very easy to climb. My children climbed it over the Christmas holidays, last year, so (2).

S: It’s not [Indistinct] [I think [Indistinct].

Mrs W: [Okay? So that’s (2.) (chair scrapes) that’s one of the reasons why weathering is important to Australians - because it’s happening.

My analysis of the teacher’s lesson revealed some surprising findings. This teacher’s talk was atypical in a number of ways. Yet the significance of what Mrs W did that was different was not immediately apparent. At first glance this looked like a typical teacher-and-textbook centred science class, with the teacher doing much of the talking, the students listening and occasionally commenting, and then later going on to read from regular textbooks and make notes. What would really work best to bring out the differences would be to do a parallel analysis of a contrasting example but this would double the length of the analysis, obviously not possible in such a short article (however see Hanrahan, 2002, in progress).

However, it may help give the flavour of such an analysis if I do something similar with the first brief segment of the lesson, just two lines at the beginning of Stage 2 of the stages listed above. (Just for this extract, I shall omit the linguistic analysis, however, in the interest of making a different point.) At the same time as describing what seems to be going on both interpersonally and in terms of the ideas being presented, I contrast this with what might be expected from a teacher who is more typical in not paying much attention to students’ feelings, interests or concerns, or any gaps in their understanding or language skills (most likely to be a teacher who has to attempt to cover a wide range of units in a short space of time, all at sufficient depth to prepare an advanced student to continue with the subject at a higher level) (cf. Hanrahan, in progress). My goal is to highlight the difference in terms of the access issue and prepare the way for presenting what can be seen in a longer extract. (See Table 3)

**Table 3**
An interpretation and comparison of teacher talk highlighting inclusive features.

<table>
<thead>
<tr>
<th>Mrs W version</th>
<th>Significance</th>
<th>Alternative version</th>
</tr>
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<tr>
<td>“Okay, now, just to put us in the picture of where we are at the moment, we have just started our next section of work. Um, yesterday, if you were here we did our title page.”</td>
<td>- signals a transition - attempts to modulates possible anxiety about what will be imposed - recognises that some framing is necessary to bring everyone up to date and involve them - relates to the broader program of units of work and tells/reminds students that they have now moved on to a new unit but only just - does not presume that all students were able to be present the previous day to complete their title page, or if they were, that this is now uppermost in their minds; recognises and acknowledges such students’ right to be included in the lesson</td>
<td>[May be proceeded by quizzing students on what they did the previous day with one answer being taken as the right one for all.] “Okay, today we’re going to ....”</td>
</tr>
</tbody>
</table>
I would suggest that the main access-related difference evident in this extract is the concern to respect all students’ particular experiences of the world, their need to be included regardless of such things as their attendance record (apparently particularly poor in classes such as this one\textsuperscript{xix}), their need to know what kind of event they are about to participate in before they are expected to participate appropriately, their need to understand what and how much they have missed if they have been away, and their need to know that their teacher understands their fear of being left behind in a subject which only brainy people are supposed to be able to do, and thus risk having their reputation confirmed as a class of “dummies”\textsuperscript{xx}.

In fact, I believe that the teacher talk I observed in this class was particularly likely to enhance access for a diverse range of students in a variety of ways and will use a more extended extract to explore this assertion. Some of these ways are tied to the curriculum and context of this “special needs” class, but others I have observed being used by successful science teachers in regular classrooms (cf. Hanrahan, 2002, 2003). Most of these discourse practices have to do with what sociolinguists call the interpersonal function of language (Halliday, 1972*), and which Fairclough and colleagues call ways of acting and relating but they also in a dialectical relationship with what Fairclough calls ways of representing and ways of identifying. Most notable features were ways of speaking that were inclusive, invitational rather than demanding and judgmental, signalled a more equal status between teacher and students than one would expect, focused on developing understanding rather than conveying information, were more typical of spoken rather than written speech (but were still somewhat formal and contained little ellipsis), were internally very coherent and cohesive and did not depend on external texts as much as one might expect, and mixed scientific abstraction and detachment with personal narrative interest and concrete detail.

Analysis and Discussion

An argument for studying weathering

The main textual structure here is a logical argument (with evaluative premises) for why the topics to be studied in this unit are interesting, important, special to know (especially for Australians) and hence worth studying for these young Australians or potential Australians (even though two Samoan students were reportedly absent that day). The argument begins with first one line of argument, relating to Australia as the oldest continent (“one of the reasons why I find this section of work really interesting is ... Australia is considered to be ... And for that reason ... So...”). This is followed by another line of argument about why the topics to be studied are particularly interesting, surprising and different, sometimes even dramatic (“Uluru holds a fascination for most Australians”, “really interesting things”, “a lot of people don’t realise”, “quite different↑, compared to what you would expect↑”, “it used to go this way and all of a sudden it’s been turned”). After that, the promise of “we’ll see why” seems to be quite a natural consequence of the news of such antiquity and interest.

After the first reason given early in the extract, the conjunctions are mainly additive (“As... and... and ... because ... and ... and”), and then we get our first consequence “so you’ll notice”. Then more evidence is presented, contrasting what used to be with what now is, with occasional “if” and “but” occurrences to deal with other possibilities, but then “so” and “because” re-occur at least twice more each (there are five occurrences of “so” and four of “because” in this short extract) leading up to the conclusion, “So that’s ... one of the reasons why weathering is important to Australians, because it’s happening.” Rather than being relegated to the geological past or the abstract timeless present of science, the topic has been represented as being a current event that interests people (including children) just like them.

Most participants in the subject position are people, or photos, or the subjects of photos, such as important tourist attractions (Uluru/Ayers Rock, Mt Kosciusko), those in the object position refer to the meaning, feelings, perceptions, details, evaluations and experiences of
these people, artefacts and places. This is in contrast to more usual science content that is supposed to be about things, material processes and abstract principles, often without any reference to human purpose or wider issues, features that can make it alienating (cf. Lenke, 1990; Tobias, 1990).

The dominant part of many clauses in this extract is the participant in the object position, particularly following relational processes identifying or explaining what went before, with several being hypotactic clauses. This accords with the purpose for this part of the lesson of arousing interest in objects presented for viewing purposes, and justifying why weathering its worth studying. More generally clauses are both paratactic—additively building up a case—and hypotactic—giving the why, when, and wherefore of the supportive evidence. However, the main goal is to motivate students, so much of the evidence that will later become the object of study is buried within embedded clauses in the unmarked object position.

With the exception of the exchanges allowing or forbidding action (“Shh”, “have a look”, “put it down”), most exchanges are information exchanges, which is to be expected in a science class. That it is happening in a science class for students with major learning problems is perhaps a little more surprising, and the preceding and remaining parts of the lesson are probably more typical of what you would expect, with more frequent activity exchanges. (It should be remembered also that the teaching aide was helping students deal with activities and behaviour when needed which left the teacher relatively free to focus on content.).

More typically, most of the teacher’s utterances can be seen to be statements or demands. However, these are often modulated or modalized in that several include conditional clauses or modal auxiliaries (“might”, “would”) or adjuncts (such as “just”), and they are also modulated by a rising tone at the end, one that suggests a question or an offer rather than a statement. There are questions on both sides, to gain “goods” or information, but also to clarify or explain. In fact, most of the dialogue appears to be what Lenke (1990) calls True Dialogue, where teacher questions are real questions to which she does not know the answer. Mrs W seemed to avoid the typical IRE triadic dialogue which is really a test of student knowledge rather than a real exchange of information though it may have that as a secondary purpose (for example for listening students to learn from). This may be linked in part to the fact that, as Mrs W explained to me after the lesson, many of the students had speech difficulties which reduced their confidence in formulating answers and hence affected the type of questions she tended to ask them.

Overall, Mrs W’s goal at this stage of the lesson seems to have been to get her students to engage with the stimulus materials and become interested, rather than test their prior knowledge, which makes it even less likely that she will expose them to the risk of shaming themselves and losing confidence by giving wrong answers. (This may be all the more so because the researcher is present on this occasion.). She seems to take the line in this part of the lesson that she is there to motivate students and help them learn and that she can do this most effectively by giving information, making suggestions, and taking an invitational tone rather than by quizzing the students. Nor is it a time for significant student activity—that will come later in the lesson and later in the unit (she has already signalled the practical activity they will be doing).

**Difference**

Difference was addressed in this class in several ways, some of which are evidenced in this extract. In some ways it was made evident and treated as valuable or at least interesting, and in other ways it was reduced or purposefully ignored. For example, differences were highlighted between

(a) Australia and other countries,
(b) Australian-born and non-Australian born,
(c) those who realise and those who don’t that really interesting things have happened geologically, and
(d) Photos that have Uluru/Ayers Rock and those that don’t.

On the other hand equivalence or potential equivalence was implied or assumed or between
(e) those in this room and others who realise these things,
(f) most Australians and this class,
(g) Uluru and Ayers Rock (see below),
(h) “our tallest mountain” and local neighbourhoods (that would have footpaths)
(i) pictures in books/stories about life and what the student would be studying.

The pedagogical purposes of most of these are obvious. I am rendered somewhat uneasy at the implication that non-Australian-born have less right to consider Australia “our country”—and perhaps this reference would have been reworded somewhat had the two Samoans been present on this occasion (I am not sure whether there were other immigrants present in the class)—but for the most part I can see that the differences and equivalences represented in this extract would encourage most students to identify with a need or desire to learn more about weathering, and to feel included rather than excluded.

More generally, and it’s not so obvious in this extract, Mrs W chose Uluru as a focus to give Indigenous students an opportunity to be proud of being different. In the interview she commented that she had chosen to bring illustrated books on Central Australia to the class because “I thought well that would pique their interest as well because I call - I called it Ayers Rock on purpose because I wanted them to correct me and tell me it was Uluru. So, you know – and they did that which I thought was good because they need to – I think they need to feel that – you know – their culture has as much place as [indistinct]” (Interview Mrs W 7/08/2002). This confrontation happened during the preceding activity, where the teacher walked the students through the main headings in the chapter they will read together subsequently, when one student was quite forceful in saying “No!” as soon as the teacher said Ayers Rock (the name may have been used in the non-so-new text-book chapter they were perusing). She immediately reworded this as “Uluru” and then used Uluru subsequently at the beginning of this extract, but reverted to giving both names at times, using the alternatives an equal number of times. Hence rather than adopting one or the other name, she reached a compromise of sorts, continuing to display difference openly, acknowledging the Aboriginal culture, but also allowing for those who already thought about the geological formation as Ayers Rock and would not have made the connection with Uluru if she had not done so (frequently).

In respect to willingness or ability to learn, she allowed the possibility that not all students would want to engage, or might not succeed in finding something even if they did want to engage. She used “if” statements to communicate this “if you have a look at this one you can see”, “if you can find a picture of Ayers Rock, have a close look at it”, “if you have a look at [a photo of “what Australia looks like from a satellite”], it’s a fairly flat continent.” The alternative would have been to presume that everyone would see what she wanted them to see, thus leaving them no choice and no escape from failure if they did try but couldn’t see what was expected. Hence these conditional statements should allow all students to feel includedxiii. This is particularly the case, since her commands in this section should be read as invitations, not only because of the modulated “Have a look at” rather than “Look at...” but also because of the way so many of her clauses finish with a rising tone, as if they were questions or offers: “So have a look through those? Just have a quick look? (.) If you can find a picture of Ayers Rock? (.) have a, have a close look at it. It’s quite different?” On the whole this increases dialogicality, and during this extract we witness a total of 13 clear contributions from students (two questions, four statements, one order, one contradiction, one affirmation, and one answer to a (true) question) as well as some others that are indistinct, and some
Another example of inclusivity, but one that is not particularly obvious in this extract unless you are looking for it and one which is potentially quite controversial, is Mrs W’s refusal both here and elsewhere in the lesson, to be specific about the geological time periods involved (from the perspective of scientists) in the processes they are studying. Instead she said things like “weathering has been happening here longer than it has almost anywhere else”, and at other times “a very, very long time”, “an awful long time”, “but not in our lifetime”, “for probably the longest time you can imagine”. She told me that the catchment area for the school was a growth area for fundamentalist religions and that there were quite possibly creationists in the class and that, since her goal is to get across the “idea of weathering” she did not see much point in an “in-your-face” confrontation about whether the world was created less than 6,000 years before or not. (Nevertheless her “it’s considered”, at the beginning of this extract, probably indicates that she would be open to discussing different worldviews at a later stage.)

On the other hand, her predictive statements during this part of the lesson assume that all students will participate actively in what is to follow. “We’re going to have…”, “we’re going to study”, “so you’ll notice as you look at it”, and “what you would expect” all presume a unitary “we” or “you”, as also does the reprimand “It doesn’t belong to us” and thus assumes the dominance of the norms of the classroom, not surprising when the goal is to have students studying, noticing, expecting, and behaving appropriately. She also refers to how “most Australians” react to Uluru, to what “a lot of people” (don’t) realise, and what “is important to Australians” as though these are a matter of fact rather than opinion, thus assuming consensus and reducing dialogicality. Against this, she treats those who are ignorant with respect and not blame them, saying “a lot of people don’t realise” rather than more pejorative alternatives. On the positive side being included in such assumptions of commonality or solidarity may be a bonus for some of these students, who are perhaps more used to being excluded from statements of what the class is doing because it isn’t true of them (for example, by assuming that everyone has been in attendance the previous day), and all of the students names are used by the teacher in the course of the lesson (two during this extract). Frequent minor clauses, such as “Alright?”, “right” and “Okay?” invite students to reply if they choose/dare and several different students can be heard speaking during this extract, some more than others but often because their louder/deeper voices are easier to pick up on the audiotape. And when there is a teacher question directed at a student, it is a true question (e.g., “Have you seen King’s Canyon?”), not a test of knowledge as in the more typical triadic dialogue used by teachers (cf. Lemke, 1990). On the other hand there are at least two questions initiated by students, and students who participate appropriately (during her pauses but not while she is speaking) get reinforced with direct answers to their questions. There are two polite requests (“Sorry?” “Put it down, please”) and there seems to be a certain amount of reciprocity between teacher and student(s) with the one echoing what the other has said some time earlier, sometimes initiated by the a student “have a look”, “put it down”, and sometimes by the teacher for example “which means” (cf. “Does that mean”), “This one doesn’t”, “They’re” “It’s not”. Overall, dialogicality seems encouraged rather than repressed and students included rather than excluded, and when consensus is assumed it is not at the expense of students’ interests and needs. One of the statements of commonality could even be seen as an invitation or opportunity to become exceptional, to become one of the Australians who does realise that interesting things have happened to produce some of Australia’s icons.

**Intertextuality**

The access that students have to information contained in teacher talk depends in part on its cohesiveness and the coherence of the lesson for the students. Perhaps because there is a high absentee rate in classes such as this, the teacher does not depend in any obvious way on the
previous lesson or lessons. This is in stark contrast to the behaviour of the “access-limiting” teacher referred to in the model above, where the meaning of almost every utterance (many of which were highly elliptical) depends on texts that were absent or not currently visible (such as the previous day’s lesson and the accompanying passages in the textbook). In this extract, there are reference to things said earlier in the lesson (“Uluru”, “layers”) as well as latter in the lesson (“snowy regions”), and the key terms to be studied, with “weathering” featuring at every stage of the lesson, five times during this short extract and 47 times during the entire lesson. Other terms that appear frequently in this segment and have appeared earlier in the lesson and are explored further later in the lesson include “shows” and “happened”, both important for science, having to do with evidence for and explanations about past events and how to read, discuss and write about these. Other references prefigure the other three topics in the unit Erosion, Sediment, and Joints and Faults, and also have been hinted at in the work on headings in the previous stage of the lesson. As such this extract demonstrates both the cohesiveness and the overall coherence of the lesson in general, even though, of course, we can’t be sure of that for all students.

Probably also because of possible lack of day-to-day continuity, as well as out of concern for the ESL speakers in the class (of which there were several, apparently, possibly including some of the Indigenous students), there is very little ellipsis. Mrs W speaks in full sentences (e.g., “Now, as I said to you, just recently, I was out at Uluru”). She explains the what, why, when, where, or how of things in specific terms. Other texts she wants to refer to, such as photos and maps are brought to the class and shown directly to the students. Most pronoun references in the text refer to what has just been said, a photo or map visible to both speaker and listeners, or to the speaker or listeners themselves. The photos and maps act as a backup authority (along with the teacher’s personal experience), (apparently) providing self-evident verification of the point being made, whether a factual point (“it’s got these layers”, “different layers in different directions”) or an evaluative point (“some of these up-close photos show you really interesting things”, “It’s a fairly flat continent”) and, even when these visual aids are withdrawn “for the moment”, can act as images and reference points for the rest of the lesson on weathering and perhaps even into the future, providing intertextuality for what is to come.

However, Mrs W asserts as statements of fact, statements that are really evaluations on behalf of absent others that may or may not be supported by the evidence. At first these are somewhat modulated, “Uluru holds a fascination for most Australians”, “a lot of people don’t realise...” [italics added by me] but by the end of the extract, Mrs W assumes that it is a given that “you would expect” [to see something different] and “weathering is important to Australians” (with all Australians now being spoken for, although this is not an assertion that they think or say it is important to them, and could include things like the fact that (some) children can actually climb over the tallest mountain in Australia). However, this claim is admittedly modified by “one of the reasons why” which means some Australians may have other reasons for thinking along these lines.

Other support Mrs W brings in from outside is references to trips she or her family have taken, one to Uluru (where she took her ailing parents earlier that same year), and one during which her children climbed Mount Kosciusko. She told me she did not have a background in Geology but was able to bring her family’s interest in travel in Australia to bear on the topic of weathering. This perhaps made her students feel more connected to such sites, since it meant someone they knew, and who may well have been a significant person to many of them (having taught some of them since Year 8), had actually seen these sites. It may even have given them an advantage over students in regular classes whose teachers may not have reported having had such first-hand experience. As well, her students could be expected to relate easily to “basically has a footpath up the side of it” which would bring it closer to their own experience by reducing it to a size that they can imagine.
The geographical references should also have been quite familiar to and/or relevant to these students. As suggested above Uluru would have a particular interest for the Indigenous students in the class, given that it is owned and managed by Indigenous people and has special religious significance for most Indigenous Australians. This would have added an extra layer of significance to this lesson and made it more immediately relevant to the class. The stress on Australia being special in regard to weathering should have added relevance to the lesson, even for the newcomers to Australia who might be expected to be a bit curious about their new homeland.

**Genres, discourses and styles**

At another level of analysis, the ways Mrs W textured together a number of different genres, discourse and styles is also likely to have served to make science more inclusive. In some ways, this extract is fairly typical of the kind of text you would expect to find in a science class. Of the 78 complete clauses (of which 14 are embedded) nearly a third are relational processes attributing qualities to things (e.g., “it’s got these layers. The layers go up and down”), and the next most common process type is identifying relational processes (e.g., “weathering is”, and “snowy regions... have a lot of weathering...”, and “which means ...”). However, there are very few material processes, contrary to what could be expected in scientific text, with several of them (referring to things happening) appearing only in embedded clauses (“you’ll notice ... [that, some of these up-close photos show you really interesting things [that have happened, different layers in different directions]]”) or in a short behaviour management episode (“Put it down”), or being in fact metaphorical forms of relational processes (e.g., “It used to go this way” “to do with”) (my italics). There are also several existential processes referring to where things are (e.g., “I was out at Uluru”, “It’s there ...”) and a surprisingly large number of behavioural/mental/verbal processes referring to focusing, considering, talking about, looking, showing, saying, in fact to the various ways of going about thinking and learning itself, rather than referring to the subject matter of learning. This is again in stark contrast to science teaching that is content-focused and matches the goal of this part of the lesson which is meta- or multi-functional rather than merely instructional.

One feature of the grammatical structure is the high use of grammatical metaphor, both in process types and in types of speech actions. In some cases it represents a borrowing perhaps from tourist information brochures “holds a fascination” while in others it’s a way of modulating an order “have a look” so that it becomes an invitation. Modal adjuncts such as “actually”, “just”, and “basically” and modal auxiliaries such as “can” “would” and “might” also soften the force of assertions, as do conditional clauses suggesting choice, “if you have a look at it” (used twice). A higher than expected use of modality, along with a high level of teacher politeness, indicates deference (cf. Eggins, 1994) and a reduction in the apparent power differential between teacher and students.

Another aspect of the discourse that reduces the power difference in this extract is that, on the whole, people and things are usually in the actor (rather than actant) role in clauses, including the teacher, students and features of the landscape (e.g., I, we (“we’re going to study”), you (“you’ll notice”, “as you look”, “if you have”, etc.), “Uluru is sitting”, “Ayers Rock is”, “our tallest mountain has”, “my children climbed”). However sometimes the students are represented as being acted upon by photos and maps which will “show” them things and “mean” things. (“some of these up-close photos show you really interesting things that have happened, different layers in different directions”, “it shows a series of”, “shows you what Australia looks like from a satellite”) (my emphasis). Even so, this is further evidence of the teacher not emphasizing her authority and aligning herself with the students, with the photos supposedly teaching the students and her alike.

Another feature that makes the teacher talk more accessible is that social actors are often personalised, even rocks and mountains (“Uluru ... is sitting”), and made specific (“some of these photos” “this one ... from a satellite”), more often than not being named or owned by
Australians (“our tallest mountain”, “Uluru”, “King’s Canyon”). On the other hand, in some cases they are generically classified (“Australians”, “tallest mountain”, “weathering”). On the whole, though, in contrast to more typical science teaching (cf. Hanrahan, 2001; Lemke, 1990), personal, specific and concrete events appear here more frequently than impersonal and abstract things or ideas.

Teaching is naturally a hybrid discourse as the teacher recontextualizes content brought from elsewhere and plays several roles. However, how s/he does this in the detail of texturing of a lesson will make a difference to the access students have to the subject-matter and culture of a particular discipline. The teacher here has combined several discourses, and is emphasizing at least two teacher roles (one itself being quite hybrid) during this extract of the lesson, as the two threads of the lesson presented in Table 4 (see below) suggest.

She combines teacher as science transmitter (speaker to students lined up in row of desks, decider of curriculum, declarative statement maker, provider of evidence, user of scientific terms, etc.), teacher as care-giver/friend/facilitator (shown in her friendly tone, modulated, conditional processes, helpful commentary/meta-talk about what is going to happen/what people thing/what things mean, user of metaphors, committed maker of evaluations), teacher as science communicator (animated speaker who makes considerable use vocal tone and body language—evident in the emphases and intonation suggested in the extract as well as in my photos of her—personalised language and stories, visual aids) and teacher as behaviour regulator (Enforcer of classroom rules; clear communicator of commands relating to behaviour that is not appropriate).

**Table 4.**

The two main roles of the teacher in this extract.

<table>
<thead>
<tr>
<th>Teacher of earth science</th>
<th>Cultural explainer/Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uluru</td>
<td>So they’re the main four sections, etc.</td>
</tr>
<tr>
<td>weathering</td>
<td>today we’re going to focus on the first one, but before etc.</td>
</tr>
<tr>
<td>notice</td>
<td>One of the reasons why I find etc.</td>
</tr>
<tr>
<td>different layers in different directions</td>
<td>As I said to you just recently</td>
</tr>
<tr>
<td>Ayers Rock</td>
<td>Uluru holds a fascination etc.</td>
</tr>
<tr>
<td>layers, the layers ... go up and down</td>
<td>one of the things we’re going to study</td>
</tr>
<tr>
<td>turned this way</td>
<td>You’ll notice as you look at it</td>
</tr>
<tr>
<td>to do with faulting and folding</td>
<td>some of these photos show you really interesting things etc.</td>
</tr>
<tr>
<td>getting smaller</td>
<td>A lot of people don’t realise that</td>
</tr>
<tr>
<td>Map of Australia</td>
<td>If you have a look at this one</td>
</tr>
<tr>
<td>a series of..</td>
<td>Which means..</td>
</tr>
<tr>
<td>looks like from a satellite</td>
<td>King’s Canyon. That’s another very interesting place</td>
</tr>
<tr>
<td>fairly flat continent</td>
<td>If you can find a picture of Ayers Rock</td>
</tr>
<tr>
<td>tallest mountain</td>
<td>Compared to what you would expect</td>
</tr>
<tr>
<td>weathered</td>
<td>No that wouldn’t but the one Hugh has might...</td>
</tr>
<tr>
<td>snowy region</td>
<td>Right but if you have a look at it</td>
</tr>
<tr>
<td>snow regions</td>
<td>and we’ll see why</td>
</tr>
<tr>
<td>weathering</td>
<td>Our tallest mountain basically has a footpath up the</td>
</tr>
</tbody>
</table>
tallest mountain | side of it; it’s very easy to climb...
weathering | So that’s why etc.

Hence she draws on several discourses: those of science education (with its technical terms, observations of impersonal, concrete detail, its lexical density, and statements about abstract material processes and principles, and assumptions about scientific time; and value-free arguments), behaviour management (Shushing students who interrupt, or reminding student of the classroom rules about how to treat property belonging to others), everyday chat between familiares (as she explains, evaluates, describes and identifies, differentiates stages and processes, situates and predicts, makes assumptions about what others think or value), and promotional genres (science communication and tourism communication). Apart from a hesitation right at the beginning of the extract when she is switching from leading a literacy-teaching activity to this promotional one, when there is a slightly awkward “um” and a pause, for the rest of the extract the different discourses and identities are practically seamless.

In summary, Mrs W enacted a hybrid discourse in a way that was highly compatible with that of the access-enhancing teacher depicted in the model above. Firstly, she represented science relevant to everyday lives and able to be discussed by everyday people. Secondly, she interacted in ways that seemed designed to enhance dialogicality and decrease the power differential between teacher and students. Finally, she styled herself as a facilitator and guide to the culture as well as a transmitter of information about earth science. In complementary fashion, she represented the students as active learners, makers of choices, and contributors to the conversation about science. In particular:

- She speaks as though she is offering the students something rather than demanding something (cf. teachers using IRE); she behaved in a way which respected students’ privacy and could have helped build up trust.
- What replaces IRE sequences looks like true dialogue, even though, admittedly, it is the teacher who does most of the talking. However, students ask questions, make statements, and support what the teacher says without being asked directly. When the teacher does ask a question it is a real question.
- Even while the teacher is talking, she has multiple ways of being inclusive of students (e.g., making “if” statements about their experience thus allowing for diversity in their life experiences, implying that they have some freedom in how they choose to think and act, her intonation suggesting she is asking questions or making offers even when she is apparently making statements or demands, her taking the trouble to explain how the topic is relevant to their lives before they are asked to engage with it and her tendency to use spoken rather than written forms of language.
- She focuses on the learning process and on understanding rather than on conveying information, and makes frequent meta-comments about the processes they are engaged in, situating the lesson and the topic, and connecting parts of the lesson to earlier and later parts, making explicit the various processes they are engaged in, and scaffolding the viewing (and, later on, other literacy) tasks the students are engaged in.
- She uses a mixture of formal presentation and informal chat, taking the most accessible features of each—explicitness rather than ellipses on the one hand, and everyday colloquial language and grammatical intricacy rather than lexical density on the other—to clarify what is going on for the listener.
- The tenor of her talk is a mixture of scientific detachment designed to generalize observations by using abstract, technical, impersonal language, and narrative techniques designed to create interest and curiosity by using concrete detail, dramatic suggestion, and personal references.
She tends to speak as though it was the students who held most of the power even though she had superior status as the teacher (particularly in the use of modality, and grammatical metaphor). Overall, the tenor of the teacher talk in this instance suggests, on the one hand, a caring older family member having a friendly chat with less experienced members of the family, and, on the other, a somewhat formal public presentation, perhaps by a science communicator. The talk might sound rather informal, but, with the exception of the moments when she is obviously talking with individuals, she uses full, somewhat formal sentences, enunciates most words clearly with more than usual emphasis on some words, and develops and sustains a logical argument over the duration.

I am not suggesting that this single episode (lasting less than four minutes) would in itself have a lasting effect on the attitudes of these students towards school science. In fact, it is only by the consistent repetition of such discourse practices within each lesson, and multiplied over time for the duration of the semester, that the teacher can convey implicit messages to students that may affect their attitudes towards their science class and eventually, school science more generally. And yet over time, I do believe that such teachers can substantially change the assumptions students have about science: assumptions about the way the world “is”, how learning happens, who can learn science and who can’t, what school science is for and who it is for, who counts in this particular classroom community, and who may or may not be treated as though they simply don’t exist for all practical purposes. The assumptions the teacher makes may be crucial in communicating to all students positive messages that they can and should learn science, that it has something to offer them that is worth learning, that their world is a fascinating place, and that they do have a place in the science classroom learning community regardless of issues or problems that they may be having with learning, with science, or with schooling at this point in time or in the past.

I should note also that I am cognizant that the teacher employed many other practices to make science more accessible to her students besides the way she spoke to them. I have already mentioned some of the adaptations she made to the curriculum to enhance her students’ positive feelings about their science and help them make the most of them. In contrast to this, my experience has been that the usual approach to equity in science education is to require that the teachers of all students at the same level “cover” the same breadth of curriculum content, even though this requires a rapid pace that makes learning with understanding beyond the reach of all but the most advantaged students (Hanrahan, 1999). Nevertheless, I do not believe the teacher would have succeeded in achieving her goals of having her students engage seriously with the content of science, even with these adaptations, if she did not also relate to students at the micro-level in ways that conveyed her respect for their needs and concern to look after their interests.

This analysis reinforces the importance of consistency between the three message systems of curriculum, pedagogy and assessment (Bernstein, 1990, Lingard et al., 2001; State of Queensland, 2002). It reinforces the importance of the access-related productive pedagogies of Recognition and Valuing of Difference and Supportive Social Environments, not in place of, but alongside Intellectual Quality and Global and Local Connectedness. It would also seem to justify Wubbels’ concern that accessible curriculum content be backed up by interpersonally conducive learning environments, where the students feel that they are treated with respect and trust. Moreover, it demonstrates how a teacher can put into practice Aikenhead’s recommendation that teacher’s adapt their style (he suggested possible roles of “travel agent”, “tourist guide”, and cross-culturally supportive teacher (who goes against racist or classist assumptions about who can learn academic subjects like science).

References


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1. In Australia a nation-wide report commissioned by DETYA (Goodrum, Hackling and Rennie, 2001) found that at the junior secondary level where science was generally compulsory, teaching tended to be highly regulated with little room for genuine student inquiry, it was seen by most students as being irrelevant to their current or future needs, and student levels of satisfaction were poor. (While it was taught less often at the primary level, where it was taught it tended to be more student-centred and activity-based, and to be associated with high levels of student satisfaction.) Declining enrolments in science in the post-compulsory years of secondary education and in tertiary science-related courses have alarmed both professional and government bodies and have resulted in major policy initiatives designed to get more students to study science (State of Queensland, 1998; FASTS, 2004; Prime Minister’s Science, Engineering and Innovation Council, 2003).

2. In these studies, attitudes towards science were found to be particularly related to perceptions of Cooperation (Helping/Friendly, Understanding, Leadership and Student Responsibility/Freedom), and achievement in science to be particularly related to both Cooperation and Dominance (with Strict being an additional significant factor). Cooperation-Opposition and Dominance/Submission were the poles of the two axes (labelled Proximity and Influence) of the circumplex model for interpersonal teacher behaviour (Wubbels, 1993), and Helping/Friendly, Understanding, Leadership and Student Responsibility/Freedom are the names of four of the factors derived from the results of surveys using items based on the model.

3. Recognition and valuing of difference is in flux, and current term appears to be engagement with difference.

4. Science and maths actually scored slightly better (still below the mid-point) than the other areas on the Intellectual quality at the middle years level but did worse at the Year 6 and Year 11 levels (State of Queensland, 2001, 1.22, p. 14).

5. Halliday (1999) made a similar point about the features of written science that cause problems for both first and foreign language speakers of English, though limiting his conclusion to the grammatical aspects of science.

6. The two teachers exemplified in the model were both engaged in teaching science in (non-elite) private schools to non-elite students, one to a mixed class and one to a class of girls.

7. This sample includes 28 other teachers covering a range of education systems, year levels, and student populations,
and with both male and female teachers, some of whom were regular classroom teachers and some science Heads of Department.

The QSRLS findings indicated that, on average, teachers in large schools in lower socioeconomic areas with significant numbers of A&TI students tended to score lower on most productive pedagogies, but particularly RVD (EQ, 2002).

She was recommended to me as someone doing “wonderful, inclusive science education” by a Deputy Principal in the school, whom I knew was particularly concerned with issues of inclusivity.

This would be particularly difficult using CDA, my chosen analytic tool, since a detailed description of each context would be necessary for a satisfactory analysis.

I was interested in whether or not science was represented in ways that made it relevant to the interests, needs and goals of students, about whether or not identities and role relationships tended to be authoritarian or more democratic (cf. Hanrahan, 1998, 1999a,b).

Because I was mainly interested in the teacher’s role in establishing the classroom interpersonal learning environment (and wanted to travel light), my technological resources did not extend to separate recording of student talk and in most instances it is generally undecipherable on the audiotape of the lesson.

My intention was to recruit volunteers (teachers don’t need research imposed on them), but in fact most teachers only “volunteered” after first being nominated by a colleague, a district science advisor or researcher contacts, and then followed up by a request on my part.

All names used in this article are fictional to preserve the anonymity of both teachers and students.

As Mrs W put it: “Some of them have come out of the mainstream, out of - after not being successful there and joined us. And some are new to the school and have learning support needs. So, yeah, they’re in Grade 10 and they need to do a science subject so they’re here with us.” (Mrs MW, Interview).

Quite apart from her excellent reputation, the fact that the teacher was able to hold the attention of a group of these students—who were more generally considered difficult or impossible to teach—over a double period of geology, while engaging them in dialogue and writing about a significant number of scientific concepts and relationships, not to mention the incidental literacy activities she scaffolded along the way (enough to be the subject of a separate paper) was evidence enough for me that significant outcomes were present, both in terms of attitudes and achievement for some, if not all of her Year 10 students. With regard to helping these students develop the language and literacy skills necessary for accessing the texts of school science and communicating their knowledge of science, in the space of this double-lesson, I remarked at least half a dozen strategies to enhance students reading (e.g., how to use headings and graphics to aid comprehension), writing (how to take notes and add diagrams, how and when to write an extended answer, how to summarise), and vocabulary (noting new technical and other terms, noticing variations of new terms, including the use of grammatical metaphor). While some of these were formal parts of the lesson, such as using a graphical organisers, a flow chart and a “vocab list” (check term), other only arose in answer to student’s queries. She remarked to me later, that whereas the more formal ones were sometimes used in other science classes only in relation to content, in her class there were employed more often to help students focus on processes as well as content. Their significance here is that they show how the teacher kept the needs of curriculum “demands” in balance with the particular needs of her students.

Mrs W later told me she is consciously vague about units of time (such as millions of years) so as not to exclude creationists in the class.

One student was withdrawn by a Deputy Principal just before this class period in relation to an event earlier in the day.

One of the students had asked me as they filed in, “How come you came our class—all dummies?”

The conditional could also be chosen to deal with stubborn students as Mrs W told me in the interview that she had learnt that the best way to deal with their stubbornness was to give them choices.

In fact students who withhold learning from teachers do hold a considerable amount of power; however, whereas this causes some teachers to “up the ante” (which student may react to in kind), Mrs W takes a more empathetic and conciliatory approach.