

Science and Mathematics Education Centre

**School Stories: Weaving Narrative Nets
to Capture Science Classrooms**

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**This thesis is presented as part of the requirements
for the award of the Degree of Doctor of Philosophy
of the Curtin University of Technology**

January 1998

Abstract

Over the past two decades, constructivism has become an increasingly influential referent for the learning and teaching of science in schools. In the role of teacher-researcher, I conducted an intensive participant observational study in an innovative Australian middle school, where both the initial planning of the school program and the principal's vision for the school took constructivism as a key referent. The research activity involved team teaching for a total of two days per week for one school year (1996) with a group of five teachers who were attempting to implement constructivist-referenced innovations such as portfolio assessment, integrated curriculum and teacher collaborative planning in their teaching practice. I chose a narrative methodology including impressionist tales to both conduct and represent this research into my own and others' teaching practices and values - a 'novel' woven from those narratives forms Section Two of this thesis. In addition, five conjectures for further investigation emerged from the research: (1) one significant constraint to constructivist-referenced innovation is 'conceptual inertia' on the part of teachers, (2) students' epistemologies and expectations must be explicitly addressed where innovation is attempted, (3) the complexity of educational contexts extends beyond the mechanical details of schooling to the webs of expectations stakeholders bring to schools, (4) it is difficult for teachers with limited backgrounds in science to use constructivism as a referent in their science teaching, and (5) the narrative methodology chosen has value in providing a rich, complex account of schools, teachers and curricular innovations.

Acknowledgments

The teachers and students of Arcadia High School are the real focus of this study. I want to thank them for accepting me into their school community, for their support and friendship, and for the exciting vision they showed me of what is possible in middle school education.

Many colleagues at the National Key Centre for School Science and Mathematics, Curtin University of Technology, listened to seminar presentations, discussed ideas, read drafts and papers, and in many other ways supported the development of my ideas. I would particularly like to acknowledge the support of Professor David Treagust and of my fellow doctoral students from Room 217 - Cath Milne, Grady Venville, Joan Gribble, Louise Tyson, Wendy Speering and Allan Harrison. Dr John Wallace provided invaluable feedback and advice in the development of the final text.

My daughters, Cassandra and Alexandra, gave me hugs when I needed them most.

My partner, Sue Geelan, supported me in more ways than I can possibly name. Her love and confidence in me carried me along when my own confidence was shaky, and she has been an unfailingly interested and challenging sounding board for new ideas. Sue read drafts of 'School Stories' and offered excellent suggestions, and most of all, she allowed me to tell parts of her story that are important to both of us.

I want to acknowledge the love and support of my Lord and Saviour, Jesus Christ.

My doctoral supervisor, colleague and friend Peter Taylor has contributed enormously to my development over the past three years, and I hope we will have the opportunity to continue to work together. Peter's critical focus on his own learning and development provided me with an excellent model, and allowed me to feel that I wasn't the only one learning in our encounters. He has suggested the right book or paper at the right time to challenge my assumptions and move me along, and the many hours we've spent in discussion in Peter's office have been a pleasure and an education.

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Section One

Weaving Narrative Nets to Capture Science Classrooms

Experience takes on dramatic forms more akin to music unfolding diachronically through time than a pictorial description synchronously present... A melody is a patterned sequence of notes of different pitches... The melody does not consist of the notes separately or alone, but in the form generated by the sequence of the ratios of the pitches of the notes. These ratios are not themselves notes. They are the differences between the notes... If the music gets to us, there is an instant sympathetic vibration through which we resonate and commune with it... A melody reverberates and regenerates feeling, mood, atmosphere, nuances of pathos, that no scientific discourse can convey, let alone scientific method begin to study...

R.D. Laing - *The Voice of Experience*

Chapter One

Research Questions and Contexts

Introduction - Telling Tales Out Of School

This study explores the constraints and successes encountered in attempting to implement a number of innovative teaching approaches in five middle school classrooms in an Australian city during 1996. These innovations included a constructivist epistemological perspective (Glaserfeld, 1993, 1989; Solomon, 1987; Tobin, 1990), portfolio assessment (Duschl & Gitomer, 1991) and ethical commitments to caring (Noddings, 1984), courage, fairness, honesty and practical wisdom (Sockett, 1993). The research explores questions about the effects of the roles and expectations of teachers and students in such an innovative context, and about teachers' beliefs and understandings of the nature of science and the impact of these beliefs on their teaching of science. It further explores the research methodology with which I have chosen to inquire into these issues, and reflects critically on the value and appropriateness of that methodology.

The style in which the preceding paragraph is written and the professional codes and conventions to which it adheres require some comment here. Throughout this thesis, a number of tensions are played out: between narrative and propositional modes of representation, between more 'objective' and 'subjective' ways of exploring my own and others' experience, between the demands of compelling fictional writing and persuasive research writing. I have tried to be as explicit as possible about why I value each pole of the various tensions (and I'm mindful that there are often more than two), and why I do not simply 'convert' to one pole or another.

One such tension is that between formal, academic writing styles - the use of citations to support arguments, and of 'scientific' (predominantly propositional-logical) language - and more casual, personal and connected genres. References and citations are used in the text in (at least) three ways: (1) to support the argument with apposite examples and

ideas or point the reader to related research reports; (2) to acknowledge an intellectual debt, the source of an idea or inspiration; and (3) to ascribe intellectual property rights for material quoted or paraphrased. I have also chosen to use the names of individual theorists as sub-headings in Chapters Three and Four: the ideas of these writers and thinkers have had a profound influence on my own 'places to stand and ways to look', and I believe it is important to acknowledge that debt, and to point readers to some of these sources which I value.

This representational tension, however, remains difficult to fully resolve: I wish to engage readers in a narrative of experience, while encouraging them to maintain some critical distance from that over-arching narrative. I wish also to connect the experiences and reflections I recount here with my professional field of science education, in order that the account may be valuable for science educators.

For these reasons, I have chosen to use at least a quasi-academic literary style for Sections One and Three of this thesis (although, as you will have noticed by now, I am writing in the first person), while Section Two adopts a more novelistic style. In other words, the entire thesis is a narrative of experience, but that 'tale' contains within it various pieces, held in a sometimes-awkward tension, that can be described as dominantly narrative or dominantly propositional in their mode of rationality and representation. Chronologically, Sections One and Three are set in a post-classroom 'present' that corresponds to the writing of this thesis in late 1997 (and are, therefore, summatively reflective and post-hoc with respect to the teaching), while Section Two is set in the 'present' of the research year in the school, 1996.

Drawing on the work of Geertz (1983), Denzin and Lincoln (1994, p. 9) speak of the 'third moment' in the history of qualitative research as being characterised by 'blurred genres', and the present work can be seen as one way in which this moment continues to be played out in contemporary qualitative research. Similarly, Denzin and Lincoln's (1994, pp. 2-3) images of qualitative research as a work of *bricolage* and of the

researcher as *bricoleur* were strongly influential on the way that this research project was conducted. This image has much in common with Polkinghorne's (1992) 'postmodern epistemology of practice'. Since this thesis is both *a representation of* and *part of* an on-going research activity (see Chapter Six), it has taken on the character of a *bricolage*: in the same sense that the research activity may be described as "a pieced-together, close-knit set of practices that provide solutions to a problem in a concrete situation" (Denzin & Lincoln, 1994, p.2), this thesis is a pieced-together, close-knit textual product intended to represent certain research experiences, understandings and problem-approaches.

The product of the *bricoleur*'s labour is a bricolage, a complex, dense, reflexive, collage-like creation that represents the researcher's images, understandings, and interpretations of the world or phenomenon under analysis. This bricolage will...connect the parts to the whole, stressing the meaningful relationships that operate in the situations and social worlds studied.

(Denzin & Lincoln, 1994, p.3)

The complex arguments surrounding issues of representation, legitimation and my constructivist/postmodernist epistemological and ontological perspective are addressed in much more detail in Chapters Three and Four. This introduction is intended to signal my intentions to readers: to challenge the tendency to read the text as a realist-positivist account of a research project. Instead, it should be read as a bricolage, or, to appropriate the image from R.D. Laing that I have chosen as an epigraph for this section, appreciated as a melody, where the intervals say as much as the notes.

The remainder of this chapter outlines the professional, personal and school contexts of the research, explores the three research questions, and outlines the structure of the thesis.

Professional Context

The research grew out of my earlier study (Geelan, 1994, 1996) on my attempts to support students in becoming 'active learners'. I found that the innovations I attempted were largely unsuccessful, and that students became frustrated by challenges to their existing roles and expectations. The pressures placed on students by expectations - their own and their parents' - placed a low value on greater quality of understandings and the development of transferable learning skills, and a high value on good grades. Their attitude was that, by attempting to change their learning roles from passive to active, and my own teaching role from one as a dispenser of information to a facilitator of learning, I was abdicating from my key responsibility of helping them to memorise the information they would need for success in their examinations.

I continue to value active learning and students' development of skills and attitudes to learning that will better fit them for a world in which they will need to continue to learn at a rapid rate in order to survive. If such changes to the expectations of students are to occur, however, it will not be because teachers have unilaterally chosen to change their own roles, it will be through a process of negotiation (Corbett & Wilson, 1995) and role redefinition that includes all stakeholders, including parents. The results of my earlier research (Geelan, 1994, 1996) had convinced me that this was the case, and the commitments, approaches and perspectives of those who planned Arcadia High School¹ suggested that such an approach would be attempted at the school.

Personal Context

The data and descriptions that form this research did not simply gather themselves, nor were they gathered by an affectless robot. I wish to make explicit the fact that it was I, David Geelan, who went into the school, taught and learned and researched, and

¹ The names given for teachers, students and the school are pseudonyms, but see the discussion in Chapter Six of the relationship between pseudonyms and fictionalised characters.

constructed and carried away these stories. Denzin and Lincoln (1994, p. 11) speak of the “gendered, multiculturally situated researcher [who] approaches the world with a set of ideas, a framework (theory, ontology) that specifies a set of questions (epistemology) that are then examined (methodology, analysis) in specific ways”. It is impossible for me to be ‘objective’ and eschew my own values and biases - from a constructivist perspective, it is my own ‘construct system’ (Kelly, 1955) that I use to construe the world and the construction processes of those around me. This being the case, I make no pretence to objectivity. Instead, I embrace my personal perspective and viewpoint and ideas and, yes, even my biases.

In the face of such an approach, however, how can I argue that the results of my research are of value to anyone but myself? Surely they are so flawed and biased and personal that they are useful only to me? If that were so, it would be difficult to defend the time, energy and money that were expended in the research. I do not believe that is the case: the requirements for legitimation and justification of a constructivist approach to inquiry are very different from those of a positivist paradigm, but no less demanding. These requirements are discussed in some detail in Chapter Four. In brief, however, what I must do to make this research valuable and useful for you is to do my very best to identify and describe my biases up front, so that you can discount them, or better, read this representation in light of them. This assumes, of course, that I know myself well enough to explicate my biases: I will make that assumption, while remaining conscious that I no doubt have many unexamined assumptions and reified notions.

As well as attitudes and beliefs, there were events and circumstances that arose in my life outside the school but that impacted strongly on the ideas, emotions and reserves of energy and enthusiasm that I brought to my teaching and research. In attempting to describe myself, I must begin with my wife and daughters, since they are the key to my values and form of life. Their love and support for me, and my love and concern for them, are what motivate everything I do, and their needs constrain everything I do. During 1996, my wife Sue was working on her last year of secondary schooling, having

returned to education as a mature age student after a fifteen-year break. She needed care, nurture, support and coaching, and I also needed to take a significant role in child care. Sue was also working night shift in a nursing home many weekends, further increasing the demands on my time. My eldest daughter, Cassandra, had begun Year One in primary school - I went to her school each Thursday morning to hear the children read. Cassie needed time and attention from her Dad, and to go to the park on weekends, and to have stories read to her. My younger daughter, Alexandra, was in day care three days each week. Sue stayed home with her one week day, and I stayed home another. I tried to do some work at home, but this can be impossible with a demanding two-year old in the house, and she needed fun and attention and hugs too. I don't regret or resent these family demands in the slightest - family life is what makes the research meaningful *for me*.

I also had to fly across the country to Brisbane one weekend during the year to attend a major (and very emotional) conference of Sue's extended family, and to Sydney for another week for my sister Kathy's wedding. Some of the frustration felt by my colleagues in the school, and the perception on the part of one teacher that I had been lazy and negligent, no doubt arose from this sense of priorities that I brought to my activities; although I attempted to be reliable and professional in all situations, if there was any conflict the family always won.

Secondly, I am a Christian, and am actively involved in my home church. I preach every two months, and am involved in a number of other roles within the church. Every Saturday (I am Seventh-day Adventist by denomination) throughout the year was pretty much taken up with church-related activities. Further, between August and December of 1996, there was a major conflict between the church pastor and one of the senior elders (yes, it happens to Christians too!), which almost divided the church, and led to much hurt, and many extra meetings in the search for reconciliation. My involvement in this process no doubt contributed - along with events in the school - to the general feeling of burnout and depression that I carried for much of the latter part of the year.

The influence of my Christianity is not only in added busy-ness and draining pressure of course - it also pervades my ethical and spiritual beliefs and values. My personal faith and devotional life also provide extra reservoirs of strength and emotional energy, on which I draw in times of crisis.

One further extra-school event had a significant effect on the way the year unfolded. In mid-February, only a couple of weeks into the school year, I broke my left leg while roller-blading in the park. A spiral fracture of the tibia and a crack in the fibular, complicated by the fact that I had already broken both bones ten years earlier in a motorcycle accident and still had a plate and screws in one, meant that I spent a week in hospital, followed by three months on crutches and a further two months walking in a cast. My consulting orthopedic surgeon held his clinic only on Wednesday mornings, a day when I would otherwise have been in the classroom of an Arcadia teacher. This event and its consequences led to a number of strains and challenges in the course of the year that would not otherwise have been present.

School Context

Arcadia High School opened in 1995 with 600 students in Years Seven and Eight (about ages 13 and 14). The school is in the rapidly growing western corridor of an Australian state capital, and was needed because a rapidly expanding population meant that the two local secondary (high) schools and five primary (elementary) schools were all overflowing. A visionary team of educators, led by the foundation principal Andrew Montgomery, chose to make this school something fairly new for Australia - a middle school. In the state where Arcadia was developed, Year Seven is the final year of primary school, and Year Eight the first year of secondary school. The change in culture and approach between the two levels of schooling is quite dramatic: in primary school, students spend their day largely with one teacher, in one classroom, while in secondary school they may have up to six different teachers and move to a new room for each subject. Primary schools are generally smaller, around three hundred students, while

suburban secondary schools can have up to two thousand students.

It was decided that Arcadia would be a middle school, relieving stresses on the local primary and secondary schools, but what is more important, easing the transition for students. The program developed was similar to that in Australian primary schools - students had a home room and a home room teacher, who taught them all learning areas (subjects) except arts, technology, sport and Languages Other Than English (LOTE). It was felt that such a structure had significant potential to support students in developing transferable learning skills as well as a high level of literacy. Other innovations introduced to support this approach included *portfolio assessment* (Duschl & Gitomer, 1991), intended to de-emphasise grades as a motivator and to value work the students did outside exam conditions, and *teacher collaborative planning*, intended to support teachers in providing a genuinely integrated curriculum.

My role within the school during its inaugural year, 1995, was as a teacher educator, involved in professional development courses with some teachers in the school. Because there were several teachers who were interested, the university course was run on the school site, rather than at a university campus. This gave me a strong feeling for both the exhilarating successes and the frustrating challenges of attempting to bring together a mixed community of primary and secondary teachers (since there were no middle schools in the area, there were no trained and experienced middle school teachers), and to blend and balance the two cultures in ways that would best support students' learning and personal growth. At one point the internal conflicts became so severe that it appeared the school community might just fly apart from the centrifugal force of conflicting expectations, but by the end of 1995 a synthesis had been reached that had many teachers raving over the new freedom they felt to teach in innovative and creative ways.

In 1996, the school added Year Nine (that is, the previous year's Year Eight students moved into the new grade), which meant that the student population increased by a

third, to more than nine hundred students. This meant that the teaching staff also increased by a third, from thirty-five to almost fifty. I chose to conduct my doctoral research in the school because I felt that what was happening there was exciting, and that it related strongly to my own educational commitments and values. I saw the research as an opportunity to put into practice the new understandings gained from the earlier research (see 'Professional Context' above).

I also felt that it was important that I give to the school at least as much as I took - ethically, it would not be fair for me to gain many benefits from conducting research in the school, to take the teachers' and students' time and energies and stories and offer nothing in return. I also wanted to take advantage of the fact that I had a Ph.D. scholarship to conduct some long-term, close-up, intensive study of teaching and learning in classrooms. I knew that in the full life of an academic I may never have such an opportunity again.

For this reason, I volunteered to team teach at Arcadia for two and a half days each week throughout the 1996 school year. The teachers had trained and worked as either primary or secondary teachers, and most of the secondary teachers had specialised in areas such as English and Social Science. For this reason, many of the teachers felt very uneasy about teaching science. As an experienced science educator, I offered to help out in this area. While teaching, I would observe my own teaching practices and those of my colleagues, and the reactions and interactions of the students. I would attempt to record the happenings, emotions and implications of the classrooms through the writing of 'impressionist tales' (Van Maanen, 1988) and would check the plausibility of these tales through interviews, surveys and other forms of evidence.

I taught in five different classrooms, with five very different teachers, and also participated in the collaborative planning functions of the team. Only one of the five teachers had been at the school in 1995, so in their various ways, each had to experience for himself or herself a dramatic change of educational culture and expectations.

The current study focuses on my own experience in working as a team teacher, supporting nonspecialists (elementary teachers and secondary teachers from other learning areas) attempting to teach science for the first time. My own teaching practice was intended to embody a critical constructivist perspective (Taylor, 1996; Taylor & Campbell-Williams, 1993, March), and to introduce new teaching strategies and epistemological perspectives through negotiation (Corbett & Wilson, 1995).

Research Questions

It should be noted that the three research questions are dissimilar in type and focus: the first two questions are empirical in nature, asked of the school context itself during the research process. The chosen research methodology was intended to be appropriate for asking - and finding useful and powerful answers to - these questions. The third question is a reflective query *about* the research methodology - essentially about its appropriateness and power for addressing the first two questions. In this sense it may be seen as a meta-question: the answer to the third question, which is about the quality and appropriateness of the research methodology, reflects directly on the degree to which it is possible to rely upon the answers proposed for the first two research questions.

- 1. How and why do teachers' and students' established webs of expectations support and/or constrain constructivist-referenced curriculum innovation?*

In the framing of this question, constructivism is seen as a *referent* (Tobin & Tippins, 1993) for ideas about teaching and learning, rather than a teaching methodology. In the context of the school, however, constructivist perspectives were embodied by - and often confused with - a wide variety of teaching innovations and approaches, including portfolio assessment, collaborative planning, integrated curriculum and a concern for addressing middle school students' increasingly negative attitudes toward school in general and science in particular. I argue in Chapter Three that these approaches are all

connected with and derived from a constructivist epistemology, both logically and from the perspective of what is valued about education. My own perspective on constructivism as it pertained to my teaching and research activities and to the teaching of my colleagues is also discussed in some detail in Chapter Three.

It should also be noted that there are other webs of expectations - those of parents are especially important, but there are also the expectations of government, administrators and industry - which are beyond the scope of this particular research project, but which no doubt have an important role in supporting and constraining curriculum change. Some of these expectations appear indirectly in the study through the expectations of students and teachers - for example, parents' resistance to portfolio assessment manifested itself through student resistance and teacher frustration.

2. *How effectively can teachers with limited science backgrounds use constructivism as a referent to teach science in integrated middle school classrooms? What can be done to support such teachers?*

This question immediately suggests the related question "what counts as 'effectiveness'?", which needs to be explicitly addressed in terms of both the approaches and the outcomes that would be expected of teachers who were effectively using constructivism as a referent in their science teaching. This further requires a very clear and explicit definition of what is meant by the term 'constructivism' - something I have attempted elsewhere (Geelan, 1997a). These issues are explored in some detail in Chapter Three.

3. *What virtues of my chosen research methodology allow me to explore these questions richly? What standards of legitimation and representation should be applied to the understandings gained from this exploration?*

As noted above, this question is in one sense not a(n empirical) research question at all,

in that it requires critical reflection rather than data collection and analysis. The warrants on which an answer must be based are theoretical, and relate to coherence and appropriateness for pre-specified purposes, rather than empirical and based in 'experience in/of the world'. In another sense, this *is* a research question - it is a question *about* research, rather than a question *for* research. I have discussed these issues in parallel with the discussion about the (re)presentation of the research in Chapter Four.

Introduction to the Research Methodology

A narrative methodology (Connelly & Clandinin, 1988, 1996), incorporating impressionist tales of the field (Van Maanen, 1988), was chosen for the empirical part of the study, because I felt that it was most able to capture the richness, complexity and human quality of school life. Theories, however complex, must simplify life by abstracting some facets and ignoring others. Stories, too, highlight some facets and hide others - a process of selection is involved. I believe, however, that stories, through allusion and shading and other fictional techniques, can capture facets, faces and voices in classrooms that are missed by theories and the practices of theory-building. In Chapter Six I argue that stories and impressionist tales are valuable as planks of a research methodology for what they show us, but that their use must be accompanied by a critical consciousness of what they hide.

Outline of the Structure of this Thesis

Section One: Chapters One to Four

Chapter Two - Expectations and Constraints: Backgrounding the First Research Question - discusses some recent research into teacher and student expectations, and their impact on teaching innovations in the science classroom (Tobin, Tippins & Hook, 1994; Tobin & LaMaster, 1995; McRobbie & Tobin, 1995, Tobin & McRobbie, 1996;

Tobin, McRobbie & Anderson, 1997; Geelan, 1994, 1996; Brickhouse, 1990, 1993; Brickhouse & Bodner, 1992). It also considers the sociological constructs of 'roles' and 'expectations', drawing on the work of Berger (1963), as an explanatory framework for some of the interactions reported in the research literature and in my own classroom experiences. This chapter is intended to provide background for the discussion of the first research question, and to carry forward the narrative of my own on-going teaching/learning/research inquiry into my classroom practices and those of my colleagues.

Chapter Three is entitled "Constructivism and the Nature of Science: Teaching, Research and the Second Research Question". This chapter addresses the philosophical underpinnings of the research, and the thesis that represents it. Constructivism, in its many forms (Geelan, 1997a), is influential in three main ways in this research project. First, the innovations and approaches that were valued by the developers of the program at Arcadia school, that the teachers were attempting to implement, and that were a key focus of my research interest, were based in a constructivist epistemological perspective on learning. Second, my own teaching, more so than that of my colleagues due to earlier experiences, was based in a constructivist/relativist epistemology and a social constructionist perspective on learning. The dissonances between my own constructivist commitments and those of my colleagues became important in the course of the research. Third, the epistemological and ontological perspectives that underpin the research activity itself were explicitly constructivist in nature. Indeed, it could not be otherwise: as Steier (1995) has pointed out, a research approach which seeks to 'objectively' study the construction processes of others is 'naive' - it ignores the researcher's *own* construction processes. This chapter attempts to clarify the relationships between these three constructivist influences on the research, but it is also intended to outline my own perspective on constructivism as a referent (Tobin & Tippins, 1993) for teaching and learning in science. I have structured the first part of the chapter as a discussion of the work of four key theorists/researchers: Paul Feyerabend, Jack Whitehead, Peter Taylor and Frederick Steier. This approach is intended to

acknowledge the intellectual debt I owe to each of these authors, and to point readers back to the sources from which my current understandings were derived. The second section of the chapter attempts to tease out my own perspective, which I have described as ‘value-driven eclecticism’, and to explore its interaction with the three areas of influence discussed above. As part of this section, I discuss my use of logic, rhetoric and dialectic as approaches to persuasion.

Chapter Four - Places to Stand, Ways to Look: Approaches and Methods and the Third Research Question - is in a sense the heart of the thesis. Both because the third research question is explicitly concerned with methodological issues, and because the methodology is the most novel (no pun intended) part of the research project, the explication of the methodological approach I have chosen/constructed, and the value judgements that informed that selection/development, is crucial to the argument. The research methodology draws on the ethnographic work of John van Maanen (1988, 1995), Jean Clandinin and Michael Connelly’s ‘narratives of experience’ (1988, 1995, 1996) and the hermeneutic phenomenological approach to human science inquiry described by Max van Manen (1990, 1991). It also explicitly values van Manen’s (1991) ‘tact of teaching’ or ‘pedagogical thoughtfulness’. Robert Donmoyer (1997, March) asserts that the argument about research methodologies, loosely referred to as the qualitative/quantitative debate, can be more productively considered as being about the purposes for which research is conducted than about methodologies. In accordance with that approach, Chapter Four outlines the purposes for which the research was conducted, and discusses the appropriateness of the methodological approach to these purposes. This chapter also addresses issues relating to Denzin and Lincoln’s (1994) ‘crises of representation and legitimation’, and explores the tensions within which the narrative nets that comprise this thesis are woven.

Section Two: 'School Stories'

The second section of the thesis consists of a 'novel' of approximately 30,000 words. The 'scare quotes' around the term 'novel' are intentional - they signal that, although the form and structure of this piece of writing are literary, its intention is somewhat different from that of an 'un-scare quoted' novel. A novel is a fictional text that is intended to entertain, to inform, to challenge and to teach (although the term 'didactic' is usually applied pejoratively to novels). Novels say something about the world - even science fiction novels - and can often, through the use of fictional characters and situations, tell us deep truths.

The 'novel' I have presented here, while it has all of the purposes of a novel - to entertain, inform, challenge and teach - also has two further intentions that tend to constrain it, and it is to signal these that I have insisted on retaining the scare quotes. Firstly, it is intended as part of my doctoral thesis - as a demonstration that I have sufficient breadth and depth of educational knowledge and insight to be admitted to the degree of Doctor of Philosophy (Science Education) of Curtin University of Technology. This applies constraints of content, approach and intention that would not be applicable to a purely literary novel. Secondly, it is intended to communicate, if not completely original understandings, certainly some newly articulated or represented knowledge about school science education, and specifically, about my personal experiences as a science educator in 'Arcadia High School'. Unlike Helen Demidenko/Darville's novel *'The Hand That Signed the Paper'* (1995), it *does* matter whether the writing I present here does, in some sense, 'really' represent my experiences in the school. If this were not the case, then I could write a pure polemic, or a theoretical article, or a creed - what would be reflected in the text would be my own beliefs, ideas and values. These will feature strongly, of course, but I must also demonstrate the connection between what I have written and the reality of the school context and experience.

One way in which this connection is achieved is by providing what Guba and Lincoln (1989) describe as an 'audit trail', linking the representational text to the various artefacts (survey results, interviews and impressionist tales) that I have retrieved - in the best ethnographic tradition - from the field. I have attempted to do this through the second and third appendices, discussed below. Another way is what I have described as the 'uh huh' factor - the grunts and noises of affirmation and recognition that I hear from classroom teachers as they read the text. Since my intention is to render clearly some of the actualities of classroom life, if what I write is recognised as having verisimilitude by those who actually live and work in classrooms, I view that as an important measure of the extent to which this 'recognition' criterion has been met. Van Manen (1990) puts this criterion in more academic language:

The essence or nature of an experience has been adequately described in language if the description reawakens or shows us the lived quality and significance of the experience in a fuller or deeper manner. (p. 11)

The third way that the connectedness between my classroom experiences and the written text can be demonstrated is through the new understandings that are demonstrated in the writing of this thesis: had my perspectives and beliefs not been challenged and changed - and also in some cases affirmed and supported - by these experiences, it would have been impossible for me to write as I have.

I make another explicit distinction similar to that between my 'novel' and a literary novel - the distinction between 'fictional' and 'fictionalised' characters and situations. Fictional characters arise in the mind of the author (although they are no doubt frequently based on real people known to the author), and are shaped exclusively by literary demands - those of plot, characterisation and style. There are some purely fictional characters in the 'novel' that comprises the second section of this thesis: as one example, I never met 'Shannon', the sexually abused girl. I have, however, talked at great length with a number of survivors of childhood incest, some of them very close

to me. Further, if we consider the statistics on child sexual abuse, in a school of nine hundred students there were probably up to one hundred 'Shannons' - they simply were not identified to me.

Through the construction of Shannon's *fictional* character, it was possible for me to address important questions about the tendency of myself and teachers with whom I worked to attribute all classroom events to themselves and their teaching innovations, rather than to extra-school factors, and about the effects of child sexual abuse on school behaviour and performance. *Fictionalised* characters and events, on the other hand, as I have chosen to use the term, are drawn quite directly from real people and events that I observed during my time in the school. That is to say, they are perhaps more journalistic than fictional - my attempt to portray actual situations and persons. In what sense, then, are they fictionalised? And for what purposes? There are two main reasons for fictionalising these characters:

1. For ethical reasons of confidentiality and protection. Some of the teachers and some of the students are represented negatively, others positively. Both to protect these students and teachers from consequences that might arise from my reporting of their attitudes and behaviour, and to protect myself from potential litigation, it was important that the characters be given pseudonyms. But many people know in which school I conducted my research, and a number of characteristics could have identified particular teachers. For this reason, where possible I have made more dramatic changes, such as changing the team name and naming system within the school and, while I taught in two different teams, placing all classrooms and teachers within one team (this also simplifies descriptions for the reader). I have changed the gender, age, personal appearance and personality of teachers where that does not impact on the story or the conclusions drawn.
2. Although I have chosen story form for the representation of my lived experience

because I believe it is richer, and less prone to over-simplification, than are other forms of theory-building, it remains necessary to make certain ideas and situations simpler and more explicit than they are in life. For this reason, characteristics of the various teachers have been amplified or attenuated - not to the extent that they become one-dimensional embodiments of an idea, but sufficiently to more fully embody ideas. Some teachers with similar characteristics have been merged to form composite characters, or incidents involving one teacher attributed to another. The justification for these processes is that there is a more powerful truth than that embodied by a transparent re-telling of 'real life' (if such a thing were possible), and that this truth can be more fully embodied in a story containing fictionalised characters.

Section Three: Chapters Five to Seven

Chapter Five - Tales of Different Kinds: Representing My Understandings - considers the issue of how the tales in 'School Stories' (Section Two) correspond to and address the first two research questions. That chapter is intended, not so much as an interpretation of 'School Stories', but as an explication: a making explicit of some of the pedagogical concerns and understandings that are more or less implicit in the text.

Through the device of a discussion between fictionalised characters, Chapter Six presents five *conjectures*, grounded in my experiences within the school and in some of the empirical materials generated during the research. These conjectures also suggest some tentative answers to the three research questions posed. This chapter is particularly devoted to issues of verisimilitude (Denzin & Lincoln, 1994, pp. 579-580) - the processes and strategies by which I aim to convince readers that the results - in all representational forms - represent something real and educationally significant about the school and my experiences within it.

Chapter Seven is entitled 'Conclusions, Implications and New Questions'. It provides

a retrospective overview of the entire thesis, and moves forward to explore the implications of the research results and the developed methodology for my own future teaching and research practices and for those of others. Further, given that I have identified the project overall as ‘hypothesis generating’ rather than ‘hypothesis testing’ research, I have attempted to outline some of the research studies that might be conducted in the future, by myself or others, in order to test, or at least explore, the conjectures developed in the course of the present study.

Appendices

The four appendices present some of the ‘empirical materials’ (Denzin & Lincoln, 1994) generated during the course of the research, along with some more explicit discussion of the genesis and evolution of the approaches to both research and representation that I have chosen. The student booklet used in Cowan Team to structure science activities during Term Four - ‘Voyage to Centauri’ - forms Appendix One. This represents an attempt to use a narrative structure as part of the teaching and learning activities of the team, and to increase the relevance and connectedness of scientific knowledge for the students. It is also intended to be strongly integrated with other learning areas, and several of the teachers developed quite sophisticated activities in language and social science and mathematics to complement the science activities.

Appendix Two presents the instruments used in the collection of the quantitative data that were intended to complement my classroom observations, along with the data generated. The Constructivist Learning Environment Survey (CLES) (Taylor, Fraser & Fisher, 1997) was administered to both teachers and students, and in both a ‘perceived’ (“what happens in my classroom now”) and a ‘preferred’ (“what I would like to happen in my classroom”) form. The Beliefs About Science and School Science Questionnaire (BASSSQ) (Taylor & Aldridge, 1997) was administered to both students and teachers.

Interviews with four of the teachers with whom I worked in Cowan Team form

Appendix Three. (The teachers appear here under their pseudonyms for reasons of confidentiality, but see the discussion in Chapter Five.) These were recorded at the conclusion of the research project, and exemplify several of the themes I have attempted to capture in this thesis. In particular: Candace gives her own perspectives on issues of trust and behaviour, and on some of the 'naughty boys' who appear in the story; Alyx identifies the degree of complexity and challenge experienced by teachers at the school; Andrea describes her discomfort and disorientation, and their consequences for those around her; and Carolyn describes, from her own perspective, the disappointments and mismatches of expectations that led to our conflict.

Appendix Four consists of an edited (for clarity and to reduce redundancy and repetition) collection of the e-mail messages that passed between my doctoral supervisor, Peter Taylor, and me over the course of my candidacy. These trace the development of the project, from my initial reluctance to try to do anything innovative with my thesis (stemming from a difficult experience with my M.Ed. thesis) to a growing excitement. They also demonstrate the development over time of the representational model that I finally adopted, and the discussions that led to this development. I further hope that these messages show the quality of the rapport we developed and of the supervisory relationship, and communicate something of the debt I owe to Peter for his intellectual challenges and constant encouragement.

Summary

This research is intended to speak richly to other teachers and educational researchers - possibly engaged in the introduction or evaluation of similar constructivist-referenced innovations in science education - of the struggles, critical reflections and triumphs involved in attempting to improve the equity, relevance and power of science education for our students. Rather than choose a single voice in which to speak of these things, I have chosen to present a *bricolage* - a collection of resonant, connected, chosen elements from my experience, the relationships of which are rich and complex. I cannot

transparently represent my experience - this thesis attempts to make of my experience something that will stimulate readers toward their own educationally and personally significant experience.

Chapter Two

Expectations and Constraints: Backgrounding the First Research Question

Introduction - My Experience

In my earlier research for the Masters degree (1994, 1996), I found that there were two significant constraints on the constructivist-referenced reforms that I attempted to implement in my Melbourne and Sydney Year 11 Physics classrooms. As I wrote at the time:

One interesting question which arises out of the data presented, particularly the transcript of classroom discussion, is the gap between my aspirations and my achievements, my ideological and epistemological commitments and my actual practices. Why was I unable (or unwilling?) to perform during the discussion session in the ways which I was fully convinced were most appropriate? (Geelan, 1994, p. 153)

In response to this question - my own experience of myself as a 'living contradiction' (Whitehead, 1989) - I suggested two hypotheses. The first is based in the work of Griffiths and Tann (1992) on teacher reflection for linking personal and public theories. Their contention is that a teacher's classroom practice is a direct reflection of his/her 'personal theories' - that any action in the classroom is a direct result of a judgement made, in a specific context, out of the totality of the teacher's understanding. I suggested that the public theories I espoused in my academic writing and speaking had been incompletely linked with the personal theories about teaching and learning that I had developed as a result of my own experiences as a learner (and as a human being in the world), my teacher preparation courses and my teaching experience.

The second hypothesis was drawn from the sociological construct of 'role', as described by Berger:

A role, then, may be defined as a typified response to a typified expectation... The role provides a pattern according to which the individual is to act in the particular situation. (Berger, 1963, p. 112-113)

I suggested that:

The teacher's role is derived from societal expectations of the role of the teacher, past experiences of the students and teacher, epistemologies and views of teaching and learning held by the teacher and learners and social constructions which control classroom behaviour. Although I intended to teach in a very constructivist manner², to surrender my central role and become a co-participant and facilitator rather than a controller, and although I fully believed that this was the proper thing to do, yet my own *and the students'* expectations about the roles of teachers and students to some extent thwarted these good intentions. (Geelan, 1994, p. 154, emphasis in original)

Constraints to teacher change are often identified as relating to timetable and curricular pressures and external demands, however both Karl Hook's experiences (discussed below) and my own suggest that a significant source of constraint on teachers is the coherent web of expectations that they hold of themselves and their students, and that their students hold of themselves and their teachers. Less significant in the classroom context, but still important, are the expectations (real or perceived) of administrators and parents.

Constraints to Teacher Change

Tobin, Tippins and Hook (1994) discuss issues very closely related to those that were foremost in my mind in the development of this research project. The classroom

² At the time of writing the M.Ed. thesis, I still identified 'constructivism' with a number of specific teaching *strategies*. I now find more compelling and fruitful Tobin and Tippins' (1993) notion of constructivism as a *referent* for teaching and learning

experiences of Karl Hook, the middle school teacher in that research team, were very similar to my own teaching experiences (Geelan, 1994, 1996). Hook began with a commitment to increasing the power and freedom of students in his classroom, and later came to develop a commitment to constructivism as an epistemological approach for the changes he hoped to enact in his curriculum and practices. These commitments became 'referents' (Tobin & Tippins, 1993) for his educational beliefs and practices. In attempting to change his own roles and practices, however, he encountered very similar constraints to those that influenced my own attempted reforms. The expectations and beliefs of students and colleagues were incompatible (and possibly incommensurable) with those Hook was trying to enact:

The reforms that Karl wanted might have been accomplished easily if he did not have to contend with others. However, the beliefs and actions of students and colleagues were a constant force that favored adherence to traditional practices. (Tobin, Tippins & Hook, 1994, p. 257)

In this paper, Tobin, Tippins and Hook suggest that a dialectical process is inherent in such reforms - teachers tend to have one eye on the new referents (beliefs, metaphors, theories) they are trying to enact, and one on the restraints and myths of the traditional approaches, supported by the expectations of colleagues and students.

This perspective on the dialectical interactions between the forces that support and constrain change informs much of Tobin's recent work with a variety of co-workers (Tobin, Tippins & Hook, 1994; Tobin & LaMaster, 1995; Tobin, McRobbie & Anderson, 1997), and is a closely related - though not identical - perspective to that adopted in the present study. The idea that teachers find themselves in a dialectical tension between the familiar, traditional beliefs and practices in which they have demonstrated success, and the challenging and unfamiliar new approaches they are coming to value is a powerful one. Jack Whitehead, whose work is discussed further in Chapter Three, describes this tension as the awareness of our professional selves as

'living contradictions' (Whitehead, 1989).

The study of a Queensland Year 11 Chemistry class reported in McRobbie and Tobin (1995) and Tobin and McRobbie (1996) provides a slightly different perspective on the issues of reform and constraint. In this instance, the teacher in the study was committed, not to constructivist and emancipatory reforms to the culture of science education, but to maintaining the *status quo* and acting as "guardian of [the] conventional wisdom and the standards of the chemistry discipline" (McRobbie & Tobin, 1995, p. 379). The perspectives and practices of teacher and students were highly congruent, and revolved around such 'cultural myths' as 'transmission', 'efficiency', 'rigor' and 'preparation for examinations' (Tobin & McRobbie, 1996). The authors conclude that:

...in the framing of goals and contexts, the microculture of the classroom interacts with a macroculture that includes the actions of others such as administrators at school, district and state levels, professional organizations of science teachers and chemists, fellow teachers within a department, and school, parents, and members of the community at large (McRobbie & Tobin, 1995, p. 384).

They go on to urge further research into this macroculture-microculture interaction. Although my own research does not explicitly address this issue, it does expand the concept of a classroom microculture to include the actions of other teachers within the collaborative team, and - to a limited extent - the actions of parents and of administrators within the school. Perhaps - by analogy with 'microcomputers' and 'minicomputers' - this research project might be described as a study of an educational 'miniculture'.

Congruence of Teacher Conceptions and Classroom Practices

As noted in Chapter Three below, the connection between teachers' conceptions of the

nature of science (constructivist or positivist, idealist or realist) and those of their students seems to be via the teachers' classroom practices. The connection between teachers' conceptions and the way their practices appear in the classroom is, however, not a simple one. As the above quote from my Masters thesis suggested, there is often a significant gap between teachers' aspirations and their practices.

Brickhouse and Bodner (1992) explored the issue of constraints to the practices and aspirations of a beginning science teacher. The teacher they studied, 'McGee', was in his second year of teaching middle school science in the Midwest of the USA. They found that although McGee had a certain conception of the nature of science and science teaching, this was not reflected in his classroom practice. A variety of institutional and relational constraints within the school contributed to this effect, as did McGee's conception of the difference between 'real' science and school science.

The McGee study was conducted as part of a broader comparative study of the influence of three teachers' views of the nature of science on their classroom practice (Brickhouse, 1990, 1993). That study found that the two experienced teachers, 'Lawson' and 'Cathcart', had very different beliefs about the nature of science and school science. Cathcart, a male middle school science teacher with 26 years classroom experience, saw scientific theories as immutable truths and the scientific method as "a linear, rational process that leads one unambiguously to scientific truth" (Brickhouse, 1990, p. 55). His teaching and instruction tended to concentrate on the procedural steps necessary for students to obtain the 'right answer' on textbook problems and experiments, and on the gradual accumulation of scientific facts. In contrast, Lawson, a female physics teacher with 15 years experience, saw science as the interplay of theory and observation, recognised that observations are theory-bound, and encouraged her students to explicitly challenge their broad sense-making schemes about science.

To use Piaget's (1972) language, Lawson was very aware of the importance of 'accommodation' - the radical restructuring of an interpretive scheme, leading to a

change in the value ascribed to certain experiences - in learning, while Cathcart tended to teach only for 'assimilation' - the incorporation of new information into an existing interpretive scheme. The classroom practices of these two teachers were seen to be congruent with the different images of the nature of science that they held. Brickhouse (1990) suggests that this is largely a consequence of their long experience in the classroom: tensions between their beliefs and practices, and between their aspirations and their professional context, have had sufficient time to be resolved.

This was not the case for the inexperienced teacher, McGee. Unlike the two experienced teachers, he was still in a state of flux, with the tensions between his views of the nature of 'real' science and school science unresolved, and the effect on his beliefs and practices of the constraints of the school system similarly unresolved:

McGee, the beginning teacher, was unpredictable. His data were difficult to analyze, because his classroom instruction was variable and could not be predicted from interview data. It was only in asking concrete questions about McGee's rationale after the instruction that the data began to make sense, and it became possible to separate what McGee believed to be desirable and what he found to be possible. Many obstacles prevented McGee from using instructional strategies congruent with his professed beliefs... Unlike the experienced teachers, McGee had not reconciled his own conflicting beliefs or the impact of institutional constraints on his teaching. (Brickhouse, 1990).

In the present study, although several of the teachers had significant amounts of teaching experience in other contexts, only one of the teachers was in her second year in the Arcadia middle school environment. All of the other teachers, including me, were teaching in this context and using this approach for the first time. Without pre-empting the results presented in Chapter Five, I think it is fair to say that the experience of the teachers at Arcadia more closely resembled that of McGee than the experiences of Lawson and Cathcart. We were all teaching in a state of flux, trying to reconcile the new

sets of roles and expectations that we (and others) held for ourselves as teachers.

Summary

This chapter explores both my own earlier research and teaching experiences and some recent research in the field of science education, related to the first research question that I asked - of myself and my colleagues and students, and of the school context - in the course of this research project:

1. How and why do teachers' and students' established webs of expectations support and/or constrain constructivist-referenced curriculum innovation?

This question requires attention to the constellation of expectations about appropriate teacher and student roles and practices that constitute the sociocultural foundations of 'schooling'. The research discussed, including my own (Geelan, 1994, 1996) and that of Tobin, Tippins and Hook (1994), suggests that teacher and student expectations will tend to support the *status quo* of teacher control and passive student learning, and to constrain attempted curricular innovations intended to increase student control and active learning. Exploring this research question also requires attention to constructivism and teachers' understandings of the nature of science. These are discussed in Chapter Three.

Chapter Three

Constructivism and the Nature of Science: Teaching, Research and the Second Research Question

Introduction - Knowledge

In this chapter, I wish first to discuss what I mean when I talk about ‘constructivism’, and to discuss the three ways that this epistemological perspective has influenced this research project: (1) through influencing the planning of the school and the teaching of my colleagues, (2) through influencing my own teaching, and (3) through influencing my approaches and methods for research. In addressing the impact on my colleagues’ teaching of constructivist perspectives on the nature of science, I discuss a recent review of research related to teachers’ understandings of, and perspectives on, the nature of science.

In exploring the latter two impacts of constructivism on this study - on my teaching and my research - I wish first to critically explore three theoretical perspectives which have been very influential on my own thinking: those of Paul Feyerabend, Peter Taylor and Jack Whitehead. Then, through exploring Frederick Steier’s notion of ‘reflexivity’, I wish to partially deconstruct the distinctions I have set up between my colleagues’ teaching, my own teaching and the research activity.

In the final part of the chapter, I attempt to outline the perspective on constructivism and the nature of knowledge that I developed - as a *bricolage* rather than a tidy synthesis - to support my teaching/learning/research activities, based in these four sources and my own professional and personal experience and values.

The Many Forms of Constructivism

In a recent paper (Geelan, 1997a), I discussed ‘the many forms of constructivism’. I noted that the term ‘constructivism’ has become almost meaningless if it is used without

some further qualifying term, because the approaches and perspectives it subsumes have become so broad and diverse. Such qualifiers have, of course, multiplied - Good (1993) lists thirteen, and the reader can probably supply nearly as many more. The common element of constructivist perspectives is the belief that knowledge is actively constructed by learners on the basis of their existing knowledge (with the corollary that knowledge is *not* transmitted directly from teacher to learner.) Glasersfeld's (1989, 1993) 'radical constructivism' adds the idea that knowledge about the world serves an adaptive function, rather than yielding objective truth about an observer-independent external reality - a perspective shared by many other forms of constructivism.

These are both epistemological ideas - they relate to knowledge and the gaining of knowledge. Much of the diversity of constructivism arises when teachers and theorists attempt to outline and put into practice the pedagogical implications of these epistemological perspectives. I have described (Geelan, 1997a) six different 'forms' of constructivism that, although they by no means exhaust the possibilities of the field, in my opinion offer a good cross-section of common approaches. These are personal constructivism (Kelly, 1955; Piaget, 1972), radical constructivism (Glasersfeld, 1989, 1993), social constructivism (Solomon, 1987), social constructionism (Gergen, 1995), critical constructivism (Taylor, 1996; Taylor & Campbell-Williams, 1993, March; discussed below) and contextual constructivism (Cobern, 1993).

Each of these perspectives has, to a greater or lesser degree, informed my own understandings of constructivism, both as an epistemological perspective and as a referent (Tobin & Tippins, 1993) for teaching and learning rather than a set of teaching strategies and approaches. I wish to argue that, rather than choosing one 'brand' of constructivism and fighting destructive turf wars over it, a commitment to Paul Feyerabend's 'epistemological anarchy' (discussed below) is more powerful: the eclectic use of a variety of incompatible, and even incommensurable, perspectives, driven by the imperatives of teaching and learning. This commitment to eclecticism goes beyond constructivism to the value-driven, strategic use of 'objectivist' and

'transmissivist' approaches (also understood as metaphors and referents) where these can contribute toward the goals of instruction.

The constructivist referents evident in the planning of the Arcadia school program and in the classroom practices of (some of) my teaching colleagues, however, were much more strongly related to the Piagetian, personal constructivist program, and to its most popular educational manifestation, conceptual change pedagogy (Driver & Easley, 1987; Driver & Oldham, 1986; Pines & West, 1986; Posner, Strike, Hewson & Gerzog, 1982). The next section of this chapter is devoted to considering a recent review of research into the ideas about the nature of science held by school science teachers.

Teachers' Understandings of the Nature of Science

Lederman (1992) has provided a thoughtful review of research into teacher and student conceptions of the nature of science. He suggests that:

Research related to the nature of science can be conveniently divided into four related, but distinct, lines of research: (a) assessment of student conceptions of the nature of science; (b) development, use, and assessment of curricula designed to "improve" student conceptions of the nature of science; (c) assessment of, and attempts to improve, teachers' conceptions of the nature of science; and (d) identification of the relationship among teachers' conceptions, classroom practice, and students' conceptions. (Lederman, 1992, p. 332)

Like the research of Brickhouse (1990) and Brickhouse and Bodner (1992) (discussed in Chapter Two), my own research falls somewhere between emphases (c) and (d) above, with a stronger concentration on teachers' conceptions of the nature of science and their impact on classroom practice, and a less strong emphasis on students' conceptions. The impressionist tales that I wrote were intended to capture much of the richness and complexity of the ways in which teachers' beliefs, personalities and

commitments were embodied in their own teaching practices and interactions with students, but also to explore the various constraints which prevented teachers from more fully embodying their aspirations in their practice. In addition, survey instruments were used to seek confirming or disconfirming evidence to complement the tales (see Chapter Five).

Lederman (1992) reports that research into students' conceptions of the nature of science, despite a broad and strong emphasis on fostering such conceptions as an important goal of science instruction, has almost uniformly found that students' conceptions were inadequate or unsatisfactory. Large scale curricular projects developed in the 1960s with the intention of addressing this perceived inadequacy were of variable effectiveness, and one explanation for this variability was seen as stemming from differences in teachers' own conceptions of the nature of science. A considerable body of research was devoted to examining teachers' understandings of the nature of science (e.g., Behnke, 1961; Miller, 1963; Schmidt, 1967; Carey & Stauss, 1968), and consistently found that teachers of science did not possess 'adequate' conceptions of the nature of science.

Attempts to support teachers in developing more adequate (i.e., richer, more powerful, but also less realist and more instrumentalist) conceptions of the nature of science ensued. Lavach (1969) and Billeh and Hasan (1975) found that programs of in-service training that paid explicit attention to the history and philosophy of science yielded significant gains in teacher understanding. Billeh and Hasan further found that teacher understanding of the nature of science was not significantly correlated with their educational qualifications, the subjects they taught or their years of teaching experience.

Lederman (1992) suggests that the assumption that students' poor conceptions of the nature of science are directly related to those of teachers is, however, too simplistic. Evidence seems to both support and challenge the assumption that teachers' own conceptions of the nature of science directly affect their classroom practices and

strategies, and thereby influence their students' conceptions. Speaking of the findings of Lederman and Ziedler (1987) and Duschl and Wright (1989), Lederman concludes that, in direct contrast to the results reported by Brickhouse (1990) and discussed in the preceding chapter:

...the data clearly indicated that there was no significant relationship between teachers' understandings of the nature of science and classroom practice. (Lederman, 1992, p. 347)

In explaining this apparent conundrum, Lederman suggests that:

...it is quite reasonable to expect that many factors (e.g., curriculum constraints, administrative policies, level of students, supplies, etc.) other than a teacher's conception of science influence his/her instructional approach and classroom climate. Complex issues surround the possible influence of teachers' understandings of the nature of science on classroom practice and have yet to be resolved. (Lederman, 1992, p. 347)

Where attention has been paid to the specific connection between teachers' classroom discourse and students' conceptions, however, the effects seem quite strong. Ziedler and Lederman (1989, as reported in Lederman, 1992) found that:

In general, when teachers used "ordinary language" without qualifications (e.g., discussing the structure of an atom without stressing that it is a model), students tended to adopt a realist conception of science. This conception views scientific knowledge as true, real, existing independently of personal experience... Alternatively, when teachers were careful to use precise language with appropriate qualifications, students tended to adopt an instrumentalist conception ...[that] emphasizes the practical utility of scientific explanations, the role of human imagination and creativity in the development of scientific

knowledge, the tentative nature of science, and the utility of arbitrary constructs and models. In short, this view is more consistent with the currently accepted view of science. (Lederman, 1992, p. 348)

In summarising his review of the research on teachers' and students' conceptions of the nature of science, Lederman suggests that:

It does seem clear...that science educators' concerns must extend well beyond teachers' understandings of the nature of science, as the translation of these understandings into classroom practice is mediated by a complex set of situational variables. Although critically important, simply possessing valid conceptions of the nature of science does not necessarily result in the performance of those teaching approaches which are related to improved student conceptions. (Lederman, 1992, p. 351)

One focus of research interest, then, in addressing the second research question (which asks how effectively teachers with limited science backgrounds can use constructivism as a referent in teaching science) is the actual conceptions of the nature of science and school science expressed (in surveys and interviews) by the classroom teachers. A related focus, however, is on the actual classroom practices of these teachers, and the extent to which they reflect the espoused conceptions.

The next major section of this chapter shifts the focus away from my colleagues and the school, and toward the constructivist referents for my own teaching and research. I have alluded to Denzin and Lincoln's (1994) image of 'qualitative research as *bricolage*' as one organising metaphor for the approach I have adopted for both conducting a representing this research project. A related image is the 'epistemological anarchy' or 'anything goes' approach to the philosophy of science championed by Paul Feyerabend.

Paul Feyerabend and Epistemological Anarchy

Paul Feyerabend's epistemological perspective - which he has variously described as anarchistic, dadaist and pluralistic (1974, 1975) - suggests that no single approach to the creation and justification of knowledge is rich and powerful enough to describe all the ways in which science and human knowledge grow. Any perspective which attempts to do so, claims Feyerabend, will take that role through power and coercion, and the suppression of alternative knowledges (1978, 1987).

Instead, he suggests, the most powerful approach is to select eclectically from a rich 'tool kit' of possible ways of creating and justifying knowledge:

A scientist who wishes to maximise the empirical content of the views he holds and who wants to understand them as clearly as he possibly can must therefore introduce other views; that is, he must adopt a pluralistic methodology... Knowledge so conceived is not a series of self-consistent theories that converges towards an ideal view; it is not a gradual approach to the truth. It is rather an ever increasing ocean of mutually incompatible (and perhaps even incommensurable) alternatives, each single theory, each fairy tale, each myth that is part of the collection forcing the others into greater articulation and all of them contributing, via this process of competition, to the development of our consciousness." (Feyerabend, 1975, p. 30)

My reading of Feyerabend's funny, passionate, erudite work, and an on-going and often intense discussion of his ideas on an e-mail discussion list over the past three years have contributed very significantly to the "development of [my] consciousness" in all areas of my life, including my research and teaching activities. I have written papers for international journals (Geelan, 1997a; Geelan, under review) that use Feyerabend's ideas as a referent for discussions of constructivism and educational research, respectively.

The importance of ‘epistemological anarchy’ for this research project is in the way it describes the bringing together of different theoretical frames and epistemological assumptions. I have attempted to make explicit such assumptions for each of the theoretical and methodological approaches described, however I have not attempted a clean, linear synthesis of all such assumptions into a unitary model. Instead, I have tried to show how each perspective contributes to illuminating my understandings and enabling me to represent them in rich ways.

Something that is implicit in Feyerabend’s work, but which I wish to make explicit in this thesis, is the central role of valuing. I have chosen the various theoretical and methodological approaches that inform and constitute the research project because I believe they have the potential to support me in doing things that I value - changing my educational practices so that they tend to “lead toward forms of life that are characterised by justice, equity, caring and compassion” (Gore & Zeichner, 1991, p. 123), and representing those changes, and the constraints and supports I encounter, richly in order to enable others to make similar changes to their own practices.

Peter Taylor and Critical Constructivism

Critical constructivism (Taylor & Campbell-Williams, 1993, March; Taylor, 1996; Geelan, Taylor & Day, 1998, Feb), as it is continually developed and refined by my supervisor and mentor Peter Taylor, has been a strong and continuing influence on my own perspective on constructivism and the nature of knowledge. It incorporates the epistemological concerns of both personal (Piaget, 1972; Kelly, 1955; Glasersfeld, 1989, 1993) and social (Tobin, 1990; Solomon, 1987; Cobern, 1993) constructivism: the constructed nature of knowledge, the importance of the learner’s existing construct system and the social nature of the processes of learning and meaning-making. Personal and social (or socio-cultural) approaches to constructivism in science education have often been held to be mutually exclusive or opposed (see, e.g., O’Loughlin, 1992, 1993; Fosnot, 1993), however critical constructivism values the holding in a ‘dialectical

tension' of a variety of conflicting perspectives - something it shares with both Feyerabend's (see above) and Whitehead's (see below) work. Critical constructivism also incorporates an awareness of the reflexive (Steier, 1995 - see discussion below) nature of knowing and research.

The 'critical' component of Peter Taylor's critical constructivism³ is derived largely from the critical theory perspective of Jurgen Habermas (1971, 1987). Mezirow (1981), in describing and interpreting Habermas' ideas and applying them in an educational context, describes them this way:

Habermas differentiates three generic areas in which human interest generates knowledge. These areas are "knowledge constitutive" because they determine categories relevant to what we interpret as knowledge. They also determine the mode of discovering knowledge and establishing whether knowledge claims are warranted. Three distinct but interrelated learning domains are suggested by Habermas' three primary cognitive interests - the technical, the practical and the emancipatory. (Mezirow, 1981, p. 143-144)

Mezirow describes the *technical* mode as being related to the human interest of 'work', the *practical* to 'interaction' and the *emancipatory* to 'power'.

The *technical* mode is "based on empirical knowledge, and is governed by technical rules." (Mezirow, 1981, p. 144) This mode is the one used in the natural sciences, and is also the mode on which much of the "process-product" (Shulman, 1986) research on teaching has been based. It is concerned with predictable, observable events, which can be explained or described by general rules. These rules can be discovered through correctly applied quantitative experiments and generalised to similar cases.

3 There have been other epistemological perspectives described as 'critical constructivism', including those of Anderson and Barrera (1995), however it is Taylor's approach that has been most influential on mine

The *practical* mode is concerned with human relationships and communication, with the building of consensual understandings and norms for action.

This understanding and mode of inquiry has as its aim not technical control and manipulation but rather the clarification of conditions for communication and intersubjectivity. It is not the methods of the empirical-analytical sciences which are appropriate to this task but systematic inquiry which seeks the understanding of meaning rather than to establish causality. (Mezirow, 1981, p. 144)

Practical actions, therefore, are those which extend human communication and understanding, and allow for the improved construction of shared meanings. The qualitative/interpretive tradition in research on teaching is based on the assumption that humans (both teachers and students) do not fall under the necessary conditions of predictability which are required for research in the objective technical mode, and must therefore be studied in the intersubjective practical mode.

Emancipatory actions involve self-knowledge and reflection on the effects of one's lived experience, and the problematising of power structures with a view to emancipation from their inequities. This mode is related to the empowering of human beings through the critique of ideologies.

Gore and Zeichner (1991) use the term "critical" rather than "emancipatory", however their definitions of the three modes are similar to those of Mezirow. They offer this definition of the three modes of reflection:

First, in technical reflection, the concern is with the efficiency and effectiveness of the means used to attain ends which themselves remain unexamined. Second, in practical reflection, the task is one of explicating and clarifying the assumptions and predispositions underlying teaching activity and in assessing the adequacy of the educational goals toward which the activity leads. Finally,

critical reflection incorporates moral and ethical criteria into the discourse about practical action. Here the major concern is with whether educational goals, activities and experiences lead toward forms of life that are characterised by justice, equity, caring and compassion. (Gore & Zeichner, 1991, p. 122-123)

Critical constructivism takes Habermas' (1971) three 'human interests' and overlays this frame on a constructivist epistemology. This theoretical scheme, as Gore and Zeichner (1991) note in the above paragraph, moves constructivism beyond a concern with only the technical mode of knowing and acting in the world, toward practical concerns with relationship and communication. The emancipatory interest is seen, within this perspective, as supportive of the practical interest (Geelan, Taylor & Day, 1998, Feb), in that its role is to address inequitable power structures and reified assumptions that act to block the development of communicative relationships (Habermas, 1987).

Jack Whitehead and Living Educational Theory

Jack Whitehead has for some years been pursuing an approach to inquiry in education which he describes as the development of 'living educational theory' (Laidlaw & Whitehead, 1995; Whitehead, 1989). Through asking questions of the kind 'How do I improve my practice?', suggests Whitehead, practicing educators work to develop theoretical understandings that, rather than being derived from bodies of formal research and theory in the disciplines of psychology, sociology, anthropology, philosophy and even institutionalised educational research, are derived directly from educators' attempts to embody their educational and personal values in their practice. Like my own perspective, Whitehead's is explicitly value-laden: teachers value certain things, and the process of attempting to improve teaching is necessarily the process of attempting to embody more fully in our practices the things we value.

Whitehead notes that, due to a variety of constraints - both external/institutional and

internal/biographical - none of us is able to fully embody in practice the values and beliefs we espouse. He writes:

My insights about the nature of educational theory have been influenced by viewing video-tapes of my classroom practice. I could see that the 'I' in the question 'How do I improve this process of education here?', existed as a living contradiction. By this I mean that 'I' contained two mutually exclusive opposites, the experience of holding educational values and the experience of their negation...Is it not such tension, caused by this contradiction, which moves us to imagine alternative ways of improving our situation? By integrating such contradictions in the presentations of our claims to know our educational practice we can construct descriptions and explanations for the educational development of individuals. (Whitehead, 1989)

Certainly this has been my experience and, I suspect, that of many of my colleagues at Arcadia. The Apostle Paul says:

I do not understand my own actions. For I do not do what I want, but I do the very thing I hate...I can will what is right, but I cannot do it. For I do not do the good I want, but the evil I do not want is what I do. (Romans 7:15,19. RSV)

On the basis of our personal and educational values, we have certain aspirations for the ways we will teach and interact with young people (see also the discussion of Max van Manen and 'the tact of teaching' in Chapter Four), yet in our practice we find ourselves negating these values and aspirations. Whitehead (1989) suggests that, rather than hiding these contradictions in a linear, propositional-logical representation of our inquiry, we should strive to represent them in a dialectical mode. The tension between our values and aspirations, on the one hand, and perceived shortcomings of our practice, on the other, is the dynamo that drives our attempts to improve our practice through thoughtful inquiry. This tension is one of those that I am striving to represent in this

text, with its variety of voices. It is possible, and valuable, for me to articulate my aspirations and theoretical understandings in academic language, but that is not the whole story, and the impulse to hide the times when I fall so far short of living my beliefs is a dangerous one. On the other hand, if I were to write only the story of my classroom practices, in an engaging tale of daily life, there would not be the empowering tension of my dreams and aspirations to 'question the answers' and challenge me to improve my practices. Feyerabend, Taylor and Whitehead each, in their different ways, value the holding in tension of incommensurable accounts and perspectives and tales. This is a specifically postmodern reaction to monolithic modernist 'grand narratives' (Lyotard, 1986), which resolve and subsume all tensions and alternatives. Similarly, Polkinghorne (1992) describes a 'postmodern epistemology of practice' for psychology:

The psychology of practice is an example of the new pragmatism in action. It has come to understand that the human realm is fragmented and disparate and that knowledge of this realm is a human construction without a sure foundation. Yet this knowledge has not led to a retreat into a disparaging skepticism; rather, it has led to an openness to diverse approaches for serving people in distress. The psychology of practices body of knowledge consists of the aggregate of the professional community's experience of what has been beneficial to clients. The criterion for the acceptability of a knowledge claim is the fruitfulness of its implementation. The critical terminology of the epistemology of practice has shifted from metaphors of correctness to those of utility. (Polkinghorne, 1992, p. 162)

Many of these changes are reflected in the critical practice of education, and this positive, constructive response to the challenges of postmodernism is, in my opinion, to be applauded. The communication of 'the aggregate of the professional community's experience of what has been beneficial' (Polkinghorne, 1992, p. 162) occurs verbally in staffrooms and seminars and conferences, but the writing of teacher tales - the

weaving of narrative nets to capture classrooms - is another important avenue for the development of a postmodern epistemology of practice in science education.

I began this chapter by setting up a distinction between the influence of constructivism on (1) my colleagues' teaching (which is also one focus of my research), (2) my own teaching and (3) my research activities. Frederick Steier, however, would suggest that, while that distinction might be a useful one for this discussion, it's not one that's useful - or perhaps even possible - to make in practice.

Frederick Steier and Reflexivity

Steier (1995) has outlined what he calls an 'ecological constructionist' perspective on epistemology and knowledge. The significant feature of his thinking that has influenced this research project, however, is the concept of 'reflexivity'. I have considered the implications of reflexivity for teaching, learning and research in science education in some detail elsewhere (Geelan, 1997b). Steier suggests that many constructivist and constructionist epistemologies have been fundamentally flawed, in that they attempt to construe the construction processes of others, without realising that the researchers themselves are involved in a construction process.

...there have been many who have adopted a constructionist label to what is still defined by objectivist inquiry. Here we find those who take, as an object of study, other persons' constructions of reality as something to be understood in an objective manner, somehow apart from the researchers' own tools and methods. (Steier, 1995, p. 70)

Steier refers to such perspectives as 'naive constructivism', because they do not take into account the idea that researchers themselves are construing the construction processes of those involved in the research. Rather than referring to those with whom he is involved in research as 'subjects' or 'informants', Steier refers to them as

'reciprocators', in order to emphasise the collaborative and co-constructed nature of that work. When answers are given in an interview, for example, they are not given to an invisible person or a machine. The answers are given to the researcher as a person, and the reciprocator is constantly construing the expressions, responses and non-verbal cues of the researcher. This being the case, research reports which purport to be 'objective' by removing the person and personality of the interviewer miss much that is vitally important about the answers given: were they given to a person in a position of power? to a friend? to a sexually attractive person? to a trusted colleague? or a complete stranger? In representing the research in which I have collaborated, then, I have tried to represent myself, as researcher, teacher and learner.

As has been discussed below (in the section on John van Maanen and the 'third moment of ethnography') there is yet another construction process - that which you, as a reader of this text, are undergoing as you construe my written representation of my construction of my reciprocators' responses, which in turn were influenced by their construction of me.

Social 'objects' change with our perspective, so that it is impossible to conduct research on a fixed social reality - the activities of our research themselves change the things we aim to understand. This does not lead to nihilism and despair of being able to say something meaningful about social activities (including education). Instead, it makes us aware that teaching, learning and research are all social activities, and the distinctions between them become less important as we understand reflexivity more fully:

Thus we must recognise that...we, as researchers, act as teachers. In addition...our reciprocators act as teachers...Understanding this might, in turn, allow us to learn what we already know, or to be surprised. Constructionist research programs that take issues of reflexivity seriously necessarily become programs of collaborative learning. (Steier, 1995, p. 84)

The current project fits very much within this description. In this situation, I acted in an institutional role as a teacher toward the school students, and in the less formal role of a teacher (teacher educator) toward my teaching colleagues, having held that role formally the previous year. I was present in the institutional role of researcher, but I was also explicitly concerned with acting as a learner in attempting to improve my educational practice. It can be a little awkward, but it would be more accurate to describe this as a teaching/learning/research project than simply as research - even participant research. The conclusions and implications discussed in Chapter Seven are largely concerned with what I have learned, and how this will be applied in my own practice as I continue to teach.

David Geelan and Value-Driven Eclecticism

My selection of theoretical and methodological approaches was not dictated primarily by my professional field (science education) nor by the research questions I wished to explore. Rather, both the research questions and the tools with which I chose to address them arose out of certain of my personal and educational values. Chapter One presents a characterisation of who I am, or at least who I see myself as being. That characterisation is offered because of my belief in the central role of valuing in the research activity I have chosen to undertake.

These values include (a) the empowerment of students and their ability to take an active role in their own learning; (b) a constructivist, instrumentalist view of the nature of science that is intended for empowering people; (c) the importance of Habermas' (1971) 'practical' and 'emancipatory' modes of rationality in addition to the 'technical' demands of science and society; (d) the desire to live a Christ-like life through acting in love toward everyone with whom I come in contact (practically, this approach has much in common with Noddings (1984) 'caring' ethic); (e) the desire that all my students would leave the classroom with positive attitudes toward science and an understanding of science that integrates well with their experiential worlds; (f) the

desire to explore modes of representing my experiences and understandings that will enable me to engage others in educative dialogue with my texts and myself.

The three research questions (about expectations, science teaching and the methodology), the four influential theoretical perspectives (epistemological anarchy, critical constructivism, living educational theory and reflexivity) and the three facets of the methodological approach (hermeneutic phenomenology, narrative and critical ethnography) have all been deliberately chosen because I believe they have the potential to aid me in more fully living these values in my educational practice, as both a teacher and a researcher.

In bringing together the disparate philosophical and theoretical perspectives drawn from my reading and formal study, along with the beliefs, understandings and commitments drawn from my life experience, I do not strive for the development of an absolutely coherent, stable and unitary synthesis. There are a number of reasons for this:

1. The nature of my conceptual scheme must be dynamic, since every new experience - every book read, every conversation enjoyed or endured, every lesson presented or heard - joins the complex flux and modifies it. Such changes are not immediately incorporated throughout my construct system (my perspective on this owes much to Kelly (1955) and Piaget (1972)) but begin to permeate my consciousness as they interact with the sum total of all my other experiences and reflections. The attempt to capture even a snapshot of my understanding in a unitary way is doomed, to the extent that I am a living contradiction (Whitehead, 1989), and because 'I' won't sit still long enough.
2. With Feyerabend (1974, 1975), I believe that many different perspectives, held in a dialectical tension, contribute to "the development of our consciousness". They do so more powerfully in this way than if they were subsumed into a single perspective, because the very act of subsuming two different and possibly incommensurable perspectives into a single entity causes both to lose definition

and richness. In this sense, my perspective on dialectical rationality is unlike that of Hegel, who believed that the process of thesis and antithesis coming together at a higher level of abstraction in a synthesis led toward further understanding of the Absolute.

3. My concerns are essentially practical - what I value is not 'knowledge for its own sake', but knowledge informing practice. (I have chosen not to use the term 'praxis' because it has been defined in so many different ways within educational theory that it has become almost meaningless). The intention of this research project is two-fold: (a) to generate, through practice, new understandings that will further inform my practice, in order to improve it; and (b) to represent those new understandings in ways that allow others to use them to inform their own practice. This being the case, I believe an eclectic, postmodern epistemology of practice (Polkinghorne, 1992) that offers a number of very different perspectives from which to understand the text is more powerful than the search for a single perspective.

My approach in this thesis is not dialectical alone. Instead, it is intended to be an example of the classical *trivium* (three roads): logic, dialectic and rhetoric.

Logic

The constraints of preparing a doctoral thesis - a document intended to demonstrate that I have the ability to perform certain tasks and functions - require that some parts of this text be written in formal, propositional-logical mode. Beyond this, however, in spite of the damaging extent to which this mode has been dominant in Western culture, I do value it, and believe that, when held in tension with other modes, it has an important contribution to make to our understanding of our experiential worlds. If the propositional-logical mode of rationality is artificially privileged - as it has tended to be in Western culture - to the extent that it comes to be seen as the only 'valid' mode of educative discourse, then our experience is impoverished. If, however, in reaction to this dominance, we move solely to another single mode of rationality - the dialectical,

rhetorical or 'connected' (Belenky, Clinchy, Goldberger & Tarule, 1986) - then our experience will be similarly impoverished (see, e.g., Miller, 1997).

Dialectic

One (rhetorical, analogical) example of the power of a dialectical approach to understanding is to think about the contributions to education of the disciplines of psychology and sociology. It is of little value to decide that psychology's emphasis on the cognition of an individual student is 'wrong', and that sociology's focus on the social relations within the classroom is 'right', or vice versa. Neither is it particularly valuable to try to subsume both perspectives into a single one - richness and complexity that may be crucial to a productive framing of the problem would be lost. Instead, by first looking at a particular educational problem through the 'lens' (to use an almost cliched metaphor) provided by psychology - the effects and influences and perspectives of the individual - and then looking at the same problem (although it cannot be exactly the same problem) through the 'lens' of sociology, a richer blend of descriptions is available than through either discipline alone. I have elsewhere made the same argument about personal and social forms of constructivism (Geelan, 1997a).

I have chosen, in this thesis, not to choose either one mode of representation or another - either a novel or a more propositional text - but to use *both* ways of attempting to richly represent my understandings. It is my hope that the reader will not attempt to subsume one text within the other - to treat the formal discussion as an explanatory appendix to the novel, or the novel as an extra data set for the research results presented in the third section. Instead, the two representational approaches should be held in a dialectical tension, challenging one another, reflecting on one another, and together contributing to "the development of [your] consciousness" (Feyerabend, 1975).

Rhetoric

'School Stories', the 'novel' that makes up Section Two of this thesis, relies, to a large extent, on the resources of rhetoric to make its educational points. That is to say, like

other novels, it tries to avoid being 'didactic' - making a too-obvious logical appeal, in which I tell you what I think and try to adduce logical evidence to persuade you to share my belief. Instead, 'School Stories' uses imagery, metaphor, allusion, fiction, narrative and the other skills and resources of the rhetorician and the novelist to bring you into a created world and a shared experience. There are definitely educational ideas and theories and perspectives that I wish to communicate, and even to persuade you to share - it is the approach and mode of rationality that is different. I would argue that the particular propositions I wish to put to you - that trust and relationship are essential to teaching, that it's tough for teachers with no science experience to teach science, that our aspirations aren't always translated into our practice - can be put far more richly and powerfully through a representation that includes rhetorical and dialectical elements than through a purely propositional-logical representation. Further, such a rhetorical approach allows for more of the genuine ambiguity I feel about many of my experiences to be represented. There is no simple, clear answer to who bears most blame for the breakdown of my relationship with one teacher - a story simply allows that ambiguity to be communicated more readily than does a 'thesis'.

Summary

This chapter outlines my understandings of constructivism and the nature of science, along with four key theoretical influences on my perspective - the work of Paul Feyerabend, Peter Taylor, Jack Whitehead and Frederick Steier - and attempts to draw them into a coherent logical/dialectical/rhetorical model (though not a synthesis) to support the research. These perspectives are all related to the way in which I construe, and seek answers to, the second research question, about how effectively teachers with limited science backgrounds can use constructivism as a referent for teaching with an integrated curriculum model in middle school classrooms. I have been explicit about the value-driven nature of the research project, and Chapter Four outlines the reflection of these values in the teaching/learning/research approach adopted.

Chapter Four

Places to Stand, Ways to Look: Approaches and Methods and the Third Research Question

Introduction - Standing and Looking (Back)

The preceding chapter, Chapter Three, focussed on constructivism, the nature of science and some of the other theoretical perspectives that informed my teaching/research/learning in the school. For this study, however, the line between theory and methodology is a fine, and perhaps a rather arbitrary, one. Each of the four theoretical perspectives discussed - Feyerabend's epistemological anarchy, Whitehead's living educational theory, Taylor's critical constructivism and Steier's reflexivity - has strong implications for *how* disciplined inquiry in the human sciences can and should be conducted, although the primary concern of each is with a philosophic approach to these issues. Similarly, the three methodological approaches discussed in this chapter, while I have chosen them for the methods and approaches to inquiry they prescribe, draw these prescriptions from well articulated theoretical perspectives.

The purpose of this chapter is to clearly describe the methodological approaches I chose for this research project, and to establish their appropriateness for the purposes of the research. This is related to the study as a whole, but most specifically to the third research question, which is explicitly about the appropriateness and value of the chosen methods for the research project. I have chosen to structure this chapter - like the approach used in Chapter Three - by describing the work of each of the researchers (or in the case of Clandinin and Connelly, teams of researchers) whose methods I have emulated or adapted, then making clear how my own research approach is similar to, and different from, that of each researcher. Finally, in the last part of the chapter, I provide a clear description of the methods I adopted for this research project, and some consideration of why I considered these methods, and not others, to be appropriate for the research questions I wished to address.

Max Van Manen: Hermeneutic Phenomenological Inquiry and Pedagogical Thoughtfulness

I have taken Max van Manen's (1990) 'hermeneutic phenomenological' approach to human science as a key referent for my methodological framework. This perspective on the representation of lived experience subsumes and provides the justification matrix for the actual methods chosen - those of Connelly and Clandinin's (1996) 'school stories' and John van Maanen's (1988) 'impressionist tales'.

Van Manen suggests that:

when we raise questions, gather data, describe a phenomenon, and construct textual interpretations, we do so as researchers who stand in the world in a pedagogic way...pedagogy requires a phenomenological sensitivity to lived experience...a hermeneutic ability to make interpretive sense of the phenomena of the lifeworld....[and]...play with language in order to allow the research process of textual reflection to contribute to one's pedagogical thoughtfulness and tact. (1990, pp. 1-2)

These three elements - a phenomenological sensitivity to the lived experience of oneself and others (in the case of the present study, the teachers and students with whom I worked), the hermeneutic activity of interpreting and making sense of that experience, and the semiotic/textual activity of representing both the lived experience and our interpretations in writing - make up the research approach of human science in the service of teaching. Since my purposes in conducting the research were to more fully understand (through phenomenological sensitivity and hermeneutic reflection) the lived experience of myself and others in the school context, and to represent those understandings in written texts that would be accessible to other teachers, I believe that van Manen's methodological stance - this particular 'place to stand' - is appropriate to my purposes.

For van Manen, phenomenological research includes (1) the study of lived experience, (2) the explication of phenomena as they present themselves to consciousness, (3) the study of essences, (4) the description of the experiential meanings we live as we live them, (5) the human scientific study of phenomena, (6) the attentive practice of thoughtfulness, (7) a search for what it means to be human, and (8) a poetizing activity (adapted from van Manen, 1990, pp. 8-13). All of these complementary and conflicting intentions and activities informed both my work in the school as a teacher/learner/researcher, and the process of writing the tales and the other forms taken by the reporting of the research, including this thesis.

The activity of writing is, itself, central to the process of hermeneutic phenomenological research: from a more traditional research perspective, the 'real' research occurs in the field, and the 'writing up' is a separate activity that represents the research. For van Manen, though, 'Writing is our method' (1990, p. 124). "Writing", he suggests:

separates us from what we know and yet it unites us more closely with what we know...distances us from the lifeworld, yet it also draws us more closely to the lifeworld...decontextualises thought from practice and yet it returns thought to praxis. (1990, pp. 127-128).

He goes on to say that writing both abstracts and concretizes our understanding of the world: the process of putting our lived experience into words places it at one remove from the world, yet our tales have the ability to capture experience in ways that are somehow more concrete - perhaps because more explicit - than unmediated experience.

Van Manen's research approach and concerns are drawn very explicitly from his concern for pedagogy - something he defines quite broadly as "being educationally involved with children" (1991, p. 3). In his 1991 book 'The Tact of Teaching: The Meaning of Pedagogical Thoughtfulness', Van Manen outlines an integrated theory of pedagogy. Although this book is intended for a different audience than 'Researching

Lived Experience' (1990) - 'The Tact of Teaching' is written for teachers rather than researchers, and uses appropriate language and forms of expression for that audience - the books share their central concern: that in both our pedagogical practices and our scientific inquiry, tact and thoughtfulness are essential qualities. Van Manen is unabashed in stating that these are moral issues as well as practical ones, and rejects amoral, value-free approaches to either inquiry or teaching.

To write about pedagogical thoughtfulness and tact courts the dangerous presumption that one claims to know how to behave with moral superiority. By definition pedagogy is always concerned with the ability to distinguish between what is good and what is not good for children. Many educational thinkers are uncomfortable with this assumption, they try to pursue educational problems and questions in a value neutral or relativistic manner. It is wrong, however, to confuse pedagogical discourse with moral diatribe or preaching. Preaching is an act of moral exhortation on the basis of some unquestioned dogma. But pedagogy does not aim to deliver diatribe. Pedagogy is a practical discipline. On the one hand, educators need to show that in order to stand up for the welfare of children, one must be prepared to stand out and be criticised. On the other hand, pedagogy is a self-reflective activity that always must be willing to question critically what it does and what it stands for. (1991, p. 10)

The construct of 'thoughtfulness' or 'tact' (Van Manen uses the terms somewhat interchangeably, although 'tact' seems broader) is two-edged:

...a new pedagogy of the theory and practice of living with children must know how to stand in a relationship of thoughtfulness and openness to children and young people...The pedagogy of living with children is an ongoing project of renewal in a world that is constantly changing around us and continually being changed by us. (1991, p.3)

Van Manen sees tact as including both of the common senses of the word 'thoughtful' - (a) a considerate, empathic regard for the needs and ideas of another, and (b) a propensity for critical reflection. In order to behave tactfully or thoughtfully toward others, he suggests, it is necessary to be thoughtful about our experiences and ideas.

Parents and teachers must be able to understand what particular experiences are like for children. But adults cannot understand children if they do not understand their own childhood. The person I am is partly constituted by my life memories...Our identities are composed of projects that we try to work out when we tell stories about our encounters, accomplishments, adventures, failings, accidents. (Van Manen, 1991, pp. 22-23)

It is this idea of 'thoughtfulness' that informs Van Manen's methods for conducting inquiry into pedagogic situations and practices such as schooling and parenting. As a teacher-researcher, my own stance within the school was pedagogic. My practices were not those of an objective researcher whose purpose was to passively observe the activities of others and to attempt to make sense of them, but of a teacher, educationally involved with young people, who was attempting to richly understand that involvement in order to improve it. As such, thoughtfulness in both these senses was required of me. First, it was necessary that I be thoughtful and tactful toward my students and colleagues - something I did not always achieve - in trying to understand what it would mean to 'improve' my practices and their learning. That is, it was important that I negotiate change with those involved, and that I make a sincere attempt at understanding their perspectives and understandings and expectations. Second, it was necessary for me to be critically reflective about my own assumptions, ideas and prejudices, and to be actively involved in reconstructing both my experiences in formal educational settings (as teacher and learner) and the rest of my beliefs and life history. This is an iterative process:

...pedagogy requires a reflective orientation to life... By thoughtfully reflecting

on what I should have done, I decide in effect how I want to be. In other words, I infuse my being and my readiness to act with a certain thoughtfulness. And yet, how I am now as a teacher will not be clear until I have had further opportunities to act in more appropriate ways. How I am as a teacher depends on what I do, on my possibilities for acting thoughtfully. But my possible actions do not magically arise, they depend on the thoughtfulness that I have been able to acquire in recollective reflection. (Van Manen, 1991, p. 116)

From Van Manen, then, I have taken not so much methodological prescriptions - particular modes of data collection and analysis and representation - but a stance for 'being in the world' or, in this instance, in the mini-world of the school. Like him, and like Jack Whitehead in Chapter Three, my concerns are pedagogical, rather than philosophical, psychological or sociological, and the modes of inquiry that are appropriate for addressing these concerns are likewise pedagogical. I wish to suggest that disciplined, thoughtful, reflective inquiry that takes as its starting point myself and my current teaching practice, but acknowledges my quest to more fully embody my values in my practice, is the appropriate mode of inquiry for this study.

Jean Clandinin and Michael Connelly: Narratives of Experience

In their 1988 book 'Teachers as Curriculum Planners: Narratives of Experience', Jean Clandinin and Michael Connelly champion a 'narrative rationality' as an approach to both understanding and representing what happens in education - and how teachers think and feel about it. In his foreword to the book, Elliot Eisner notes that teacher narratives are seen as 'soft' data, and that their use requires courage. He suggests that:

One must be willing to understand by participating sympathetically in the stories and in the lives of those who tell them. One must be willing to vicariously participate in scenes that one cannot enter into directly. One needs to be able to trust on the basis of coherence, utility, and the often ineffable sense of rightness

that true stories display... The use of narratives, and the epistemological frameworks through which these narratives embody and convey meaning, not only provides an important way to think about curriculum and teaching, but is also vital to understanding what goes on at school. (Eisner, 1988, p. x)

Clandinin and Connelly suggest that the research literature on teaching has tended to concentrate on the observable behaviours of teachers and students as they occur in classrooms. Such research, they suggest, tells only part of the story, and perhaps not the most important part. A narrative rationality that attempts to understand teachers' classroom practice as the meanings teachers make of classroom events and situations, systemic prescriptions and requirements, their autobiographies as teachers and learners and the specific, contextual needs of students is more powerful.

Narrative is the study of how humans make meaning of experience by endlessly telling and retelling stories about themselves that both refigure the past and create purpose in the future...Constructing a narrative account of oneself, or of someone else, is difficult, rewarding work. It is difficult because so many aspects of life need consideration and because people are so complex that they all have many life stories, not only one. It is rewarding because it is curricular and educational. It is a way of making educational meaning of our lives... (Connelly & Clandinin, 1988, pp. 24-25)

The construction of narratives about our own and others' teaching - whether as written text or as the on-going 'lived narrative' of school life - is powerful because such narratives take into account not only current practices and situations but the past lives and experiences of teachers, and their future aspirations.

Narratives are both lived and told. This is a distinction that Clandinin and Connelly do not always make well: their language often confuses the lived narratives of teacher experience with the told narratives of researcher or participant observer accounts. I have

attempted to make this distinction more clearly, suggesting that the 'novel' which I have called 'School Stories' is the second kind of narrative - my written (retrospective, reflective, constructed) account of the lived narrative that I experienced while teaching in the school. Such written narrative accounts are intended to provide an occasion for reflection on the part of the writer and the reader - particular dilemmas of education are seen with their full moral and emotional force, and with much of their complexity intact.

Such dilemmas, suggest Clandinin and Connelly in their 1995 book 'Teachers' Professional Knowledge Landscapes', arise out of the richness and complexity of the 'professional landscape' within which teachers work. This goes beyond the classroom context to include the other 'professional places' within the school - staff rooms and offices - and to include the life experiences and values of teachers. The professional landscape also includes "the conduit" (Clandinin & Connelly, 1995, p.9) or "the pipe" through which flow the apparently unassailable theoretical pronouncements of researchers and the prescriptions of governmental and educational authorities. Such prescriptions have a moral force, because the descriptive 'is' of research tends to become the prescriptive 'should' of accountability and requirement. Clandinin and Connelly describe these intrusions from the conduit as 'sacred stories'.

Teachers in classrooms are, in a sense, in a secret environment. Although they are increasingly accountable to parents and administrators, and although the 'conduit' has a strong influence on what occurs, essentially the way teachers act and think in the classroom is private. The stories they enact in this context are their actual classroom practices, and reflect their biographies as teachers and learners and their beliefs and values about teaching (and life). The gap between these 'secret stories' and the 'sacred stories' of the school is another - although perhaps rather richer - description for the oft lamented 'theory-practice gap'. Teachers tell and share their secret stories when it is safe to do so - sometimes in the staffroom and with other teachers, sometimes (if they're very fortunate) with their partners at home. Secret stories, though, do not play well in

the professional landscape outside the classroom, because by necessity they present the teacher as tentative, thoughtful and uncertain. In the professional landscape it is necessary for teachers to appear confident, competent, certain - so teachers also tell 'cover stories' which deal with classroom events, but present the teachers' role and actions as unproblematic.

Classrooms are, for the most part, safe places, generally free from scrutiny, where teachers are free to live stories of practice. These lived stories are essentially secret ones. Furthermore, when these secret stories are told, they are, for the most part, told to other teachers in other secret places. When teachers move out of their classrooms into the out-of-classroom place on the landscape, they often live and tell cover stories, stories in which they portray themselves as experts, certain characters whose teacher stories fit within the acceptable range of the story of school being lived in the school. (Clandinin & Connelly, 1996, p. 25)

In a recent paper (Clandinin & Connelly, 1996) this scheme is embellished by the addition of the fourfold distinction between school stories, stories of schools, teacher stories and stories of teachers. School stories are those a school tells about itself as a school, while stories of schools are told about the school by others (parents, teachers, the community). Teacher stories are the stories lived and told by teachers, and include both secret and cover stories. Stories of teachers are the stories told about teachers by others.

The scheme of secret, sacred and cover stories is one that I have found valuable in considering many of the moral, ethical and educational dilemmas raised during my year at Arcadia High School. Its value is as one more way of teasing out the tangled fibres of my life in the school, spinning them into narrative threads and weaving these into a useful and aesthetically pleasing narrative net. Another such scheme, which I have also found useful, albeit for weaving a different type of net, is that of John Van Maanen.

John Van Maanen: Impressionist Tales and the Third Moment of Ethnography

John Van Maanen, in his 1988 book 'Tales of the Field: On Writing Ethnography', describes 'realist, confessional and impressionist tales' that, he suggests, ethnographers have used, and can choose, in representing their research: their lived experience in 'the field'.

Realist tales, according to Van Maanen (1988, paraphrased), have the following four characteristics:

- (1) Experiential author(ity) - the author of a realist tale is not present as a character in such a tale, but acts as an omniscient and invisible narrator;
- (2) Typical forms - the events and practices of the studied culture are subsumed to categories devised by the author or arising from the discipline of ethnography, such as "rites, habits, practices [and] beliefs" (Van Maanen, 1988, p. 48);
- (3) The native's point of view - direct quotes from those studied are included as a way of acknowledging their perspectives, however these are turned to the narrative and rhetorical purposes of the author; and
- (4) Interpretive omnipotence - in realist tales, 'the interpretations of the author are final, and no correspondence will be entered into': uncertainties or alternative interpretations do not appear in the account.

My own tales are specifically *not* intended to be realist tales - I am very much present as a character in the account, I have tried to allow features of the school context to generate their own categories rather than impose mine, and alternative interpretations and the impossibility of closure are also features of the writing. The voices of the teachers and students have in a sense been turned to my narrative purposes, but I would suggest that there are also dissident voices and alternative constructions of events within the excerpts included.

One problem I have encountered already with the use of the tales is that readers tend to react to them *as though* they were intended as realist tales. The representation of the fictionalised character 'Carolyn', for example, has been seen as an ethically inappropriate attack on a particular teacher. There is no 'Carolyn' teaching in the school, however - this character is a composite of a number of teachers and of my personal experience, intended to convey some particular narrative points about trust and pedagogical tact. Although it is definitely and strongly grounded in my experience in the school, my account is not intended as a realist, objectivist portrayal of particular people and incidents. As discussed below, the metaphor of the 'impressionist tale' is much more commensurable with my intentions.

Confessional tales, suggests Van Maanen (1988), are intended to support and provide context for realist tales, through showing some of the methods and approaches of the ethnographer. Confessional tales are usually presented as complementary text (in the same article or book) for realist tales. They are characterised (in parallel with the characteristics of realist tales (Van Maanen, 1988, paraphrased)) by:

- (1) Personalized author(ity) - the tale is usually *about* the author and his or her actions and practices;
- (2) The fieldworker's point of view - this form of tale is intended to complement the realist tale by making the researcher's biases and assumptions more open, although not at the expense of the final veracity of the work;
- (3) Naturalness - the contention that, despite flaws and questions raised in the confessional tale, the ethnography is nonetheless 'good' - uncontaminated, pure, work of quality.

It should be noted that confessional tales have no direct parallel for the 'typical forms' of realist tales, although the conventional categories of the genre may be no less rigid. I consider that my own tales, although they are to some degree concerned with making my own assumptions and ideas explicit for the reader, do not really fit the metaphor of

the confessional tale. My intention in any confession that I do is not so much to bolster the apparent reliability and validity of the tales I tell, but to (re)present my own processes of critical self-reflection and pursuit of understanding.

The work of my doctoral supervisor, Peter Taylor, has particularly influenced the development of my research approach (Taylor, 1997, March, 1995). Taylor draws the art history analogy with French Impressionist painting even more strongly than does Van Maanen. The following excerpt exemplifies both Taylor's approach to impressionist tales and his reading of Van Maanen's approach:

In Monet's lake-scape, 'La Grenouillere', there is a recognisable public space inhabited by people whose social habits are identifiable but of minor concern to the artist. Monet's main concern is to express the mood of this particularly sunny day. The choppy brushmarks of pure colour result in a mesh of light and atmosphere which is the true subject of the painting. More dramatically, Van Gogh's land/sky-scape, 'Starry Night', is a partly imaginary or composite image that amalgamates elements from two of his earlier paintings as well as a fictional church spire drawn from memory. These devices contribute to a synthesis of the artist's present and past experiences. But the painting is not so much about landscape forms as it is about the theme of a wonderful restless life force that sweeps upwards through the trees and swirls across the sky, a theme that is conveyed through self-conscious use of vibrant colour and heavy brushstrokes. These paintings engage the viewer as a participant in the rich life experiences of the artists.

For ethnography, Van Maanen's *impressionist* mode of writing - *tales of the field* - is an attempt to bring the knower and known together in representational form as a means of "cracking open the culture and the fieldworker's way of knowing it so that both can be jointly examined . . . [keeping] both subject and object in constant view" (van Maanen, 1988, p.102). The fieldworker draws on

her experiences to write stories about remarkable and memorable (rather than recurring) events, which she makes striking by skilful use of words, imagery, phrasing and metaphor. The writer aims to draw the reader into the story, to have them relive the experience from beginning to end, to work out its puzzles and problems. To intensify the relived experience, the writer may exaggerate, be entertaining, be uncharacteristically kind (or unkind), or use crude figures of speech typically forbidden. (Taylor, 1997, March)

The final paragraph above describes very nicely the approach I have taken - and the effect for which I was aiming - in the present study. The tales, brought together to form a 'novel', are intended to allow the reader to be engaged in an experience of some facets of my year in the school. This is accomplished through tales of 'critical incidents' that occurred during the year, rather than through the realist tale's approach of building up layer upon layer of the ordinary. I was not really interested in the minutia of daily lessons, of classes that went well and teachers who unexceptionably carried out their duties. Instead, the tales reflect "[their] out of the ordinary or unique character. Impressionist tales are not about what usually happens but about what rarely happens." (Van Maanen, 1988, p. 102)

The four parallel characteristics of impressionist tales, Van Maanen (1988, paraphrased) argues, are:

- (1) Textual identity - the intention of the impressionist tale is not to objectively describe a culture (like the realist tale), nor to analyse the motivations and theories of the researcher (like the confessional tale), but to engage the reader in the experience, from the perspective of the fieldworker. The craft is one of narrative, and of holding and engaging the reader.
- (2) Fragmented knowledge - life is not simple, resolved, or closed, and the successful impressionist tale represents this complexity in the narrative, with details, juxtapositions, allusions. Reading becomes a pedagogical occasion - Van Maanen

notes:

In short, a learning process is suggested by the impressionist tale. Certain unremarkable features of the beginnings of a tale become crucial by its end... The audience cannot know in advance what matters will prove instructive, and thus by trying to hang on to the little details of the tale, they experience something akin to what the fieldworker might have experienced during the narrated events. (1988, p. 104)

- (3) Characterization - the author of the impressionist tale will use the techniques of the novelist or short story writer to personalise the characters who appear in the tale, and most especially to personalise him- or herself as a likeable and engaging (though not always right or patient or wise - this portrayal is related to confessional tales) character who will engage the reader.
- (4) Dramatic control - while the impressionist tale serves an academic purpose, and answers questions of academic interest, it does so through the skills of the storyteller, and the appropriate standards of judgement are therefore more likely to be literary than (objectivist) scientific ones:

Literary standards are of more interest to the impressionist than scientific ones... In telling a tale, narrative rationality is of more concern than an argumentative kind. The audience cannot be concerned with the story's correctness, since they were not there and cannot know if it is correct. The standards are largely those of interest (does it attract?), coherence (does it hang together?), and fidelity (does it seem true?). Finally, since the standards are not disciplinary but literary ones, the main obligation of the impressionist is to keep the audience alert and interested. Unusual phrasings, fresh allusions, rich language, cognitive and emotional stimulation, puns and quick jolts to the imagination are all characteristic of the good tale. (Van Maanen, 1988, pp. 105-106)

In describing impressionist tales, particularly in the above excerpt, Van Maanen probably over-states the reliance on literary standards rather than disciplinary ones, at

least for the case of this thesis. While it is *necessary* that the tales presented must engage readers and hold their attention, for the purposes of a doctoral thesis it is not *sufficient*. My accounts must demonstrate (partly through the tales-in-themselves and partly through the meta-text that forms the first and third sections of the thesis) (a) that they are grounded in my personal experience within the school, (b) that the things they say are in some sense 'about' that experience and about the school, and (c) that those assertions and conjectures are significant and valuable within the field of science education. I would suggest, then, that rather than embracing (Van Maanen's vision of) ethnography whole-heartedly, I have chosen to use the techniques and methods of fieldwork and narrative representation in order to examine questions of pedagogical interest - turning John Van Maanen's (1988) methods to Max Van Manen's (1991) project.

In a more recent account (1995), Van Maanen describes the 'three moments of ethnography'. The 'first moment', he suggests, is the fieldwork activity itself - the disciplined, thoughtful experience of a culture that is in some sense foreign to the ethnographer. This was the first phase of ethnography to be seriously studied and addressed.

The 'second moment' is that attended to in Van Maanen's earlier work - the writing of the ethnographic text. As both he and Max Van Manen (1990) suggest, this act of writing has gone from being seen as simply a realist, laboratory-report-like representation of the events and behaviours observed in the fieldwork - which had been seen as the *real* ethnographic activity - to becoming a vital part of the activity of 'doing ethnography'.

The 'third moment of ethnography', suggests Van Maanen, is the act of reading the written account - the reactions, emotions and ideas elicited in the reader by the text.

...an acute textual awareness has developed in some circles based on close

literary readings of ethnographic work. From such readings comes the view that an ethnographic truth is, like any truth (including this one), a rhetorical category whose meaning and shape varies with the contingencies of history and circumstance. This is not, as some traditionalists might argue, the beginning of an inevitable slide into solipsism, relativism or (gasp) nihilism... My reading of the current turn toward text and language in ethnography is governed by a belief that holds rhetoric, broadly defined, to be the medium through which all truths or certainties are established (and shaken). (Van Maanen, 1995, pp. 12-13.)

My own avowed intention - to provide, through the text, an occasion for pedagogic reflection on the part of the reader - is itself rhetorical. 'School Stories' does not argue its case in logical propositions, but in narratives of experience, and, if it is persuasive, that suasion is through an act of the heart as well as of the mind - the appeal of rhetoric, rather than of 'pure' logic. The analogy for the representation of experience offered by R.D. Laing (and used as the epigraph for Section One) - that of a "melody [that] reverberates and regenerates feeling, mood, atmosphere, nuances of pathos, that no scientific discourse can convey, let alone scientific method begin to study..." - seems apposite for the impressionist tales that make up 'School Stories'.

Verisimilitude, Representation and Legitimation

Denzin and Lincoln (1994) provide the following definition for qualitative research:

Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials - case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts - that describe

routine and problematic moments and meanings in individuals' lives. (Denzin & Lincoln, 1994, p. 2)

The present study is explicitly 'multimethod in focus'. The 'novel', woven of impressionist tales, is the largest and most dominant of the 'empirical materials' that I have chosen to collect and use in my attempt to interpret the phenomena of the school year and to answer the three research questions. This dominance occurs for a number of reasons: (1) narrative representations of research are naturally larger and longer than statistical or other 'compressed data' forms of representation - it takes time and space to tell a tale and include enough detail to make it meaningful; (2) as noted in Chapter Seven, I became infatuated with this form of data collection/generation, possibly to the exclusion of other forms; (3) it is the 'novel' presentation of the research that is genuinely novel about this thesis - people have addressed related research questions using interviews and surveys before. Despite the apparent dominance of the 'novel' as a form of representing the results of the research, the other empirical materials collected - interviews and surveys - serve to enrich understanding of the questions of interest. This is a form of 'triangulation', but not one that wishes - or is able - to fix precisely the location of a static, observer-independent reality. Denzin and Lincoln note:

...the use of multiple methods, or triangulation, reflects an attempt to secure an in-depth understanding of the phenomenon in question. Objective reality can never be captured. Triangulation is not a tool or a strategy of validation, but an alternative to validation. (1994, p. 2)

The three forms of empirical materials (Denzin & Lincoln, 1994, prefer this term over 'data') in this study are used in this way - to enrich and deepen the understandings developed by the author and the readers, related to the research questions and the school context, rather than to more tightly pin the truth to a display board. The relative epistemological status of the three forms of evidence is discussed in more detail in Chapter Five.

If validity - the search for a perfect match with an observer-independent external reality - is not the appropriate standard for measuring the value of a qualitative research project such as this one, what might be? Certainly one answer is to reclaim the language of validity for richer, less positivistic uses and ends. Lather (1993) has attempted this task, with the description of several forms of post-structurally conceived validity (reflexive, ironic, neopragmatic, rhizomatic, situated). 'Ironic validity', according to Denzin and Lincoln:

...proliferates multiple representations and simulations of the real, showing the strengths and limitations of each, arguing that no single representation is superior to another. (1994, p. 585)

The *bricolage* approach adopted in this thesis has something in common with this notion of validity, in that I have refused to commit to a single discourse and 'truth strategy', but have held competing perspectives in a dialectical tension. The use of the interview and survey information can be described as 'post-positivist' in its epistemological foundations, while the impressionist tales are constructivist/postmodernist in intent and approach.

An alternative strategy might be to abandon the pursuit of absolute truth, and judge an account by the standards of verisimilitude - does it *seem* true?

Verisimilitude can be described as the mask a text assumes as it convinces the reader that it has conformed to the laws of its genre; in so doing, it has reproduced reality in accordance with those rules... (Denzin & Lincoln, 1994, p. 580)

However:

The truth of a text cannot be established by its verisimilitude. Verisimilitude can

always be challenged. Hence a text can be believed to be true even if it lacks verisimilitude. (The opposite case holds as well.) (Denzin & Lincoln, 1994, p. 580)

If my account of my teaching year at Arcadia High School is to have value, it must have verisimilitude. My readers will almost exclusively be teachers, and if the account of what schools and school life is like does not seem true or believable to them, then the account itself will be of very limited usefulness. But, as noted above, verisimilitude does not establish truth - only its semblance. Is that sufficient for my purposes? Perhaps it is.

This thesis is particularly open to challenge on the issue that Denzin and Lincoln (1994, pp. 577-578) identify as 'the crisis of representation'. This turns on questions of the ability and right of a researcher-author to represent the experiences, aspirations and lifeworlds of the Other in his or her text. Is it possible to do so meaningfully? If so, is it politically acceptable to take on the role of representing another to the world, an act which can have real consequences in the Other's life? Denzin and Lincoln (1994) suggest a variety of strategies that have been employed in attempting to address the crisis of representation. These include collaborative or participatory research, empowering Others to engage in their own inquiry into their practices, becoming coauthors and the creation of multivoiced texts. Although I have used some of these strategies in conducting this text - many of the direct quotes spoken by characters in the novel are taken from interviews and field notes with teachers in the school - yet the final product remains my story, told in my words, in my order and with my emphases.

The strategy I adopt for addressing this issue is, however, (relatively) simple: this is *my* story, and makes no claim to be anything else. The 'Carolyn' and 'Candace' in all parts of this thesis, both 'fictionalised' and 'factual', are characters built up from my impressions, my observations. I do not claim to be representing these teachers 'realistically', but to be selecting facets of my own experience with which to tell an educationally significant, experience-based story. Perhaps that is sufficient to free me

to some extent from the crisis of representation, but it lands me squarely in the middle of the crisis of legitimation!

This so-called crisis arose when anthropologists and other social scientists addressed the authority of the text. By *the authority of the text* we reference the claim any text makes to being accurate, true, and complete. Is a text, that is, faithful to the context and the individuals it is supposed to represent? Does the text have a right to assert that it is a report to the larger world that addresses not only the researcher's interests, but also the interests of those studied? (Denzin & Lincoln, 1994, p. 578, italics in original)

Denzin and Lincoln go on to suggest that the claims to authority of the text are based in its epistemological validity - the extent to which, within itself, a text claims to have fulfilled certain rules and procedures intended to guarantee validity. There are many such sets of rules (positivist, post-positivist, interpretivist, constructivist), each hotly contested and supported. In the end, however, such arguments must be circular, since a text is supplying the evidence for its own validity: that's a little like having a potential conman identify *himself* as a trustworthy individual! In the end:

Every text must be taken on its own terms. Furthermore, the desire to produce an authoritative (valid) text is renounced, for any text can be undone in terms of its internal structural logic. The unmasking of validity-as-authority now exposes the heart of the argument. If validity is gone, values and politics, not objective epistemology, govern science. (Denzin & Lincoln, 1994, p. 579)

As noted in Chapter Three, this teaching/learning/research project is explicitly value-driven: it is the story of my own, and my colleagues', attempts to more fully live our educational values in our practice. From a post-structural perspective, this is all there is: the value ascribed to my work by me and the community with which I wish to identify myself.

The answer to the crisis of legitimation for this text, then, has two parts. The first is to ensure that the text fulfils the rules for 'epistemological validity' within the grounds that I have chosen - a particular subset of the science education community. This is difficult, because this community finds itself in something of a state of epistemological flux at the moment, with a variety of (possibly incommensurable) rules and epistemologies competing for dominance. For my purposes, however, these requirements can essentially be reduced to those for verisimilitude: does it *seem* true and plausible? Assuming that I have not faked or doctored the interview transcripts and survey results (since readers have only the evidence of the text available), do they cohere well with the tales? Does the evidence provided address the research questions, and does it provide adequate, relevant grounds for the results reported? Are those results educationally significant?

The second part of the answer, though, lies in the utility of the text. In an earlier paper, Lather (1986) described 'catalytic validity' - the extent to which an account is empowering for a community of learners. This provides an excellent description for one of the purposes of this research project: the use of the impressionist tales as an occasion for reflection - a catalyst - by other science teachers. This criterion fits with Polkinghorne's (1992) 'postmodern epistemology of practice' and its movement 'from metaphors of correctness to those of utility' (p. 162). There are (at least) three potential audiences for whom this text ought to be of value if it is to fulfil its purpose. Firstly, the writing, reading and re-writing of the text must be valuable for me. It must allow me to experience myself as a 'living contradiction' (Whitehead, 1989), to reflect critically on my practice with the intention of improving it. Secondly, it must be valuable and useful for the examiners who will be its first readers (after Peter, my supervisor), both in allowing them to reflect on their own teaching and research practices, and in allowing them to evaluate my knowledge claims. Finally, it ought to be valuable to any other teacher who receives a copy, and reads either the entire thesis or 'School Stories'. This is not the only criterion by which this text should be judged and legitimated, but it is an important one.

Synthesis? - The Research Methods of This Study

A narrative methodology (Connelly and Clandinin, 1988, 1996), incorporating impressionist tales of the field (van Maanen, 1988), was chosen for the study because I felt that it was most able to capture the full richness, complexity and human quality of school life. I had long suspected that the reasons for the 'theory-practice gap' lay in the extent to which the prescriptions of the curriculum developers both failed to take into account the 'practical' complexity⁴ of the school context, and expressed the theoretical perspectives underlying the proposed innovation in 'researcher language', not 'teacher language'. Griffiths and Tann (1992) have suggested that teachers, through critical reflection and reading of research journals, can develop a vocabulary of 'researcher language' to complement their classroom experience, however I would suggest that research which is written in the language of teachers' classroom experience is much more likely to appear to them to be relevant, useful and applicable in their practice. Van Maanen notes:

Ironically, the ethnographer charged with being a novelist manqué by colleagues and other social scientists is quite likely to be the ethnographer with the largest number of readers. (Van Maanen, 1995, p. 11)

The key form of evidence used in the study is the collection of *impressionist tales* (van Maanen, 1988) that I wrote immediately after each 'critical incident' in my teaching or in the school. These consist of short narrative pieces in a variety of literary genres - journalistic reportage, reflective analyses, fictionalised incidents or pieces of fiction. They are intended to capture not only the incidents that occurred, but - by analogy with impressionist paintings - the feelings and ideas which these incidents aroused in me, and the ways in which they affected my construction and understanding of my teaching and my students' learning.

⁴ see the discussion under the third conjecture, in Chapter Five

Other evidence collected included transcripts of audio-taped conversations with four of the teachers (Appendix Three) and data from the Constructivist Learning Environment Survey (CLES) (Taylor, Fraser and Fisher, 1997) and the Beliefs About Science and School Science Questionnaire (BASSSQ) (Taylor & Aldridge, 1997) (Appendix Two). I am aware that these forms of evidence are epistemologically *different* from the tales - they bear a different relationship to the life in the school, and are less - or at least differently - mediated by my own perspective and biases. The words recorded by the cassette recorder as the teachers spoke have a different degree of verisimilitude compared to the words I put in the mouths of the characters in my tales, and the opinions recorded in survey responses are likewise different in kind from the views on the nature of science that I inferred from their classroom utterances and practices. This issue is addressed in more detail in the preceding section of this chapter and in Chapter Six.

The interviews were each conducted during December 1996, and ran for between 30 and 60 minutes. They were semi-structured, in that I had a list of questions but pursued various interesting topics as they arose, so that the final interviews are quite different. Each teacher was formally interviewed only once. I had taught in five classrooms throughout the year, however since one teacher left and another arrived part way through the year in one classroom, I chose not to interview that teacher.

The surveys and details of the way they were interpreted and when they were administered are given in Appendix Two. They were used heuristically as a means of exploring the epistemological and ontological perspectives of students and teachers as a complement to the impressionist tales, rather than psychometrically to statistically establish generalisable facts about the students and teachers.

The interview and survey data both supported and challenged the ways I had construed events, contexts and motives, leading to a deeper appreciation of the school context, and the constraints and freedoms of classroom teachers. The five conjectures (reported and

discussed in Chapter Six) that - together with the tales themselves - form the results of the research grew out of the process of living and working as a team teacher within the school. I do not mean this statement in a grounded theory (Strauss, 1990) sense - that perspective takes a much more *tabula rasa*, objectivist approach to the role of the researcher. It was David Geelan, with his own concerns, ideas and history, who taught, discussed, observed and collated the experiences that, together, provide the evidence for the conjectures. In that sense, this is not hypothesis testing but hypothesis generating research: it has not 'proved' its results, but has generated a number of intriguing conjectures, for which further confirming and disconfirming evidence will need to be marshalled, both in my own ongoing inquiry into and reflections on my teaching practice and by others who may take up these concerns for exploration in their own teaching.

The narratives were woven together with the other evidence to develop a richer variety of 'teacher stories' (Clandinin & Connelly, 1996). Much of the interest of the overall study was in the ways that the 'secret stories' told and lived by individual teachers contrasted with the 'sacred stories' (Clandinin & Connelly, 1996) on which the school was founded. For example, Andrea, one of the five teachers with whom I taught, was violent and verbally abusive towards students, in spite of the school's foundational ethic of caring. The ways in which the school administration and the school community dealt with this situation were illuminating of the conflicting value perspectives and value judgements made, and the tale of this teacher also helped me to reflect on my own propensities for aggression. Each tale on its own is powerful, and tells us something new, or affirms something we already knew, about life in schools. But it is the rich and complex braid made of a hundred individual stories and incidents that becomes a far more powerful tool for understanding school life.

Summary

This chapter outlines the types of information that have been gathered in the course of

the research, the reasons for choosing to gather those particular pieces of information, and the ways in which that which was collected has been represented. It also addresses issues of verisimilitude, representation and legitimation.

Section Two, which immediately follows this chapter, consists of the 'novel' entitled 'School Stories'.

The first two chapters in Section Three, Chapters Five and Six, present some of the results of the research project, and explore the tensions between the representation of the research that comprises the 'novel' in Section Two and the five 'conjectures' generated as a result of the research.

Section Two

School Stories

There are many ways to read a book. Good readers are perhaps as rare as good writers, and, authorial intentions aside, there is only so much a writer can tell. Reading is also a creative act and perhaps a far more creative act than we have to date recognised. Reading is the third moment of ethnography and it may be, dear reader, the determining one. Read on.

John Van Maanen, 1995, p. 26

Cast of Characters

The Teachers:

- ▶ Andrew Montgomery, principal of Arcadia High School - visionary for the school and its programs, but in this second year perhaps a little remote from the teachers' struggles.
- ▶ Fiona Johnson - team leader for Cowan. Fiona is having a number of problems, and having trouble leading a group that is full of leaders, and that doesn't share her personal style.
- ▶ Candace James, Cowan 1 - sympathetic with the vision for the school, reflective and talented - an exemplary teacher, but one who also requires lots of attention and affirmation. A good friend and ally to David.
- ▶ Emma Wallace, Cowan 2 early - excellent young teacher, leaves on maternity leave at the end of Term 1.
- ▶ Andrea King, Cowan 2 late - violent and abusive, because insecure and embattled, teacher who replaced Emma. Very intelligent and capable teacher, experienced in the most traditional of senior high schools, finds the transition from that educational style to Arcadia's middle schooling model difficult.
- ▶ Carolyn Young, Cowan 3 - bitter, not very secure, yet quite confident in her abilities and judgements. Does not want to be at the school, disappointed with David's approach and performance. Tends to treat students negatively, especially Tony.
- ▶ Alyx Nilssen, Cowan 4 - exemplary new teacher with some science background. Finds the demands of Arcadia daunting, but does a great and creative job.
- ▶ Robyn Black, Cowan 5 early - first year teacher, with a very tough group. Really struggles with class control, reminding David of himself at that stage. Leaves the school in the middle of the year in discouragement - teaching is not for her. Supported by her team, but had trouble learning from experience.
- ▶ Colin Chapman, Cowan 5 late - takes over from Robyn when she leaves. Very capable beginning teacher.
- ▶ Tanya Simpson, Cowan 6 - runs her science herself throughout the year, not really involved in the study.
- ▶ Etta Webster, Cowan 7 - Education support teacher who tries to integrate a class of very difficult students. Needs support in science that David can't give her.

The Students:

- ▶ Simon, Cowan 2 then 1 - was in Emma’s/Andrea’s class, but responded dramatically to Andrea’s abuse. Moved to Candace’s class and has responded extremely well to trust - now a top student.
- ▶ Therese, Cowan 3 - very bright, but a little cynical and a lot anti-science. Perceptive enough to see the conflicts between David and Carolyn, and clever enough to exploit them.
- ▶ Tony Case, Cowan 3 - teachers call him ‘hard’ or sometimes ‘nut’ in the staff room, and are scared they’ll say it to his face one day. Carolyn’s mistrust and negativity make him worse - David tries to trust him.
- ▶ Shannon, Cowan 4 - Alyx can’t figure out her ‘silent days’.
- ▶ Adrian, Cowan 1 - a very naughty boy, who Candace has chosen to trust with a simple job, and who has responded well.

The Academics:

- ▶ David - writer of the story, sometimes protagonist, rarely hero. Trying to merge teaching, learning and research.
- ▶ Peter - supervisor, friend and confidant of David. Involved in attempts to understand and change his own teaching and that of others, and in collaborative reflection.

Cowan 1 Candace Simon (late) Adrian	Concertina Door	Cowan 2 Emma (early) Andrea (late) Simon (early)	Cowan 3 Carolyn Tony Therese
Cowan 7 Etta	Cowan 6 Tanya	Cowan 5 Robyn (early) Colin (late)	Cowan 4 Alyx Shannon

Prologue: Farewells

You'll probably think I'm making a lot of this up just to make me sound better than I really am or smarter or even luckier but I'm not. Besides, a lot of the things that've happened to me in my life so far which I'll get to pretty soon'll make me sound evil or just plain dumb or the tragic victim of circumstances. Which I know doesn't exactly prove I'm telling the truth but if I wanted to make myself look better than I am or smarter or the master of my own fate so to speak I could. The fact is the truth is more interesting than anything I could make up and that's why I'm telling it in the first place.

Russell Banks, *Rule of the Bone*

“I will be your father figure, put your tiny hand in mine, I will be the one who loves you...” George Michael’s croon floats across the ice as the skaters glide in erratic circles. The wisps of steam rising from the ice and the way the skaters smoothly slide lend a touch of glamour to this tatty barn of a building in a suburban shopping centre. It’s a forty degree summer afternoon outside - that’s about 104 Fahrenheit - but cool and dim here by the ice.

I’m standing at the edge of the rink, chatting to Candace and watching our skating, laughing students.

“Did you hear I got that curriculum job?” she asks.

“No, I didn’t know - well done. When did you find out?”

“Andrew told me this morning - I’m not really s’posed to tell anyone yet. I really didn’t think I’d get it,” she says, “Everyone said James had it in his pocket and no-one else had a chance. But I thought ‘What have I got to lose?’, and put in an application.” I’m excited for her - she’s a friend and ally as well as a colleague, and it’s great that her talents are being recognised. She’ll do a great job for the school.

Candace is looking to me for some affirmation of her worth and ability. Below her expensively blonded hair, her warm brown eyes are surrounded by rays of fine laughter lines. Those eyes are such an accurate barometer of her moods - usually flashing with joy and intelligence, and an irreverent humour, occasionally sad, or questioning, as they are now. She’s a talented, capable teacher, but she seems to want to hear that, to require the approval of others. I’m pleased to let her know I think she’ll be great in her new role. Besides, I’ve been known to need some affirmation myself.

Every five minutes or so, a group of smiling teenagers slides to the wall to ask “Are you coming skating Mr Geelan?”

“I can’t guys - my leg’s still too weak. It’s almost there, but I don’t want to risk it...”

I broke my left leg roller-blading in February and spent the first half of the year on crutches and then limping in a cast. Although I only have a slight limp now, the kids accept this and skate off, yelling over their shoulders “See ya, then”.

I’m pleasantly surprised at how many, and which, students come to invite me

onto the ice - it's a nice feeling to discover that I'm more than the policeman I seem to have to be in our school encounters. The realisation that these students see me as a friend takes away some of the tiredness and depression that seem to be getting stronger as the year comes to an end.

I really don't know how these students see me. I wonder whether this is because I haven't listened to them, or because they haven't told me - or perhaps because we can never see ourselves clearly in the eyes of others; we look too avidly, and through the distorting lenses of how we see ourselves.

Andrea sits by herself at the side of the rink, her white crocheted cardigan wrapped tightly around her thin form. No students skate up to invite her onto the ice, and no teachers go to sit with her, although they nod politely as they pass. I go and sit with Andrea, talk to her and spend some time, and everything's pleasant, at least on the surface. But this attractive looking, slightly greying woman in her late forties is really not popular with teachers or students; she should never have been teaching at this school, as she would be the first to acknowledge, and the conflict of styles and aspirations made her caustic and dangerous. She was emotionally and physically violent toward the students, reacting out of her fear and disorientation, and the students reacted out of their own fear. There's a sense of relief - from Andrea as well as her students and colleagues - that she won't be in the school next year.

She, too, has just found out that she has a job, back in the type of school where she's comfortable, and she's looking forward to the future.

“Will you show the stories you write to the people they're about?” asks Peter, my doctoral supervisor, “Sort of like a ‘member check’, to make sure that you've represented them accurately?”

I laugh, and Peter looks at me questioningly. “Sorry,” I say, “but I can never hear that term without laughing. I saw a standup comedian once, talking about how men do the ‘pat check’ on their pants when they leave home - ‘back pocket - yep, wallet's there, front pocket - yep, keys are there, front of trousers - yep, genitals are

OK!' - so whenever someone talks about 'member checks'...." Peter grins, and I continue.

"I showed some of the stories to some of the teachers we worked with last year," I respond, "but in a way member checks is not the right metaphor for what I want the stories to do. The characters in my 'novel' are based on the actual teachers and students, but they're really not meant to be true and fair representations of particular people. So, for example, the character of 'Carolyn' is based on one teacher, but I've really taken some things she said and did, and compounded them with other things about teaching that I'd observed, and with my reactions. She probably carries a bit of simmering resentment I felt toward my own parents and teachers when they refused to trust me, too!"

"That's interesting," murmurs Peter, "because I can see someone like Ken Tobin saying that you'd been 'symbolically violent' toward that teacher by the way you represented her. How would you respond to that?"

"I guess by saying that the characters are not the people, and shouldn't be seen as representing them in a realist way. Certainly if the teacher Carolyn is based on ever reads this account, I hope she'd recognise some characteristics of herself, but there'd be other things where she'd say to me "that's not a fair picture of me", and I'd say "good, 'cos that bit's not you". I'll be able to make all that stuff - about the purposes for making the characters, and their relationships to real people - much more explicit for the reader in the second part of the thesis. But it needs to be clear in the first part too, because I imagine teachers - for whom it's partly being written - will only read this part, not the really academic, formal stuff in the second part."

"So it's really a matter of what significance you want readers to attach to their readings of your text," Peter comments. "You need to give them some pretty explicit signals, because I think people will tend to default to reading it as an attempt at realism. How will you do that in the book?"

"How about I include a discussion of these issues with the fictionalised 'Peter' in the prologue - something that breaks that realist mold from within?"

"Yeah, that might work," says Peter.

“So the character ‘Candace’, although she’s based on a particular teacher we both know pretty well, she’s *not* that teacher, nor even my best shot at representing her. Candace is a character with a role to play in making certain ideas and meanings clear. I’d argue that those meanings did come out of my experiences in the school, but that to simply expect a realist correspondence between a character and a real person misses what I’m trying to do. There are also a couple of characters who are entirely ‘fictional’, at least in the sense that I never met a person in this school on whom they’re directly based, but they convey things that I believe are true and important.”

“Why do that, though? Why not just tell the story as plainly as you can? It makes the problems of justifying your research in academia that much more difficult, doesn’t it?”

“Two reasons. One I suggested a moment ago: by selecting the incidents and ideas and words of the characters - and that’s something I have to do anyway, because I can’t fit every last second of every school day for a year into a single book - but by doing that purposefully, the ideas I’m trying to convey - my interpretive assertions if you like - come across more clearly in the text. By compounding two non-trusting teachers into one character, for example, the story becomes clearer and more manageable for the reader. The idea about the damage caused by lack of trust did arise in the school, but I can make it more explicit by telling the story a little differently. This is the sense in which novels can tell us true things about life and the world, perhaps better than non-fiction writing.”

“The second reason is for the protection of the teachers. I actually taught in two different teams, with several different teachers, but I’ve disguised their appearances, their characteristics, their locations and even where the school is, as part of my ethical responsibility to ensure that the teachers can’t be identified and receive any negative effects from the research. Since I’m being absolutely clear about the fact that no one character is a particular teacher, even if someone does know which school I was teaching in, they can’t bring consequences to bear on any

individual based on this book, because I'm stating that the correspondence is not direct. People are people, characters are characters - but the resemblance between them goes way beyond the 'purely coincidental' of the standard disclaimer."

Shannon circulates silently, arms around herself in the cold, sleeves pulled down over her hands. Her birth-mother was from Shanghai, her father from Scotland, and she's a striking looking girl, with beautiful Chinese features, in which her grey eyes are a sudden shock when she lifts them to yours. She doesn't meet anyone's eyes very often, but she gives Candace and I a shy smile as she passes, then looks away. Tony asks her to skate with him, and she politely refuses, then quickly leaves the floor and goes to sit with Alyx. They're talking quietly, heads together, and the other teachers deflect students before they reach Alyx, and quietly deal with their questions and requests.

Simon is moving around the ice twice as fast as anyone else, skilled and sure. A rink employee asks him to slow down, and I tense for the explosion, but he just smiles and slows down - a bit. The changes in Simon through this year have been astonishing, and our reflexes still haven't really adjusted: we tend to expect him to behave as he did in Term Two, but he confounds our expectations.

Carolyn and Tanya are chatting together, and tending to the occasional casualty. I've spent dozens of hours working with Carolyn this year, and have barely spoken to Tanya - I'm not really comfortable spending time with either, and I'm relieved that they're talking together. Carolyn - a few years younger than me, slim and pretty, hard-eyed - expected more of me than I was able to provide, but she also expected things that I had never intended to offer, nor ever had to give. Our personal styles and attitudes are so different that it was no doubt a mistake to concentrate my study in her classroom. But that's the way it grew up during the year, and perhaps it meant I learned more, as well as hurting more.

Later, driving home from the skating rink, I remember the people, events and emotions of Arcadia High School, 1996. No, that's not exactly it: the school has nine

hundred students and fifty five teachers, and many of them I don't even know by name. I taught in Cowan Team, and came to know seven teachers and perhaps a hundred and fifty students. What I remember on the drive home is *my* life in the school this year - my own experiences as a teacher, researcher and learner. These are my memories.....

On the first day...

I remembered something Antonella from Nintendo once told me about her job at a day-care center, about story-telling to kids - about how the stories the children liked best were the ones in which the characters fled their old planets amid great explosions, leaving everything behind them to start a new world.

And then I remembered this book-writing program my mom told me about from someone in her library. The big deal in book writing is to quickly establish at the very beginning what it is that the characters want.

But I think that the books I really enjoy are the ones in which the characters realize, only in the end, what it was that they secretly wanted all along, but never even knew. And maybe this is what life is really like.

Douglas Coupland, *Microserfs*

A story is a selection. A fictional story is a selection of characters, events and situations, created by an author to embody an idea. A factual story is a selection, from the incredible complexity of life, of characters, events and situations, created by an author to try to capture something true about the people or places portrayed. In this postmodern world, I don't want to claim that I can capture the Truth about my experiences at Arcadia, but I want to assert that the story I'm telling you - the selection I've made - conveys something of the truth of my life at Arcadia High School during 1996.

Pulling into the school car park on the first day of school - for teachers, not students - my heart is pounding and I'm nervous. I'm not sure why - I spent hours at this school last year, I know the principal and the deputies and many of the teachers. I guess it's partly the pressure of expectations. What I do in this school, this year, will form the heart of my PhD research. If I blow it, at the very least it will mean another year or more before I complete the doctorate. At worst, it could mean I miss out completely. That's not the whole story though - I'm also quite shy when meeting strangers, and with the student population of the school growing from six hundred to over nine hundred in this, its second year of operation, the teaching staff will increase from the thirty five teachers I already know to more than fifty. No doubt these new teachers will be friendly, but I'm still a little shy.

The other reason for my nervousness is that I really don't feel prepared. Any time I'm teaching or presenting, and I'm fully prepared, I'm calm and comfortable; but if I don't feel ready, I get nervous. I'd hoped to have the shape of my days at Arcadia laid out in much more detail by now, so that I'd know what was required of me, and be able to plan my other commitments around that program. But, in keeping with my own values and those of the school, I can't impose a program on the teachers I'll be working with - I need to negotiate it with them. Because several of them are new too, and their own programs are still crystallising, it will be well into the first week before I really have an understanding of what I'll be doing in the

school, and it will turn out to be quite different from what I'd imagined.

I'm gaining a taste for the Basil Fawlty view of education - schools are such lovely places without students! Arcadia, like most new schools in Australia, is a symphony

actually, to my taste more like a cacophony

of red clay bricks and white clay bricks and concrete footpaths. The school's lawns still show the worn tracks where a thousand student feet dragged to class last year, and the midsummer sun, in a sky so pale blue it's almost arctic, reflects dazzlingly off the broad green sheets of transparent sheeting that interrupt the brilliant white of the painted steel roof. Today is Wednesday, and the school seems empty, silent and clean with only the teachers moving quietly around the classrooms. They dress for comfort, not for the illusion of professionalism, and listen to the music they enjoy - the teachers feel much more free to be themselves, and tend to use a lot of the words they'll have to give students detention for using during the rest of the year. Next Monday, nine hundred and thirty-three students, aged from about twelve to fifteen, will descend on the school, and it will be filled with hand-ball games, screeches and yells, running feet and litter. But for today, the teachers enjoy the quiet and one another's company.

Arcadia High School opened last year. It's in the rapidly growing western corridor of an Australian capital city, and was opened because the local primary and secondary schools were groaning at the seams. Although Arcadia is in the west, the people of the surrounding suburbs are not the stereotypical 'Westies' found in lots of Australian cities - black stretch jeans, heavy metal T-shirts with a packet of Winfield Red cigarettes in the sleeve, blue flannelette shirts. There are a few, but there are also some very wealthy students who wouldn't be out of place in one of the city's prestigious and expensive private schools. This area used to be an industrial suburb, with government housing projects. Lately, however, the swamps have been landscaped into lakes, the streets have been re-named after waterbirds and yachts,

and the old fields sub-divided into expensive housing estates. As is happening in all Australian cities, suburbs that used to be considered too far away from the city are now prime commuter territory, and the face of these suburbs is changing to reflect the new realities.

The student population at Arcadia, which was originally designed for four hundred and fifty students, was six hundred in the first year, and has risen to nine hundred in this second year. Demountable classrooms have appeared on concrete blocks in the playground, and students are lucky if they can fit in an hour a week in a science lab. The library will only accommodate one of the school's thirty classes at a time. Stage two of the building project is under way, adding to the confusion, but the new labs won't be ready until at least next year, and the 'temporary' classrooms look like becoming a permanent feature of the landscape.

When the need for a new school in the area became glaringly obvious, the state education department decided to try something a little different with the new school. In the state where Arcadia High School was built, Year Seven is the final year of primary school, and Year Eight the first year of secondary school. The change in culture and approach between the two levels of schooling is quite dramatic: in primary school, students spend their day largely with one teacher, in one classroom, while in secondary school they may have up to six different teachers and move to a new room for each subject. Primary schools are generally smaller, around three hundred students, while suburban secondary schools can have up to two thousand.

'They' decided

The ubiquitous and occasionally iniquitous 'they', as in 'they oughta do something about...'

that Arcadia would be a middle school, combining Year Seven and Eight in the one school. They felt that this would help to relieve stresses on the local primary and secondary schools, but more importantly, hoped it would ease the transition for students, and encourage them to take ownership and control of their own learning;

to become, in the currently fashionable phrase, life long learners.

The foundation principal, Andrew Montgomery, formed a consultative committee that included my supervisor, Peter Taylor, and a number of other educators from schools and universities throughout the state. The committee looked at a number of different potential educational and structural models for the school. As a result of this process, the program developed was similar to that in Australian primary schools - students had a home room and a home room teacher, who taught them all learning areas (subjects) except arts, technology, sport and Languages Other Than English (LOTE). Andrew felt that this structure would support students in developing transferable learning skills as well as a high level of literacy. Other innovations introduced to support this approach included portfolio assessment - intended to de-emphasise grades as a motivator and to value work the students did outside exam conditions - and teacher collaborative planning, intended to support teachers in providing a genuinely integrated curriculum.

I originally imagined that I would be teaching in classrooms where I was the sole teacher, giving the class teachers some much-needed release time to prepare their other lessons, and clearing the decks for me to negotiate the learning practices, and the teaching and learning roles and expectations of the classroom, with the students. As the program evolved, however, this turned out to be impossible: Andrew and Fiona - the team leader in Cowan, where I'll be working - felt it would be unfair if some teachers had this extra release time and others didn't, so it transpired that I'll be team teaching rather than teaching alone.

This will change the nature and focus of the study, because I won't have a free hand to negotiate with students, but will have to negotiate with the teachers as well. The power relations for the students are completely different, and much more complex. I think it'll make for a much richer and more interesting study, but it also makes some of the ethical dilemmas more tricky, and I think my life in the school will be far more complicated than it would otherwise have been.

The shape of my weeks seems to have crystallised: I'll be at Arcadia, which is about a half hour drive from both my home and the university, on Monday mornings for the Cowan Team collaborative planning session, and all day Wednesday and Friday team teaching with five of the seven teachers in Cowan. I have teaching commitments at Curtin on Monday afternoons during first semester - this means I will be spending two and a half days in the school each week. Wednesday morning will be spent with Candace and Emma's classes - they're in adjacent rooms with a concertina door between them, which gives us a lot of flexibility: we'll have three teachers for a group of about sixty kids, and only one laboratory, so some groups will work in the classroom while others work in the lab, and we'll be able to mix and match the classes depending on the activities we plan.

I've worked with both Emma and Candace during professional development courses last year, and I like them a lot. I think we'll be able to do some exciting things.

Carolyn is a new teacher in the school this year. She's a very capable teacher of upper secondary school English, but she really didn't want to come to Arcadia: it was just the job she got, of the ones she applied for, and was close enough to home. Carolyn is very nervous about teaching science - she has no science background, and really hated even the small amount of science she studied at school. I'll be spending most of my time in the school with Carolyn's class which, at twenty two students, is smaller than most in the school. Every Wednesday and Friday afternoon I will be team teaching with Carolyn in her room. Hopefully this won't all be science time - that would be a bit of an over-load for a Year Eight class. I'm really looking forward to doing some interesting integrated curriculum stuff that uses science to explore the various themes raised in the collaboratively planned modules the team comes up with this year.

On Friday morning I'll spend about an hour with Alyx's class and about an hour with Robyn's. Both of them are new teachers in the school for 1996 too, so it will be interesting to see how these classes develop. Since neither of them is

confident in the science lab, that hour on Friday will probably usually be spent there, with my support.

Peter Taylor is my doctoral supervisor. He's about 15 years older than me, and has been at Curtin for about 10 years, but he treats me as an equal and a colleague rather than as a student. Part of this, I'm sure, is a result of his personal style and his commitments to equity, and part of it to my own assertive attitude and willingness to construct myself as a colleague. We've conducted inquiries into our own teaching practice together in the course of my candidacy - last year Peter taught a course for teachers at Arcadia, and I sat in as a 'critical friend' to help him reflect on his own teaching in order to improve it. In the second semester I taught a course to another group of Arcadia teachers, and we discussed my impressionist tales about my teaching experiences.

The study this year will continue this teaching-learning-research process, and Peter will continue to be an integral part of what I do. At least once each week, and frequently more often than that, Peter and I will sit down in his office, ostensibly to discuss my research in his role as supervisor and mine as student. Based on last year's experience, though, the discussions will usually be far more wide-ranging: we'll discuss our own teaching and learning activities, some other teacher education activities that we're collaborating on, papers we're writing together and want to write, and our theoretical and spiritual views and ideas.

Increasingly, Peter is also willing to discuss his personal life and his family - it was over a year into our relationship before I knew his wife's name, because he has always preferred to keep his personal and academic lives very separate. He's coming to realise, though, that what we do as educators comes out of who we are, and if we are to discuss our understandings fruitfully, we need to be there as people, not just as academics.

For both Peter and I, our families are the keys to how we define ourselves - our academic work is our job, but our family is our life. We ruefully agree that we

probably won't scale the heights of our professions, simply because the family will continue to come first, and we won't work the 60 or 70 hour weeks that real productivity seems to require.

"I can already see two potential problem areas," I say to Peter one morning in his office. "The Cowan Team planning meetings so far have been very frustrating, and I'm not sure whether the way my program has turned out is really going to work for the research project."

"What's the problem with the planning meetings?" asks Peter. "Fiona seemed like she'd be pretty capable as a team leader, based on how she went in our class last year."

"Well, so far there's been almost no actual collaborative curriculum planning. There's about two and a half hours available for the meeting, and that seems to just be taken up with a whole lot of 'house-keeping' details and staff meeting type stuff. There's really not much I can contribute to that, and it doesn't help much with my teaching either, 'cos most of it isn't classroom focussed."

"Do you think that will change once the term gets under way a bit more?"

I think for a minute, then reply, "I really don't think so, but I need to talk to Fiona. It could just be that it's because she's not experienced as a team leader. I think the teachers are getting frustrated too. They were looking at the planning meetings as a chance to work on their curricular stuff - most of them are finding integration pretty daunting - and if it's not gonna do that, I think they'd rather plan individually."

"It doesn't sound like it's a very efficient use of your time at the moment," suggests Peter, "might it be better to skip that and use the time for something else - either to write your cases or in helping the teachers plan?"

"Yeah, maybe it would. If I did that, I'd need to talk to Andrew, 'cos I sort of committed myself to spend two and a half days in the school each week. If I change it at this early stage, he might see it as down-grading my commitment to the

school.”

“Yes, I think it’s important that you be aware of some of the political things surrounding the research, and keeping the principal on side is certainly something you’ll want to do.” Peter pauses - “What did you say about your program?”

“The way it’s turned out, I’m team teaching with five different teachers and their classes in Cowan Team. It seems like the main thing they’re looking for support in is lab activities, so I could be spending a lot of my time in the science labs. If that’s the case, how easy is it gonna be to do the things I’m interested in, like integrated curriculum and negotiation of roles and practices with the students?”

“Yeah, I see what you mean... Do you think this is something you need to address with Andrew or Fiona?”

“No, I think I’ll let it ride for a bit and see what develops,” I say, with some reservation, “I think with both these problems it’s really too early to intervene at this stage - I need to watch and see what happens, and how the teachers themselves want to set up the teaching.”

On a sunny Sunday afternoon in mid-February, in Federation Park, overlooking the city, I’m enjoying Sue’s company. Our daughters - Cassandra is five and Alexandra is two - are racing around the bike paths between the trees. Down in the city it’s a hot, sticky day, but here on the top of the hill there’s a cool breeze and a bit of shade. A golden retriever gallops past, tongue flapping in an excited grin as she chases a ball, and I grin a little myself and lie back against Sue’s thigh as she sits on the rug.

I’ve been teaching at Arcadia for a fortnight, as well as continuing with my academic work at Curtin University - writing papers for publication, reading the relevant literature, preparing for conferences, teaching postgraduate distance education students - and it’s nice to just slow down and enjoy the sun and air for an afternoon.

I got some roller-blades for Christmas - a pretty hip gift for a 31 year old - and I’ve been slowly getting better at using them. After spending an hour or so

teaching Alex to ride her bike, it's time to take a few turns around the park on my skates. I'm really starting to get into a smooth glide, even with the cracked concrete of the path, and the gumnuts that form a minor obstacle course.

I'm cruising along when I see a child standing on the side of the path, his feet on the edge of the concrete. No problem - I just head for the other side of the path. But then another small child on a pink bike with trainer wheels comes down the path in the opposite direction, and also has to swerve to miss this kid on the side of the path. I swerve even further to miss the second child, and one of my skates goes off the concrete and into the grass. It immediately slows down dramatically (yep, I know all the physics for this stuff, but it didn't help!), twisting my ankle. I fall awkwardly, still trying to avoid landing on the child, and my whole body weight lands on top of the twisted left leg.

I know immediately that it's broken. I had never broken any bones as a child, but 10 years ago I had a major motorcycle accident that I was lucky to escape from alive, and broke this same part of my lower left leg. So I know what a broken leg feels like, and this is it. The kid who caused it all is standing by the side of the path laughing, and I'm swearing ferociously at him under my breath. But basically I just lie there, and wait until people start to gather. I tell them the leg is broken, and they straighten it gently - it's still pretty numb, but the pain is starting to break through. They ask if we have ambulance insurance, and we don't, but we do have a big Ford station wagon, so some kind people roll me onto a blanket as a makeshift stretcher and carry me to the car. A kind couple bring our children down to the nearby Victoria Hospital, as I'm taken to the Accident and Emergency section and admitted.

The doctors gently remove the ungainly roller-blade boot from the leg, and send me to X-ray. Apparently I have a major spiral fracture of the tibia (below the old break, which had a thick callus and several screws still in it from last time), and a cracked fibula. They give me a cocktail of painkillers and Valium and set the leg, wrap it in plaster and that's that.

The leg healed very slowly: I was on crutches with a heavy, itchy full-leg cast for three months, and then with a half-leg walking cast for another two and a half months. My appointments with my specialist were always on Wednesday mornings - one of the days I should have been in Carolyn's classroom. Who knows how differently the year would have shaped up if that rotten kid had stood a foot further back?

Teachers

I am a man, and men are animals who tell stories. This is a gift from God, who spoke our species into being, but left the end of our story untold. That mystery is troubling to us. How could it be otherwise? Without the final part, we think, how are we to make sense of all that went before; which is to say, our lives?

So we make stories of our own, in fevered and envious imitation of our Maker, hoping that we'll tell, by chance, what God left untold. And finishing our tale, come to understand why we were born.

Clive Barker, *Sacrament*

All my schooling, from kindergarten to the end of my first degree, was in Seventh-day Adventist schools in a small town in New South Wales, called Cooranbong. I was one of those students who was very bright but very lazy - at least, that's how just about every report card I ever got described me. I've always preferred to think of myself as unmotivated - it sounds nicer, and perhaps also helps put some of the blame for my lack of motivation on my teachers! I worked reasonably hard in science, and coasted in the other subjects, usually writing my English and Geography essays the night before they were due, and usually receiving grades that were adequate, but not spectacular. I'm sure I frustrated the hell out of my teachers; they were caring, professional people, and they'd seen the scores on my intelligence and aptitude tests, and the work I did when I actually got motivated. They knew I could do better.

But I had a bicycle, and later a trail bike, and Cooranbong nestles at the base of a row of gum tree covered blue hills with plenty of fire trails and tracks to explore, and I had a best mate whose grandparents owned a farm and... There were just so many more interesting things to do than study, and I knew I'd get the grades I needed anyway - why exert any more effort? In my adolescent opinion, this was the ultimate evidence of intelligence: exerting no more than the appropriate effort to meet the goal.

I also loved to read - science fiction and horror novels mostly, but pretty much anything I could get my hands on, including encyclopaedias and the Readers' Digest in times of desperation. I read at least two or three books every week from about the age of fourteen, and although this gave me a love of prose that has probably resulted in this story being written the way it is, it really didn't contribute a lot to my studies.

besides, most of what I was reading would have been frowned on by the school.

Two teachers had a huge influence on me. My chemistry and physics teacher for Years Eleven and Twelve at Avondale Seventh-day Adventist High School was Dr Eric Knightsbridge. After a quite distinguished career as a tertiary lecturer in

chemistry, Dr Knightsbridge had returned to the secondary school classroom because he just loved to teach. He had an immensely broad knowledge of science, a real and evident love for it, and a fund of anecdotes from 'real science' with which to illustrate his lessons. I had a great affection for him, and was doubly mortified when, after tolerating the sight of me reading a novel under the desk at the back of the room for a couple of weeks, he bawled me out at considerable length with his face glowing an apoplectic red. I never read in his class again, and probably learned a lot more than my effort really deserved.

Pastor Edward Reed was my teacher for Bible and English. Although I loved language, his English lessons were so dull that I slept through a third of them. It's only now that I really appreciate the fact that his chosen poetry texts were Coleridge and T.S. Eliot - both poets whose work I still love.

even if he claimed that there couldn't possibly be any sexual connotations in Kublai Khan!

Pastor Reed also chose not to toss me unceremoniously out of school when I became very publicly paralytic on cheap port outside a church function, one stupid evening in Year Twelve. Seventh-day Adventists abstain completely from alcohol, which made the offence doubly heinous, but he treated me in ways that were redemptive instead of punitive, and pulled me back closer to the school and to God, rather than pushing me away. Both of these fine teachers deserved better than I gave, but both of them have influenced me in my own teaching.

Of course, I was also a bit fuzzy about what the goals of my learning were. I liked science, and did well at it, and thought I'd do something in that line. I was the kind of pyromaniac kid who made pipe bombs and needed the hand of God over me daily to ensure I survived to adulthood. This inclined me toward chemistry

hey, chemists have whole bottles of sodium!

as a career, so after receiving a Higher School Certificate score that was adequate to gain me a place in any university in Australia

but still not too distinguished

I applied to the University of Newcastle for a place in their Bachelor of Science

program, and was accepted.

Two weeks before I was due to start, however, a combination of dreading the long train journey from Cooranbong to Newcastle, some parental pressure and other factors I can't quite recall now, meant that I decided I'd try Avondale College, the Seventh-day Adventist teachers' college in my home town, for a year first, then go to Newcastle and do chemistry. After that first year I took two years off to work as a trainee anaesthetic technician, kitchen hand and builder's labourer, then re-applied to Newcastle, was accepted, and again ended up at Avondale.

I think perhaps God had a hand in all this - I was gonna be a teacher whether that was what I planned or not!

I finished my Bachelor of Education (Chemistry) degree in 1988. I'd met Sue in my first year back at college, and we were married at the end of 1987. Under her influence, I actually started applying myself to my studies, and completed the last two years of the degree with distinction. The church offered a teaching job in Lilydale, outside Melbourne, and in 1989 I became a teacher.

"I'm really not sure what I can do with Shannon." Alyx is sitting in the Cowan staff room, hands wrapped around a mug of coffee. She looks puzzled and a bit depressed, as she talks about quiet, grey-eyed Shannon. Alyx herself has the brightest blue eyes I've ever seen, and they're usually sparkling with laughter, but today she's looking worried, and her high forehead is creased down the centre. She's a beautiful woman who thinks she's too fat and isn't, and spends a lot of her time at the gym when she's not at school.

"Some days she's really involved in what's going on, wants to answer the questions, full of ideas. Other days she's really quiet, puts her head down on the desk, doesn't want to be involved at all. I'm not sure what I can do."

"Is it something to do with the topic?" I ask. "Maybe she just likes some of the modules more than others."

"No, it's not that - I've been watching her for a while, and the pattern doesn't

seem to have anything to do with what we're doing in class. I really try not to be sarcastic or anything, but maybe she's getting some signal from me when I'm not in the best of moods - she's very sensitive to how people are feeling."

"Maybe there's something going on with the other girls in the class... Robyn's having trouble with Angie and Mel."

"Nah, I don't think it's that either," Alyx says, after considering for a full ten seconds, "Shannon seems to keep to herself pretty much. I never see her with anyone in the playground, do you?"

"I'm usually inside preparing or talking to someone," I admit ruefully, "I don't get out much at lunch time to see what goes on..."

"I guess I just need to keep watching her and see what develops," Alyx sighs, and goes back to looking into her coffee cup as I blow on my reddened palms and labouriously lever my crutches under me and swing out the door and away.

Andrew's office, on a sweltering Wednesday afternoon in March. I've just finished a lesson with Carolyn's class where we made rockets using plastic soft drink bottles, a rubber stopper and a bicycle pump. The kids were delighted, and water went everywhere - my shoes are soaked. Some of them may even have learned something about pressure and rocketry: we had a good time.

I'm here to talk with Andrew and 'debrief' a little bit about how my research in the school is progressing. This is partly a formal requirement - he wants to be sure about what's happening in the classrooms, for the students - and partly a friendly visit: Andrew sat in on a number of the professional development sessions I was involved in running last year. He is working on a Master of Science (Science Education) degree through Curtin, and the way the school's program has developed has been strongly influenced by Andrew's constructivist commitments. Andrew is ten years older than me, and looks five, although his year planning for Arcadia and then running it last year occasionally make him look haggard for a moment, before his energy and charisma switch on again and he's away. He's one of those tall,

pleasantly ugly sort of men - he played basketball at the state level as an eighteen year old and still coaches a local team - who seem like perpetual adolescents in some indefinable way, even in their forties.

Somehow, we get onto the topic of how new teachers to the school this year are to be inducted into the new middle school culture he intends to foster. Last year, the beginning group of thirty five teachers - some primary and some secondary trained - worked and struggled together toward developing a new culture and approach. Although Andrew and his deputies paid quite a bit of explicit attention to this process, it was still by no means smooth: at one stage in May I thought the whole middle school approach was about to self-destruct. Teachers were stressed and frustrated, and were tending to withdraw back into the 'comfort zone' of doing things as they always had: into ways of teaching they knew they could handle competently.

The school weathered those challenges - committed, talented teachers worked collaboratively to develop new strategies and approaches. In the middle of the year, many teachers I spoke to felt that the experiment was doomed to fail: although the school might be more 'warm and fuzzy' for students, it was not adequately preparing them for their later education. Toward the end of last year, though, those same teachers were incredibly positive about and excited by the potential to teach in ways that they realised were more appropriate for adolescent learners. They also believed that this type of teaching and learning activity *was* preparing students for the Year Twelve external examinations, and university or employment.

"We did really try to make sure that we paid attention to the new teachers," says Andrew. "We're very aware that we've got sixteen new people who didn't go through that process last year, and they'll be going through it this year. They'll have extra problems - last year we were all going through it together, and there was a real empathy for the challenges people were feeling. But they'll also have the advantage of seeing it working - all around them in other classrooms they should be able to see teachers and students working together in a middle school way..."

“Yeah,” I offer, “and you did do the two day induction program for the new teachers in the week before school started. I went to that too. I think it was good, but the sheer weight of information was huge - a whole folder full of stuff that people needed to know, or at least be aware of. There was so much of that to do - and I realise it’s important and necessary - that there was really no time dedicated to looking at ‘Arcadia culture’, and the practicalities of how to be a middle school teacher.”

“Hmm,” Andrew pauses, then continues. “I realised that at the time, but we sort of felt that it’s not something you can really tell someone, you know? They probably have to try things in their own teaching, and they’ll get support from other people in their team. Also, we did talk about some of that stuff in the original selection process for staff, when they were first employed here.”

I muse, “It’ll be really interesting to see whether the new teachers to Arcadia - I’m working with Robyn, Carolyn and Alyx - do actually go over that ‘hump’ at about May that we noticed last year. That was really clear in just talking to teachers - they felt as though that was the time they really decided that they weren’t gonna roll back down the hill the way they came, they were gonna go forward beyond it to a new way of thinking about teaching and learning. ‘Cos I think that’s what it really is - the strategies and techniques and approaches are important, and teachers need them so they can survive, but what underlies all that is a constructivist attitude toward knowledge and learning, and if they miss that, they miss everything.”

“Yeah, we’ll just have to wait and see what happens, and try to support them as they go along....”

“I can’t work like this - I’ll have to go next door and do something.” Candace would really prefer to just let Robyn handle things in her own way, but the noise from the classroom next door sounds like a full-blown riot, and Candace’s quiet voice is just failing to carry to the back of the room.

Robyn is new, not only to Arcadia, but to teaching. At 46, she has worked

as a secretary for many years, before going back to school, when her children were old enough, to re-train as a teacher. She is talented, idealistic and has a great breadth of experience - the lessons she prepares are engaging and interactive, and she's shaping up as a very capable teacher. She has one fatal flaw - she lacks the self-confidence to assert her will in the classroom. If she was teaching Carolyn's class, this would be a minor difficulty - that group has only one really difficult student, and he is surly and sulky in a quiet way, not disruptive. But some strange quirk of the class allocation process means that Robyn has four very difficult boys - two of them will be suspended in the course of the year - and a group of girls who continually fall into extremely vocal feuding. Robyn understands all the theory about what she should do in a situation like this, but when it comes to actually addressing the problems, she tends to revert to yelling threats from behind the barricade of her desk, while the riot goes on unabated around her.

Andrew and Fiona have both tried a variety of strategies to help Robyn regain control of the group - they've withdrawn the worst troublemakers, sat at the back of the room, helped her develop charts and rewards and strategies. The bottom line, though, is that if Robyn is to succeed as a teacher it has to be with this group, and it has to be her.

Candace walks into the room, and in her best sergeant-major voice (which she keeps for these special occasions, and only very rarely needs with her own class), gets them quiet and sitting in their desks. She apologises quietly to Robyn for coming in, and walks back to her own room. The noise begins to swell again almost immediately.

Violence and Love

I wanted to explain things to myself - to see if I could slice through to the truth with that old, old weapon, the battered old sword of story telling

Peter Straub, *The Throat*

“Can you look after my class for a minute, I have to go next door. She slapped Simon in the face in front of the class yesterday, and she’s with the admin.” Andrea, in the room next door to my friend Candace, has hit students before, in one case with a book. I hope this latest and most public transgression will lead to some sort of solution: personally, I favour tossing Andrea unceremoniously out of the school.

And of course I forget the mercy that was shown to me as a student when I should have been tossed out - right now I’m on the high moral ground

Arcadia has been founded on a number of key ethical commitments: one of these is mutual respect and caring between students and teachers. I can’t understand how Andrea possibly convinced the school’s selection committee that she was the kind of teacher this school is looking for: she must have been a convincing liar. Not only is she violent and verbally abusive toward students, she has no image of, and doesn’t value, collaborative planning approaches, the attitude of respect toward students or any of the other key commitments on which the entire school program is based. And she’s a rotten teacher: unwilling to prepare, unable to extemporise.

It’s just so sad: my good friend Emma began the year with this class. They were fractious, full of energy and a bit rebellious. Through a brilliant combination of firmness and respect, by the end of first term Emma had the class cooperative, engaged and enjoying their learning. Her approach was grounded in the language of rights and responsibilities, and in a deep respect for the students’ opinions, ideas and choices. The change was remarkable, and I looked forward to my weekly time with the class. Then, at the end of Term One, Emma left on maternity leave.

Within days of Andrea’s arrival, the class reverted to their earlier state, and beyond. They became - with good reason - cynical, suspicious, sneaky and mean. Tape appeared on the edges of their desks, delimiting their personal space and daring others to cross it. Graffiti began to appear.

Perhaps the saddest thing for me is the way that my own teaching with the group is changing, against my will. While Emma was teaching the class, I could operate in similar ways: placing the responsibility for the students’ behaviour and learning squarely on them, respecting their choices, and applying appropriate

consequences for disruption, but plenty of praise for good learning. The students responded well to this regime: even if they chose to misbehave, it was a conscious choice, and they responded well to correction. But under Andrea, I find that my own approach has to become more authoritarian: after a week of being bullied, attempts to allow them to take responsibility for their learning result in chaos.

Weeks later, Andrea is still teaching at the school: the mills of the gods grind slowly. But do they, as the proverb goes, grind exceedingly fine? How can the situation be allowed to go on and on, when it's just so directly opposite to the values the school espouses? It's hard to understand the apparent lack of action from Andrew: if the school administration has done anything about Andrea's actions, it hasn't been reported back to her colleagues in Cowan team, and that gnaws at their morale. We'll see what happens as the year progresses - I wish something dramatic would, just to make the situation tolerable.

One thing, at least, has happened - Simon, the student Andrea slapped, has moved over into Candace's class for the remainder of the year. I think everyone realised that the conflict of personalities was extreme, and that Simon's reaction to Andrea's bullying would continue to land him in trouble. It just wasn't fair - Simon is very bright, and quite mature for his age. He's also very strong-willed: he knows his rights and will stand up for them. But he's not a wilfully disobedient or disruptive kid.

The dilemma, for me, is how to support all my colleagues, and the students. How do I support Candace, without having our entire conversations be about Andrea: there are other things we need to talk about, for the students' sake and our own. Can I support Andrea in attempting to change her attitudes and behaviour? Must I continue to be civil to her in the staffroom, while something within me cries "Abuser!?" Should I provide my own curriculum resources to her? I don't want to: she ought to be doing her own planning work. But I want to support the students, too.

What is the most professional, and the most ethical,

The two don't always coincide, although perhaps they should

line to take with the students?

I can't condone her behaviour, but I shouldn't undermine a colleague. I have to acknowledge the students' anger and frustration, but I can't condone their subversion of her. I don't know what the right thing for *me* to do is, given that I don't have the power to do the things I think would really help...

Jesus said "There are only two rules: Love God, and love each other." Sounds simple, doesn't it, but I find it impossible. It's easy to love Sue - she's beautiful, she loves me, we share our whole lives.

Well, it's easy most of the time, but when we're busy, and I'm tired and stressed, and she's being unreasonable... And besides, loving her fully doesn't only mean flowers when I come home and phone calls from work and boxes of chocolate. It means stubbing my toe and cursing naked in the night as I get up to the children for the third time, it means scraping the greasy dishes and emptying the bin and cleaning the toilet and not buying the CDs I want. I fail to love her as fully as I want to, almost every day.

And she's easy to love. But Jesus wasn't just talking about Sue - he was talking about Andrea too. I can't even start loving her - liking her is a tough enough proposition.

But that's what God is for. God is an infinite reservoir of love, just waiting there. When I have the guts and the mind and most of all the heart to remember, I don't have to love Andrea myself. I can let God's love for her flow through me to her. In the end, it all comes down to Jesus' two easy

impossible

rules, and to keeping my heart open. But sometimes even that's more than I can manage...

“I hadn’t thought there’d really be any major dissonance between what I was trying to do - you know, integrated curriculum, student centred learning and negotiation - and what the rest of the teachers at Arcadia were doing.”

In Peter’s office, Thursday morning, we’re reflecting - or at least, I’m reflecting, and he’s listening - on my expectations of the school, and some of the frustrations I’m already starting to feel with the progress of my research.

“I expected a fair bit of freedom in developing curricula for my classes. Listening to the discussion within the school last year, I expected the curriculum to be much more fully integrated than it is: the various learning areas inform one another more than they would in a traditional high school, but there are still separate sections of the day dedicated to particular disciplines in many classes. You know, it’s like ‘Put away your maths books now, it’s time for science’.”

“Why is that, do you think?” asks Peter. “Is it because of constraints on the timetable, or demands from the Education Department? Or is it the hegemony of the technical rationality reasserting itself?”

“I think one reason there’s not much integration of science with other subject areas is that Fred Simmons, the Head of Department for science, has a really strong content-based view about what’s important in junior secondary science. He’s had years of experience in traditional science teaching, and he talks about ‘non-negotiables’. These are supposed to be the things students need for upper secondary science, and he defines them in terms of particular facts and pieces of ‘content’, rather than skills and attitudes. Because these content lumps are usually pretty scientific and abstract, it’s almost impossible to integrate them with the particular module the students are studying.”

Peter listens and nods. “What will that mean for your teaching, and your work with the team and the other teachers?”

“My role in the school becomes ethically problematic: I want to improve students’ learning opportunities, and I think one important facet of that has to be discarding most of this ‘non-negotiable’ stuff. I mean, really (1) students don’t retain

it anyway, and we re-teach it in upper school, (2) it wrecks their positive attitudes toward science, (3) it gives them a very positivistic model of what science 'is'...do I have to go on? I'd far prefer to concentrate on the integrated modules, and draw in scientific ideas and ways of working and experiences when they're relevant and when they'll fit neatly."

"Can you go ahead and do that? Surely you've got a fair bit of autonomy within the five classrooms, and even in the whole team?"

"Yeah, I guess I can do some of it, although not as much as I'd like to. I guess I feel like I'm a guest in the school, and it wouldn't be appropriate or fair for me to attack Fred's approach or subvert it. I need to continue a dialogue with him and try to broaden his approach, but my own teaching will still be constrained by his influence."

"That is a bit frustrating," agrees Peter. "How will that impact on your research? Does it make it impossible to do what you wanted to do?"

"No, not really - well, maybe. But I think it can also be seen as a positive thing. If one important 'use' of this study is to explore what it means and how it feels for a teacher to innovate in the classroom, to improve students' learning opportunities, then it's realistic that there be some constraints and opposition. The interest comes in trying to develop ethical, effective, creative solutions."

Carolyn and I are sitting at a large round table, discussing ideas for science in Cowan 3 this term. Her mane of dark brown hair has lighter highlights in it, and falls across her shoulders in spiralling curls that give her a vaguely exotic look. Her lips are full, impeccably outlined in a darker brown and filled in with a lighter colour, and her green-brown eyes beneath arching brows have a bright yellow ring around each pupil that gives her gaze a real intensity. She's one of those girls who has been pretty since she was very young, and has had to meet men's grasping eyes for so long that she's put up a wall of hardness between herself and the world. The hardness has just begun to erode the prettiness, but when she drops her guard and laughs for a moment

she's gorgeous.

Another teacher, Helen, who is teaching in the school two days each week but was a full time teacher at Arcadia last year, is sitting across from us, marking work, but occasionally joining in our discussion.

"So how are you enjoying the place, Carolyn?" Helen asks, out of the blue.

Surprising me, Carolyn says "Honestly, off the record? I hate the place. I'm a secondary teacher, an English specialist, and I think I'm pretty damn good at that. But I feel really uncomfortable having to meet the complete learning needs of a Year Eight class, across all learning areas."

Carolyn goes on to say that she's not at all confident in maths and science, and is very pleased to have me there to help with the science learning of the students. Her argument is that, if the same structure and culture could be maintained within the school up until Year Twelve, that would be OK - the students would be assessed in the same educational culture where they'd learned. But social and political constraints on the school will force students to attempt the statewide, external examinations for the Tertiary Entrance Rank (TER) at the end of Year Twelve. This means that they'll need to be acculturated to a much more traditional, specialised, abstract approach to learning by the time they reach Year Twelve. Given this situation, Carolyn feels strongly that it's impossible for non-specialists like herself to adequately prepare students.

"I really feel like I'm responsible for all this stuff I don't know that well - you know what I'm like in science, " she looks at me, "and that I'm really letting these kids down."

"What about the other things they're s'posed to get more of?" I ask. "They might have less actual facts and bits of information, but the rhetoric at least is that they'll have more generic, transferrable learning skills that will make them 'life-long learners'."

"I'm not really sure about that, but I think we actually spoon-feed them a lot more than we would in a normal high school: it's more like a continuing primary school where they expect you to find their folder for them and pretty much do

everything for them, where in a traditional high school they have to sink or swim. I don't think they're being prepared to be independent learners."

Helen agrees - although the intentions of the school are good, and in an ideal world it might be possible to teach this way, in the real world the TER is looming, and the students should be prepared: if they're not, that's inequitable, because the TER is the gateway into university and the privileges that flow from a university education.

"That's not the only thing, though," adds Carolyn. "I think it's less satisfying for me as a teacher too. I really enjoy teaching Year Eleven and Twelve, where you can actually have a bit of an intellectual conversation, and play around with ideas. That's what I find most stimulating about teaching. Now I have one Year Eight class all day, instead of a situation where, if you have a difficult lesson or a painful kid, you know they'll be gone in 40 minutes. Now I have to look at Tony bloody Case all day. At least when I was teaching in a normal high school and I had Year Eights I could think, 'Oh well, I've got the Twelves soon' - here it's just unrelenting."

By this time I'm really wondering why Carolyn is teaching here at all. She may not have known about how well, or otherwise, the school would prepare students for Year Twelve, but surely she knew that she would have one class all day, and would have to teach outside her 'comfort zone'? As if she knew what I was thinking, Carolyn said that her decision to come and teach at BCC was mediated, not by a strong commitment to the principles on which the school was founded, but simply because the only other jobs available at the time were in country areas.

"Do you think you'll stick it out next year?" asks Helen.

"No, I really doubt it - if I can get another job I will."

Thinking about the conversation later, I felt that Carolyn's frustration mainly arose from her ethical commitments as an educator. These made her really uncomfortable with what she saw as her half-baked attempts at teaching maths and other subjects. Perhaps it was also her discomfort with the challenges of teaching outside her subject specialisation - with no longer being able to feel like a professional, in control and possessing all the knowledge that might be required of

her.

The Aggressive Uses of Irony

Strange as it may seem, my life is based on a true story

Ashleigh Brilliant

A good novel tells us the truth about its hero; but a bad
novel tells us the truth about its author

G. K. Chesterton

Fiona crucified herself yesterday. OK, she got a bit of help with banging in the nails and standing up the cross, but I don't know - perhaps it was necessary, perhaps not. I just hope that after the crucifixion comes the resurrection.

I was very late for the meeting: I'd promised some science curriculum material, then put off getting it down on paper

the lure of a new CD-ROM drive and some music software

until very late, so I was flat out putting the finishing touches to it and printing it out, and of course both the printer and photocopier malfunctioned, just 'cos it was urgent. As I walked into the room, there was an uncomfortable silence, and Fiona continued in the vein in which she'd (apparently) been speaking:

"I know that there've been problems in the operation of the team, and some people have been uncomfortable with what's been going on. I've been going through some personal problems, which I don't want to go into now, and I've been driving myself too hard with work to really work on some of these things. I've asked Andrew, who I really respect as an educator, to come down after recess and act as a mediator so we can work through some of these issues. I'm trying to understand my own professional practice as a team leader, and I've been writing about this as part of my masters study. This is the first time I've been a team leader, and I'm still learning, and I know I haven't done a very good job, but..."

People wait. Normally in such a situation, someone would rush to reassure the speaker, but no-one does - later, they're much more open toward Fiona, but right now there's some real anger. Alyx finally speaks "You see, that's really part of the problem. We all know there are some problems, but to use us as part of your masters study, and then invite Andrew to come in without talking to us about it - that..." she pauses, "...that really sucks."

"I never intended to mention anyone's name in writing up the report - it's just looking at the development of my role as a team leader." Fiona defends herself hurriedly, but perhaps she's missed Alyx's point. Tanya speaks up: "I think it needs to be discussed inside the team: we need to solve it as a team, not have someone from admin come in to solve it for us. And we'd need Robyn to be here."

Comments and discussion ensue, and the consensus seems to be that yes, the team isn't working well and needs to address some issues, but this morning provides too little notice, an external moderator would be a handicap, and Robyn does need to be present.

One of the problems is really outside the team's ability to address: most team leaders have a small teaching load within their team. This allows them to have some connection with the students, to relieve their teachers for planning time, and to interact with the teachers in a teaching, rather than an administrative, capacity. Fiona initially had that time with the team, but the school administration decided that her expertise as a mathematics specialist could be better used elsewhere in the school, and took her out of the team for her teaching time.

It seems that there's been a perception (Fiona challenges its reality, but is - correctly in my view - reminded that if a perception exists then it needs to be addressed) that Fiona has tended to carry issues and problems to the administrative staff too quickly, rather than searching for solutions within the team. Tanya felt that she had been made to feel like a naughty student for talking during the planning meeting, which had incensed her, and Etta - while generally affirming that the team was working quite well - felt that Fiona had tended to set the agenda for team meetings without consultation, and that the creative planning of the group had to some extent been stifled in administrivia. The group noted that Fiona had tried honestly - and been partially successful - to reduce this component and speed up the meetings.

Some members of the group had spoken against Fiona behind her back, and these comments had got back to her by circuitous paths. Everyone acknowledged that although that was easy to do it was unprofessional, and resolved to be more open and direct in dealings within the team.

The group also acknowledged that there are issues of personal style and temperament to be overcome and dealt with: Fiona has a much more rigid, no-nonsense, mathematician's style, while the predominance of language specialists in the team has led to the desire for a more intellectual but emotional, caring and

casual form of discourse within the team. This may be the toughest issue to deal with: the tendency of 'birds of a feather to flock together', forming a 'language mafia' within the team. I feel quite strongly that it's unfair for Fiona to carry the can entirely for the problems in the team - although it may be politically expedient for her to appear to do so until someone else raises the issues - because the other members of the team have given up too easily and have not made the necessary effort to build bridges across the divides of personal style and professional practice within the team.

This is a very diverse group, ranging widely in age, classroom experience, intellectual commitments, out of school lifestyle, family background, artistic and musical tastes and a myriad of other things. Etta's approach is different from those of some others, as is Fiona's. Alyx is bright and a great teacher, Carolyn is a little insecure in teaching cross-curricularly, Tanya is open and caring, Robyn is sparkling and irreverent. They are individuals, but need to work together as a cohesive team: creative solutions will be necessary, and so will compromise on the part of everyone, not only Fiona.

The decision is made to postpone the discussion until the following Monday, and to devote the whole team planning time to it. I diffidently suggest

my role is still not totally clear to me - perhaps that will need discussion too?

that it will be more productive to discuss how the team can operate better: to concentrate on the positives of how to improve, rather than to put Fiona in the stocks and throw rotten eggs at her for a morning. That might be satisfying to people who've felt offended, but it won't provide us with a way forward.

As I walk away from the meeting, I'm thinking about three things: what, from my perspective, has gone wrong (and right) with Cowan Team, some possible approaches to solving the problems, and my own role: to what extent, and in what ways, should I contribute to the team in general and the meeting on Monday in

particular?

I suspect that there are two reasons for the current inter-personal discomfort in Cowan Team: firstly, the great differences of personal style and approach between team members, and the fact that it was possible for a 'clique' of similarly minded teachers to form within the team. Secondly, Fiona's insecurity in a leadership role, which she attempted to assuage by conducting the meetings very much as business meetings. The crucial first few meetings were taken up with administrivia, boring and alienating the teachers. In hindsight, it would have been far better to use some 'team-building' activities, and to jump straight into some heavy-duty curriculum planning activities. These would have built cohesion in the early stages, and developed a respect for one another's skills and abilities. The other material could have been soft-pedalled and introduced later. I suspect it was these first few meetings that set the tone that has led to the current situation. Feeling like a bit of an outsider and suffering personal problems as well, having her role changed and being taken out of the team for her teaching - all of these must have made Fiona's life very difficult, and many of these things were beyond her control.

Hanging Fiona out to dry on Monday wouldn't be a way forward: she's already acknowledged her 'sins', such as they may be: it's time for others to acknowledge their share in the situation, but much more importantly, for the team, collaboratively, without outside interference, to try to find ways forward. I believe the crucial step is 'putting our cards on the table' - we really need to explore one another's personal styles, ideas and commitments, in such a way that we are able to negotiate new understandings, and a new professional relationship between team members. This will involve compromises from everyone: we will need to adapt our styles a little, and to be tolerant of the styles of others. Caring will be a crucial component.

And that brings me to my own role. Should I talk about Nel Noddings' model of 'care', or will that simply be seen as irrelevant theoretical waffle - or worse, an attempt to use the authority of academia to put my views across? And do I have a right to speak up anyway? Am I a stakeholder, or a part-stakeholder? Has

my presence actually exacerbated the problem? Probably - what can I do about that? I want to be a member of the team, but that depends both on my constructing myself as one, and the group members admitting me. By this time, were the group functioning well, I would be much surer of my role, but with little consensus on anything, there seems to be no consensus on that.

Stay tuned for Monday's report.

There's enough irony floating around here at the moment to cure anaemia - or to make you weep. The school newsletter went home this week with a message from the principal, passed on from the Education Department, about violence in schools.

Oh, not teacher violence toward students: something that at least a sixth of the students know is going on in this school, apparently unaddressed. This was a strongly worded message saying that violence toward teachers by students would under no circumstances be tolerated.

How did the parents and friends of the slapped students in Andrea's class take this message? I didn't meet or talk with them, but empathy is really all that's needed, isn't it? How would *you* feel?

There was a School Development day last Friday. In the jargon of the Department, this means the students don't go to school, but the teachers do, in order to make collaborative progress on the issues facing the school. I wrote down my reactions in my journal:

We had a staff meeting today, intended to "address some key problems within the school". So why were the two most pressing problems in the school - at least from my perspective in Cowan - not on the agenda?

The first of these problems: the violent teacher. Of course, she's right there in the meeting, and it would be embarrassing, and there are processes,

and... But it all seems a little shallow to be working out better processes for passing around Curriculum Consultants' timetables when someone in the school is slapping students! Maybe this embarrassment, combined with our obsession with due process, is what stops us from stopping other types of child abusers - why aren't we making it crystal clear to her, as teachers and human beings, that she's respected but her behaviour is intolerable? And why do the procedures make it impossible to just get her the hell out of there?!

The second problem: the discord in Cowan Team. The focus of the meeting is on improving communication, but it doesn't do a thing to address the communication breakdown that's disabling a sixth of the school.

Fiona thought all the problems had been addressed in the Thursday meeting. There was no meeting on Monday.

The Cowan Team planning meeting was running beautifully: everyone was involved and on task, and the creative flow was energising and exciting. We - the seven Cowan teachers, Fiona and I - were collaboratively planning the student activities for next term's integrated learning module. It's called 'Our Heritage', and focusses on the history and society of this State, and more specifically our area, since the Second World War. It will include the Aboriginal heritage of the region before white settlement too, and will also look at the heritage of the many students who have come here from other countries, including Vietnam, Hong Kong, Rumania and Poland. We're designing activities that will integrate skills and ideas from science, maths, technology, language, the arts, health and studies of society and environment (what used to be called 'social studies').

Technology ideas really had the group fired up, with Alyx and Robyn suggesting creative projects linked to the history of the State, like wooden toys and

cottage crafts. These would nicely integrate the historical, social and technological emphases of the module, and the teachers really felt that it would catch the students' interest - it certainly caught the teachers'.

The next planning meeting, a week later, started out the same way: people were energised and ready to be creative. Our guest for the morning was Ellen Carver, the Curriculum Consultant for the Technology learning area. As she lectured to the group of teachers about the projects that had been chosen by the technology team for our students, the teachers sank into silence, fidgeting and staring at their hands.

“OK, all the students will be making the steel dustpan in the first 7 weeks of the term. We'll give you the plans and instructions and you can go over it with them. I also want you to get the students to do these three technology assessment tasks in class...” she pauses to hand out thick wads of paper to everyone in the room. “They need to be done in the next week and a half, and I want you to mark them and hand the marks to me before the third week of term.”

The shocked silence from the teachers deepens. The timetable is already too full - where will they find the two hours or more to have the students do these tasks on such short notice? And where will they find the time and energy to mark all this extra work? And what happened to the exciting activities we'd planned for our students?

“But we'd planned all these other activities that tie in with what we're teaching...” Fiona begins, somewhat plaintively.

“I think you'll acknowledge that we're the ones with technology experience. We know the skills the students need to develop, and we've planned these activities very carefully, within the budget we have,” Ellen says. “If you want to do anything else with the students, you'll have to finance it yourselves and do it outside technology time. You won't be able to use the resources in the technology area either - they'll be in use by other classes. Are there any more questions?” Stunned silence reigns. “Good, then I'll be going. I'll expect those marks in my pigeonhole by Friday

the Twelfth then..." She gives us a sunny smile, not returned, and packs up her bag of papers and breezes out.

We probably should have challenged her agenda - refused to do her work until she negotiated on ours, or tackled her on her assertion that she, not we, knew what our students needed. I think we were just too shocked and demoralised even to raise our voices: the whole tone of her presentation had robbed us of the willingness to engage, because it was so clear that she was unwilling to engage with us.

This meeting just seemed to contravene so many of the values and commitments that the school was intended to carry out - no negotiation, no collaborative planning, no curricular integration, no empowerment of teachers, no relevance to students' perceived needs... What the hell happened? How did we get rolled like this?

Trusting Tony

To understand something, one must give not only one's mind but one's heart to it

J. Krishnamurti

We can only understand something or someone for whom we care

Max van Manen

One learns to know only what one loves, and the deeper and fuller the knowledge is to be, the more powerful and vivid must be the love

Goethe

“We’re really excited about the place: the kids are involved and active”. The visitors nod politely, and ask polite questions, but you can see that they’re wondering “So, what did they pay these teachers to say all this?”

It’s quite strange. When we’re together we bitch and moan as much as the next bunch of tired, stressed teachers: the admin’s not supportive enough and we never see them, the kids are painful, the Curriculum Consultants ask us to do too much and don’t provide enough guidance. But let any stranger enter the school, or any of us leave it to attend a conference, we suddenly become ‘Arcadia evangelists’. We’re all incredibly excited and positive about the innovative approaches used in the school, we think it’s the wave of the future, we think the students are being supported/trained to become lifelong learners/motivated...we go on and on like new Proton owners.

Why is this? Perhaps a bit of fortress mentality against the vocal and ill-informed critiques that the place seems to have attracted from a variety of sources? Including ones we would have hoped would support us, like the teachers union. Or is it that we really, truly do believe that this is just a better way to teach and learn?

“It’s quarter past twelve - what’ve you been doing?”, Sue mumbles sleepily as I slide into bed beside her with a sigh. I push down the urge to snap - this time - and snuggle in beside her.

“I had to mark some stuff from Arcadia - the lab reports from Carolyn’s class. Then there was some marking from my Curtin work to do, then I had to write up my reflections on this week at Arcadia. I’ve still got tomorrow’s lessons to prepare, but the screen was starting to blur. Put the alarm clock on for 5:30 in the morning.”

I kiss her goodnight and roll over, and am almost instantly asleep. The beeping wakes me a subjective moment later, and I flail at the alarm clock until it shuts up, then slip back into sleep. I’ll be going to Carolyn’s class unprepared again

today, but right now I can't face it.

Sue makes my lunch and wakes me at 7:30 with a cup of strong coffee. She rubs my shoulders as I eat a hurried breakfast, and kisses me goodbye at the door before preparing for her own day.

When I graduated from teachers' college we moved to Melbourne, to a small Christian boarding school called Eastern Hills Academy. Our first year there was 1989. About half the students were boarders and the rest were day students from the comfortable eastern suburbs of Melbourne. The boarders were farmers' kids from country New South Wales and Victoria, and the children of wealthy parents from the Pacific island nations - Fiji, Samoa, Nauru, the Solomon Islands and Papua New Guinea. That first year, I was 'thrown in the deep end' with a Year Twelve physics class, but I found that I really enjoyed teaching, and the students ended up with significantly better results than anyone had expected of them - I was happy to accept the credit! The Year Twelves were easy though - my real, on-going struggles were with discipline and class control in my Year Nine science classes. I was a very young 24 year old, not particularly self-confident, and although things don't really get out of control, it was a struggle every day.

It did get better - every teacher's first year is hellish, as Robyn's discovering this year. The following year, just to keep life tough, I started on a Master of Education program at Melbourne University that meant I travelled for an hour each way to a two hour class, two nights each week. This increased the pressure on my marking and preparation time, and the Head of Science thought I really wasn't doing enough of either. I disagreed, of course, but in hindsight he was probably right.

During that year we also lost our much wanted baby 17 weeks into the pregnancy - a devastating experience for Sue and I. We had always wanted a daughter - I came from a family of boys (two brothers, five uncles, five great-uncles on the paternal side) - and the baby we lost was a girl. We were terrified that our next child would have the same problem, and worried that we would have only boys.

We became pregnant again almost immediately, and Cassandra was born at the end of 1990. I decided to take 1991 off from teaching, look after the baby and finish off my Masters thesis. Nice in theory - I had a wonderful year, bonded with my tiny daughter, took her for long walks in the park, cooked for Sue who was working full time as a secretary - and got almost nothing done on the thesis. I wasn't yet ready to write it, but didn't realise that at the time. I ended up completing my M.Ed. four years later, in Papua New Guinea.

My mother, who had been diagnosed as having leukemia four years before, and who had been in and out of remission several times, finally lost the fight in January of 1991. We had planned to wait a couple of weeks before taking Cassandra north to Sydney to see her grandparents, but on the spur of the moment decided to take the twelve hour drive when she was only a week old. So Mum met her tiny new granddaughter, held her, then quietly gave up a week later. Seven months later my 25 year old brother Jeff, married for only a year, went out bushwalking alone, and didn't come back. Searchers found his body the following morning at the base of a small cliff where he'd fallen.

At the end of 1991 we returned to Sydney, and I took a teaching job at Eastside Christian Community School. This was a wonderful year, taking Cassandra for long walks by the beach in her backpack carrier, teaching better and with more enjoyment than I had for a long time, and being close to support my Dad. Sue had been unable to find work as a secretary, and had gone back into geriatric nursing, something she had done before we met. She was working nights and weekends, which meant that we got to spend less time together, and were often tired when we did talk. On top of the usual pressures of marking and preparation that are pretty much unrelenting for teachers, the Masters thesis was still hanging over my head: I was actually doing very little with it, but it was a fruitful source for drifting guilt!

At the end of 1992, the Seventh-day Adventist church tracked me down and offered me a job as a teacher educator at Pacific Adventist College in Papua New Guinea. I jumped at the chance to move into tertiary teaching - I saw it as a way to teach more and act as a policeman with unwilling students less. I probably showed

too much alacrity in accepting the offer for the taste of my employers at Eastside: they had anticipated at least 3 or 4 years of service from me. My father had found a new partner, and we attended their wedding on Cassandra's second birthday, then moved to Port Moresby.

"I can't do this any more." Robyn looks up as I walk into the Cowan staffroom, red eyes through tears and a veil of hair. "I've tried, I really have, but I just can't..."

Much to my relief, Alyx walks in behind me and immediately goes and puts her arm around Robyn. Although I like to think I'm fairly comfortable with emotions, the nakedness of Robyn's pain frankly scares me. And besides, there are all sorts of potential legal minefields, these litigious days, for a man who comforts a woman with a hug.

Perhaps I wimped out - I think I probably did.

Robyn has made her decision. She'll be leaving Arcadia at the end of Term Two to spend the rest of the year recovering, then she'll look for a part time teaching job with senior students at a traditional high school. I know how she feels - I came close to quitting teaching myself in that first year, for exactly the same reasons: the inability to command enough force of personality and power of will to face down 30 sullen students who just don't want to be there. At least, that's how it feels at the time - there are probably only 5 or 6 students who are really negative, but that spreads if you don't confront it, at least initially.

I was lucky - I had a sympathetic deputy whose door was always open, who would listen and nod, then suggest a strategy or remind me of the things I already knew, pray with me and send me back to the fray. In Arcadia, this should really have been Fiona's role, but she's been struggling hard enough in her team leadership and anyway has no time to spend in the team just talking to teachers. Besides, there's really no *simpatico* between them - Fiona is a fine teacher, but not the person Robyn

would turn to. Fiona would probably tend to offer immediate solutions, rather than listening.

“Don’t think you’ve failed”, says Alyx quietly, “I’m having a really tough time with all the demands of this school too.” I silently agree - it’s tough. But Alyx just has that combination of an iron will and a heart full of love for her students. They love her in return - but were they an easier group than Robyn’s to start with, or is it Alyx’s teaching? I suspect the truth lies somewhere between the two extremes - it’s neither all the teacher nor completely the students. I do think there are students in Alyx’s class who would have rioted under Robyn, but how can I really know?

Robyn wipes her eyes and walks off to communicate her decision to Andrew, Alyx offers to take over her class for the morning, and I remain in the staffroom, hands hot around my mug of instant coffee. There but for the grace of God...

Carolyn arches a perfect eyebrow and says: “In any teaching it’s hard not to be most enthusiastic about the things you like - and you put on this false sense of enthusiasm with the things you just have to teach. Obviously sometimes my attitudes weren’t too positive: ‘shit, here goes science again’”

I venture, “And I think the kids read that sometimes....”

“Oh yeah, of course. But it’s hard to control your mouth and your tone all the time.”

What can I say about Papua New Guinea? It’s a beautiful country - Port Moresby harbour is one of the most striking in the world, the diving in the tropical waters is incredible. It is rich in coconuts, cocoa, coffee, copper, gold and oil, and the people are friendly and open-hearted. But the city is full of rubbish and violent crime, you don’t leave your locked compound at night for anything, rape and murder rates are huge. The reefs outside the city have been destroyed by people dynamiting fish, and you can’t go diving because your belongings and car will probably be

stolen from the beach.

Our own time there was idyllic in many ways. Sue couldn't work, because she didn't have a work permit, but my income was sufficient to keep us, and she developed a preschool program for 40 beautiful children under six and ran it in the space under our stilt house. My work load was relatively light, so we spent a huge amount of time together as a family, talking and planning and dreaming.

Alexandra, our second daughter, was born in Sydney

if you have any choice at all, you don't go into a hospital in PNG - but many people have no choice

at the beginning of 1994, and my Masters thesis was finally completed and passed in that year. I began my doctoral program from Curtin by distance education, and at the end of 1994 it was time to decide whether to stay in Port Moresby and continue studying by distance education, or to move to Perth. Understandably, these employers too would be less than pleased if we left after only two years. They had assisted our move to PNG, and would be expected to help repatriate us.

But the political and law and order situation was deteriorating almost by the week. As we contemplated leaving, the kina had been floated on the international money market, immediately cutting my effective income by a third, and the government had mismanaged its funds so dramatically that the police had no petrol for their patrol cars and all the schools closed early because there was no money to feed the students. In the week we had to make a final decision, three women were raped within a ten kilometre radius of our home, including one actually on the campus of the college.

Along with the many other issues, that tipped the balance, and we came to Perth at the beginning of 1995 to continue the doctoral program. Sue returned to school to complete Year Twelve and gain entrance to university: one of the dreams she'd spun in PNG was to become a psychologist, and this was the first step on that journey. She did well in 1995, returning to study for the first time in fifteen years, but not quite well enough to gain a place in her preferred course, so she is attempting Year Twelve again in 1996. And I'm teaching, learning and researching at

Arcadia....

Tony Case

the teachers in Cowan call him 'Hard', or sometimes 'Nut' in the staff room, and are terrified that one day they'll say it to his face by accident

is a big, solidly built, scruffy looking boy with unruly black hair that droops forward over one eye. He's perpetually in trouble with Carolyn for not doing his work, and she thinks her life would be twice as easy if he just disappeared. I can sort of see her point.

But it makes me wonder about 'worst kid' syndrome. I've done the same - "this kid is absolutely rotten, and my teaching would be infinitely more pleasant if he (almost invariably, it's a 'he') wasn't here". But now that I'm teaching in five different classrooms across each week, I begin to realise that the 'worst kid' in some of these classes would be considered an absolute angel in others. OK, Tony refuses to do his work, and that's an annoyance, but in Robyn's class there's a kid who got caught with a gun at school and who is regularly suspended for exploits like placing the gas hose of his bunsen burner over the flame, or stabbing other students with a scalpel. I begin to wonder if it's all relative, and if the worst kid was kicked out, there'd be a new worse kid - 'less worser' than the other one, but still the one the teacher concentrates on. It feels like an insight, but what's it good for?

Anyway, I digress. This morning, I'm in the room by myself: Carolyn has gone off to deal with a particularly violent eruption in Robyn's room. The atmosphere in here is like the cool clean air after a thunderstorm, instead of the still, humid sense of foreboding before one. Tony asks whether he can sit with his friend James, and promises to do his work.

"Well, Tony, I've seen you and James muck about before..."

"Yeah, I know Mr Geelan, but we'll work today." In this moment, Tony

looks like the rather forlorn 10 year old he must have been before he was swept away on the *tsunami* of puberty, and I relent.

“OK guys, I really believe you can do this.”

Tony and James are working quietly, heads together over the desk, producing more this morning than I’ve seen before from either of them. The task is to develop an original signalling code that they can use to transmit a message to one another at a distance of 100 metres. Some of the groups have developed intricate semaphores of body movements, but Tony and James have put their money on a system of coloured flags made of paper. I have my doubts about its efficacy, but they’re working well on it.

“Oh, you’ve put them together.” Discussing the finer points of whether hand gestures would be too small to be seen from 100 metres with another group, I hadn’t noticed Carolyn’s return to the room. “They’re not to work together - they don’t get anything done.”

This in spite of the evidence: until they heard her voice, they were probably the most focussed pair in the room

She stands at the door of the room, hands on hips, an expression of disgust on her face. “You just can’t do it, can you?”, she sneers at Tony, who mutters something under his breath and slumps in his seat.

“I told them I’d try them together, and that I trusted them to try it,” I interject lamely, “and they’ve been doing really well so far...” But it’s too late - their body language shouts their defeat: their best has not been good enough, and they’re damned if they’ll try again now.

I’m furious. In part it’s for myself: she’s walked in and undermined my authority as the class teacher yet again. But much more of my anger is on behalf of these boys. I’ve just seen a tiny glimmer of hope for them - they’ll never be saints or academics, but they were on-task and enjoying their learning. But Carolyn’s labelling and negativity have just crushed the spark out before it really got established. I wonder whether a huge part of Tony’s problem with school is not Tony but Carolyn. And I wonder whether Carolyn’s slap hurt worse than Andrea’s.

I think it probably did.

Depression, Incest and the Nature of Science

Stories are the secret reservoir of values; change the stories individuals or nations live by and tell themselves, and you change the individuals and nations

Ben Okri, *Birds of Heaven*

Several students have left Arcadia to attend other local high schools, only to return to Arcadia after a few weeks, saying they preferred it - or, more directly, that they hated the other school. There are

at least

two possible ways of construing this:

1. Arcadia doesn't prepare students adequately for a 'real' high school: because of the more 'primary-like' atmosphere, students are conditioned to extra levels of support from teachers for dealing with their weaknesses and lack of organisation, and they just can't 'hack the real world'.
2. Arcadia is so great, so nurturing, caring, relevant, integrated, interesting, that all other high schools pale into insignificance. When they leave the Arcadia environment, students miss the levels of support and interaction, they miss the personal feel of small teams, they miss the integrated curriculum.

We'd need more information than is currently available to decide which is the most true, since they probably both contribute.

Candace and I are sitting in the staffroom at recess, sipping coffee and talking quite intensely. We're friends as well as colleagues - some of the teachers in the team see us as allies, and possibly even conspirators - but basically we just like and respect one another a lot.

Candace is an experienced and reflective teacher. She's one of those teachers who was a 'naughty girl' herself, and it's given her a real empathy for kids who struggle at school. She's also raised two sons and taught technology classes, and has great skills with handling difficult boys. I know I have plenty to learn from Candace, and I take this opportunity to ask her about something that seems to keep bubbling up for me - how much responsibility for the way students learn and behave is owned

by the teacher?

“There are a couple of kids I wouldn’t mind talking about. One is Adrian. I mean, Adrian’s still a naughty boy, basically... But you’ve asked him to take care of the attendance rolls and absence lists for the whole team, and I think giving him those responsibilities has helped him...”

“Oh yes, he’s very good in that role,” says Candace, “when he’s given a responsibility to do something - or when the task suits him.” We laugh together, holding our steaming mugs, and other teachers look up from their conversations. Candace continues more quietly. “Actually, he treats responsibility with great respect. He also accepts whatever correction he’s given quite happily - he knows when he’s done the wrong thing, and accepts the consequences.”

I think for a moment, and suggest, “I think in a way that’s a strength of your approach, though. You’ve made it very explicit: ‘You’re responsible for your behaviour’ - these consequences are logical.”

“Yeah, that’s right, but I think the kids have also gotta understand that ultimately you - as teacher - *are* responsible for the class - in fact you’re the boss.” She laughs again. “And you can make that very explicit, and say ‘I have accountability for these things’.”

“But,” she continues, “I just wonder whether, by giving them all this responsibility... if they hit an autocratic teacher next year, I have great concern. But really I think they do it because they respect me, they also respect themselves, and they do it because they like what happens in my room.”

I pause for a moment, then, “I was just going to say - do we undervalue relationship? You know, they have skills with this meta stuff about responsibility, but they really have a *relationship* with you. And I think we undervalue that. I think each teacher has to develop a relationship, and the first phases are gonna be tough. And your first phases were tough with this bunch...”

“Oh yeah, absolutely,” Candace nods emphatically. “I mean every phase and every new bunch is tough.”

I continue, “I think Simon’s the other one who’s interesting to talk about,

because he's really - I don't see him as being a naughty boy, in here, but in his other class he was..."

"No he's not a bad kid at all. His father said to me 'Simon has always had to respect people - he doesn't respect many but when he does he'll kill for them, and you've gained his respect'."

"Mmhm," I murmur, "he respects people, not offices or roles..."

"Yeah, that's right, so much so that he said if I'm teaching Year Nine next year he's requested that he has me again, which'll kill me," she laughs. "But he's not like a lot of other kids, because he will stand up and say 'excuse me, these are my rights', and this has got him into deep... water, before he came along to me."

"Yeah, I'm just intrigued, though, about whether it's Simon specifically or whether some of the other people who have problems in other classes would respond similarly if they came into yours."

"I think they would, because seeing the difference in ... another bunch of Year Sevens here,

she's talking about Robyn's class since Colin, who replaced Robyn when she left, took over, but being discreet

when they changed over to a new teacher... It's unbelievable - I go in and teach literacy there, and it's a different bunch of kids. But kids have to learn, same as we all have to learn, that we've gotta get on with every type of individual and we're not all the same. So it wouldn't do for them to have seven Candace James' or seven David Geelans, because I don't think that would help them to go out into the real world. I think to have a Candace James then a David Geelan, then a Fred Bloggs, then a Jamie Jemima, whatever - I think that gives them a balanced view."

Therese looks from Carolyn to me, and back again. Most of the other students in the room have missed the inconsistency - frankly, most of them stopped listening ten minutes ago. But Therese is bright, and even though she considers science "a waste of time", she's almost always listening and thinking, even when I think she's just

adding another layer of intricate doodling to the inside of her folder.

“That’s not what Mr Geelan says science is about”, she murmurs, without bothering to raise her hand. Carolyn has just come out with the statement that “science is true facts about the world”, and Therese remembers that a few weeks ago, in one of my fairly frequent digressions into the nature of science, I claimed that science is a way of understanding the world that doesn’t necessarily yield truth.

Now Carolyn’s looking at me too, and I try to explain again my understanding of the nature of science. My perspective owes something to Paul Feyerabend’s ‘anything goes’ approach, something to postmodernism and constructivism and something to the sociology of science. It’s eclectic and rather complex, and I’m trying to describe it as clearly and simply as I can, without using any of those academic terms.

But even as I’m explaining, I’m thinking “Do the students really need this? Is it appropriate for their age and stage of development to try to grapple with epistemological and ontological questions that I came to much later? Or would it be more comfortable and productive for them to believe in the sacredness of scientific knowledge for a little longer?” I can’t decide what is most appropriate, and the situation has arisen in the classroom right now, so I try to make the best of it.

“Well, I think about it this way,” I begin.

How do I do this without openly disagreeing with Carolyn?

“Science is a word that’s used to talk about two things, and they’re both important. Science is a body of knowledge - ideas and theories. These are really ways that people have found to think about what they see in the world. But science is also an activity - it’s something people *do*, as well as something they know. In our school science lessons, we try to introduce you to some of those scientific ways of thinking about the world, and we also try to let you do what scientists do - explore the world in thoughtful, careful ways.”

“I don’t want you to think that science is just all about memorising a heap of facts - that, number one, isn’t very useful, and number two, doesn’t make you a scientist, or even scientifically literate. Science is about learning a special set of

ways of working and thinking. They're related to ways we work and think in other learning areas, but also a bit different. For example, in English, we look at a novel or a poem or a story and try to understand what it's about, and how it makes us feel."

Carolyn breaks in, "But in English there's really no one right answer, where in science there is...isn't there?" I don't want to deal with that right now, so I turn from the class to her and say "I'm getting to that, but I want to do this a particular way", then continue.

"What Ms Young was talking about was the first of those two things about science - scientific knowledge..."

I continue with my explanation, in a lecturing mode that's unusual for me, and I'm very aware that, fascinating and important as this stuff is to me, and although I think I'm explaining it pretty clearly, most of the students' eyes have glazed over. Some are staring out the window at the gentle grey drizzle, one or two have their heads down on their desks, and Tony is flicking bent staples at Jules when neither teacher is looking. I've been seeing the staples appear, but I want to try to catch Tony in the act - perhaps then the inevitable visit from his mother will be at least marginally less unpleasant. Unless I have some pretty direct evidence, it'll just be "You're picking on him" again. I'm not, but Carolyn is, and that makes my position morally difficult when I'm talking to Tony's Mum.

Carolyn says, "So, you're saying scientific facts aren't really true?" While I'm trying to get my thoughts together, Therese blessedly breaks in. "No, Ms Young, it's more like they're true at one place and time, but not always. They're sort of like fashion..." Carolyn completely ignores her and keeps looking toward me, and I try to explain the ideas Therese has just put together so cogently. I also try to acknowledge Therese and her contribution, by alluding back to them in my comments, and earn a grudging smile before she drops her head forward and hides behind her long dark fringe - a frequent refuge.

Carolyn says, "Oh, OK, I think I understand", but her expression makes it clear that she doesn't, and doesn't really believe me anyway. Therese has a better understanding of this stuff than Carolyn ever will - but she still thinks science is a

waste of time.

I can't put my finger on a specific reason, but I'm really beginning to dread coming to school. No doubt some of it is the fact that it's winter; cold, grey and depressing. I feel overwhelmed too - I'm teaching here two days, and that involves preparation and marking. The other days I'm reading and literature searching, writing papers and talking to Peter at Curtin. I also have a job tutoring some distance education courses, and that means more marking and pressure. My life at home is supportive and great, but having a five year old just beginning school (I go to read with Cassie and her classmates each Thursday morning) and a two year old learning to talk and think and a wife studying and asking for help and discussing ideas are all demanding my time, attention and emotional energy.

I think the main thing, though, is that Carolyn just doesn't like me very much. Part of it is that she hates science - an attitude with which she tends to infect the students. Part of it is that she thinks I don't prepare enough worksheets, and that she doesn't like my teaching style. Surprisingly for a teacher of senior English, she has a very black and white view of life: if my teaching is different from hers, then mine is wrong.

She hasn't really forgiven me for breaking my leg. My doctor held his surgery on Wednesday mornings, which meant my appointments with him cut into my time with her class. This meant she had to take over, and she resented that. Thank goodness the cast is coming off this month, so I won't have to miss any more classes.

The feeling is pretty much mutual - I don't like her much either. I came into the class determined to like her, and to keep an open heart, but the way she tends to sarcastically put down the students who are already struggling for their classmates' acceptance really grates on me.

The atmosphere in the classroom when I'm there is oppressive - I'm sure the kids pick up on it - and having to be there for five hours a week is getting beyond

tiresome and into painful. I have to be here for the rest of the year, so I've tried to change my approach and what I'm doing, and I've tried to support and encourage Carolyn to take over more of the science teaching as she gains more confidence with the content, but she seems to have made up her mind that we're to be reluctant and rather hostile partners, and the things I try don't seem to really change that.

As Alyx staggers into the staffroom and collapses into her seat, her face is drawn, and she's near tears. "Why didn't I see it?" she asks. I have no idea what she's talking about, but with a bit of an effort she raises her head, fixes my eyes and begins her tale.

"You remember how, a couple of months ago, I was trying to figure out what I was doing wrong with Shannon?" Alyx asks. "Well, now I know what the problem was, and it wasn't me. Why the hell didn't I think of it before?"

"Today was the day I decided to do that 'Protective Behaviours' package from the District Office. You know, the one to help kids know what to do if someone tries to molest them or anything? Anyway, while we were talking about the statistics that show it's usually not a stranger but a family member or friend, Shannon just started wailing. It wasn't just a quiet snuffle like kids sometimes have in class, she was really sobbing and hyperventilating. I gave the kids something to do and took her outside."

"She didn't want to talk for ages, so I just hugged her. Then she told me there's a step-brother at home who's about eighteen, and he's been forcing her to have sex with him for the past three years. She's never told anyone before, her father and step-mother don't know and they keep telling her how wonderful her brother is, so good at school, it's like 'why can't you concentrate and be more like him?'"

"I just can't believe I didn't see it sooner - I mean, you hear about this stuff all the time, but it just didn't come into my head as a reason why she wasn't doing her work. Here I was hassling her to concentrate, and..." Alyx is quietly weeping herself by now, and I'm sitting there in a state of shock. Not because I'm not familiar

with the pain caused by incest - I'm way too familiar - but because it's happened again, and because this explanation had entered my mind when Alyx spoke to me the first time, and I'd dismissed it as paranoid. Why hadn't I at least raised the possibility with her?

Divers Alarums

...stories are important. People think that stories are shaped by people. In fact, it's the other way around... Stories, great flapping ribbons of shaped space-time, have been blowing and uncoiling around the universe since the beginning of time... And their very existence overlays a faint but insistent pattern on the chaos that is history... This is called the theory of narrative causality and it means that a story, once started, *takes a shape*... It is now *impossible* for the third and youngest son of any king, if he should embark on a quest which has so far claimed his elder brothers, *not* to succeed.

Terry Pratchett, *Witches Abroad*

Etta accosts me rather forcefully as I walk into the staffroom. I've been subtly avoiding her for weeks, because I know what she wants, but I really needed a coffee just now - it's a freezing day, and I'm boiling the kettle more to get my stiff cold fingers around a steaming mug than for the caffeine.

although that's gonna be a big help too

I have to travel to Brisbane this weekend for a family conference that will be harrowing, and I really just feel like hiding in a corner, clutching my coffee and breathing.

"Are you going to help me with the science preparation for the new module?" Etta asks, and I wince. In theory, at least, my role in Cowan team is across the whole group, and I'm meant to be providing assistance with science planning to all the teachers. What that means, though, is different for each teacher. With Candace (and by extension Andrea) and Alyx, the planning is genuinely collaborative, and we work together to develop interesting science-related experiences for our students. Tanya has chosen not to be involved with me at all, simply because she feels self-sufficient in science and is quite happy to run her own lessons. From what I've observed, they're not exactly as I would teach science, but since when am I the standard of practice? In Carolyn's class, I essentially do all the planning and preparation, while the working relationship with Colin is still establishing itself.

One of the things I had to try to break the teachers of early

but should I have been more responsive to their wants and needs, rather than imposing my perspective?

was the idea that 'science support' is synonymous with 'resources', and 'resources' basically means worksheets and textbooks. There were two problems with this, from my perspective.

Firstly, I really don't value these kinds of teaching approaches - I think worksheets that just need to be completed lead to almost no learning, like 'recipe' type practical sessions.

Secondly, I've never taught Year Seven or Year Eight before, and I've never

taught in this state before. This means that their assumption that I've built up a huge fund of 'resources' that I'll be able to provide to them is simply unrealistic - if I want resources I'll have to research and write them myself, and I really don't have the time.

The case for Etta's class is a little bit different. Cowan 7 is the 'Education Support'

this year's politically correct term for students who are 'learning disabled' or 'ADHD' (Attention Deficit Hyperactivity Disorder), or whatever other labels we might need

classroom. She has seven students, only one female, who range from the hard-of-thinking but lovable and gentle Russell to autistic and withdrawn Brendan to disturbed and often violent Patrick. Their ages range from twelve to fifteen, and Etta is a miraculous teacher - the responses she elicits under what look to me like impossible conditions are amazing.

She wants to offer these students some science-related experiences, and she's looking for my help and support in planning them. In a way I'd love to help - I think what she's doing is exciting - but then I think about the time involved. It would mean learning a lot of completely new stuff for me, about the capabilities of these students and the appropriate level of challenge and information, and what to expect in the way of activities and results. It would also mean chasing down some primary school resources and information, to which I have even less access than I do to secondary. Time pressure from my two jobs, church responsibilities and the needs of the family mean that for me to help Etta with this, something else would have to give, and I'm already feeling stretched and tense. Reluctantly, I agree to meet with Etta next Thursday (an extra trip to the school, and more time I have to find for everything else in my life) to talk about the next module. But before that can happen, something else blows up in my face, and we never have that meeting.

The trip to Brisbane has evolved as a possibility over the last month - it's dreadful

timing, and we can't really afford it, and it's rushed, but it's something that's needed to be done for a long time, and now it's time.

My father-in-law, may he burn in hell, is a pedophile. He sexually abused my wife, Sue, from age eight until she stopped him when she was about eleven, and the consequences of that abuse still cause her emotional pain every day of her life. In self-defense, her mind has dissociated itself from her emotions and sexual responses, and she feels as though she leads a shielded half-life. She's in counselling, and will be for years to come, and she's healing and growing every day, but there's still a harvest of pain to come, and he's the one who sowed it.

Christians are supposed to forgive, and I suppose I do, but it's unbelievably hard, and I can't just forgive him once, I have to do it every day, because what he chose to do hurts the one I love again every day.

He'd molested other children at around the same time, but he claimed that he'd repented and changed his ways, and because everyone in the family needed to, they believed him. But it's finally come to light in the past couple of months that he's also molested some of his grand-children, quite recently, and the family feels the need to confront him together, both to make him understand the enormity of what he has done, and to get him into some serious counselling so he won't hurt anyone else.

Sue doesn't feel she's ready to confront him yet - she's still so shielded off from the anger in her heart that she can't feel it, and doesn't see any purpose in what would be an empty confrontation. There'll come a time when she needs to see him face to face, but that time is not yet. I'm quite nicely in touch with my anger, thanks very much, and I'll be there.

I used to have fantasies of punching the bastard out, of kicking him, of throwing him against the wall. But in the flesh, he's a pathetic, weak, rather frail seventy year old man, not a ravening monster, at least apparently. And such monsters often are powerless men - they turn to children to exert their power because they're pathetic, not because they're powerful.

He keeps on lying - to himself most of all - saying that what he did was all

over twenty years ago and God has forgiven him, and quoting Bible verses in his letters. But he's selfish to the core - even in a letter asking for forgiveness, what he concentrates on is the pain this is all causing him: he never acknowledges the pain of those who must survive his touch.

I'm going to hate every minute of it. I avoid confrontations whenever I can, and I'm not even sure it'll be productive: can you change the pattern of thirty years or more? Especially if you don't even truly understand why you need to try? But if we can get him into treatment and stop him from doing it to even one other person, the \$40,000 it'll cost in cash terms, and the inestimable human cost, will all be worth it.

Even as I'm kissing Sue goodbye and getting on the plane, I'm scared and I'm worried and I'm depressed and I'm hyped. I don't want to do this.

It all started on Friday. No, actually, that's not right, it all started on Wednesday. No, it probably started earlier than that, but it only became really obvious on Friday.

Fiona approached me in the staffroom and asked whether there was a problem - why had she seen me sitting at the computer in Carolyn's room when she passed the door on Wednesday, and why was Carolyn so frustrated? I guess I'd known that things were far from perfect - and I was pretty frustrated myself - but I hadn't really known how Carolyn felt. Fiona arranged for the three of us to meet on Monday morning to try and reduce the levels of frustration for both of us.

Last Wednesday was annoying. I had arrived back from Brisbane at 10:30 p.m. the previous night. I was still tired and emotionally drained, and I had heaps of work waiting for me at Curtin. I arrived in Carolyn's classroom a little late.

for reasons that were adequate, but that she didn't know

I went to her desk to ask her what was going on, but she wouldn't look up, so I retreated. She had already begun an activity with the students, so I sat down and tried

to figure out what my role might be. There seemed to be nothing I could contribute, and I was depressed and pissed off, and I had plenty of work to do if I wasn't needed here and... So, foolishly, I turned around and spent a little time working

playing

on the Internet, using the computer in the classroom. It left Carolyn even more frustrated, and me annoyed too. This day probably 'broke the camel's back', and let Fiona know that something was wrong. That's why she challenged me on Friday, and why we met this morning.

We met in Carolyn's empty classroom, sitting on desks. If this was intended as a neutral zone, it was far from being that. On the other hand, if the aim was to remind us just how dysfunctional our teaching relationship had become, it was perfect: the walls seemed to drip frustration and suppressed aggression.

Carolyn's first question was "What is your role here?" - an indirect way of getting to her concerns to say the least. But she outlined her perspective on what my role was, Fiona outlined hers and I responded to those. I think there were some significant misunderstandings there, but that also my own perspective on my role had changed, and the various demands on me had shifted, so that there was a need to renegotiate exactly what it was we were trying to achieve together.

It was a highly emotional meeting - frustrations and anger were shared honestly - but I think it was also productively focussed on the problems and on finding workable solutions.

Carolyn was very angry, and really felt let down - I needed to know that. I had been feeling generally depressed - this had manifested itself in unacceptable actions like fiddling with the computer or reading

my besetting sin that I struggle with every day!

when I was in the classroom but not 'on stage'. I think this meeting showed a way forward for us. At one point Carolyn suggested that the whole program be aborted, but in a way we knew that, because of the research focus, that was impossible: or at

least, more difficult than the alternatives.

Carolyn's basic concern was that she felt I'd been unreliable: she was making the effort and taking on the commitment of having me be part of the life in her classroom, but felt that she couldn't rely on me to have prepared adequately for the lessons I was to take. This was to some extent fair: while I would plead a broken leg requiring hospital visits, a necessary trip to Brisbane and the difficulties of juggling two jobs in mitigation, I really had not been able to be trusted to be adequately prepared. I had turned up with an idea, but no resources, and expected to just make it up as I went.

I also needed to be more positive and assertive: if I had prepared something, but Carolyn hadn't seen it, I needed to let her know very clearly what I planned to do with the class, and describe her role.

In part this was a difference of personal style - I've always valued flexibility and topicality highly, and have tended to be a 'top of the head' sort of teacher in response. Carolyn, on the other hand, is the kind of teacher who has a diary with lessons planned two weeks ahead in great detail. So what she saw as unpreparedness was often simply the fact that my lesson plans usually reside in my head rather than on paper. But I also need to be aware that to be fair in a team-teaching situation I need to give her confidence in my preparation - so I hereby resolve to plan ahead more, and more visibly!

Carolyn also prefers an approach which uses plenty of 'tangibles' - worksheets and written documents which can be kept by students - whereas I tend to prefer discussions and other means that concentrate on what's in the students' heads rather than what's on the paper. Again, I need to be sensitive to her approach with 'her' students, so I'll be preparing a lot more written material for students to complete. This will include very traditional prac report write-ups.

One of the key communication problems, I think, is that I'm responding out of the most recent research and practice in science education, whereas she is basically responding on the basis of her English expertise, and on her own science education in school. What I'm doing, therefore, appears to her to be wrong or sloppy, whereas I'd argue that it's progressive.

Should I have explained all this to her? Could I have? What I do grows out of an entirely different theory of knowledge - would she have been willing to make the mental leap necessary to understand? Or was it my job to make it understandable?

I also need to acknowledge, however, my tendency to advance beyond the basics before the basics are actually in place, and to reign in that tendency.

I was roundly criticised for standing at the front and talking for long periods when I'm teaching. I would agree that this is an inappropriate strategy for most of the time in classrooms, but would make two points:

First, I rarely if ever lecture: when I'm standing at the front it's to convene and focus student discussion, take student experiences and ideas and mold them into new understandings. I'm not really sure how it's possible to explain the ways in which science makes sense of the world without taking some form of verbal leadership in the room. But I can tend to do this too much, partly because:

Second, I felt that most of the activities Carolyn set concentrated excessively on individual written work, sometimes followed by some group work. Strategies such as 'structured overviews' of text segments seemed to require huge slabs of time for very limited dividends in terms of student learning, and to be too individualised. They do serve the positive purpose of challenging students who are weak in written literacy, but can also serve to alienate such students if they're over-used: students also need opportunities to interact socially and verbally. Another problem for all concerned is the shifting set of expectations we've had to deal with. I expected to be supporting Carolyn to take on more and more of a science teaching role, while my

own teaching moved into other, more integrated areas. Partly because I hadn't supported her, and partly because she expected me to continue to act as the 'science expert', this hadn't happened, and our conflicting expectations had caused friction. The resolution of this meeting, therefore, was that the science time become more fully my domain, and at the same time more fully science oriented, and that Carolyn take a support role while I take a leading role during this time. In terms of the philosophy of the school, this seems like a bit of a retrograde step, but there are also the constraints of my time in the classroom acting as a distorting pressure against fuller integration. So I'll make the running for those five periods each week, and also try to make clearer where we're running to.

Another problem of expectations was my cross-team role: partly because I was over-loaded already, but also because I had felt 'squeezed out' by most of the team members (not in any negative sense - they were simply self-sufficient), this role had evolved to the point where I felt my only real role was in Carolyn's classroom. Given this, Etta's expectations of a significant amount of help with science were very uncomfortable - I wanted to support her, but it would be a huge extra commitment to a whole new syllabus area, and if I did that something else would have to give. We decided that I would focus on the role working with Carolyn, rather than trying to do too much and doing it all badly. I will no longer attend the Monday team meetings. This will significantly improve my time management situation and make life much easier. The challenge is to use that time to improve what I'm doing in the school, rather than on academic work or other things.

I feel that, having sat down and honestly communicated some of these expectations and ideas, I'm in a position to fulfill Carolyn's expectations of me much better, and I'm going to make every effort to do that. But I also believe she needs to accept my expertise, and realise that science teaching is a different activity from English teaching: not only the content, but the pedagogy is necessarily different. I need to accommodate my teaching to her style, but she needs to appreciate that I can't, and

shouldn't, teach exactly as she does.

Where we go from here is partly mapped out, but also a little mysterious. I'm going to really make a sustained effort to be reliable, and will try to address some of the space concerns, get organised for materials and produce many more worksheets and written materials. I'll never touch the computer, never take a novel to class, walk around lots, be assertive... I'll try harder to be a 'real teacher'.

Happy Endings?

Believe those who are seeking the truth - doubt those who find it

Andre Gide

And ye shall know the truth,
and the truth shall make you free

John 8:32

The blocks to the school's vision for reform, caused by two of Arcadia's Curriculum Consultants, have been partly solved. Fred Simmons, the Science Curriculum Consultant, has taken the second half of the year off on long service leave. He's been replaced by a new person in that role who seems to remove all the blocks I'd identified earlier, as well as to provide some positive benefits to the school. Darshan Vijaya is right up to speed on the requirements of teaching science in an integrated way. He doesn't insist on content as an end in itself, but on relevant, manageable, interesting science lessons for all. He's much more personable than Fred, but beyond that Darshan is really keen to help and be involved with the teachers and to support them in their science teaching. He's really revitalised the science program in the school - this is interesting: to what extent do single committed, capable individuals have a dramatic effect on a whole school?

The situation with Ellen Carver, the Technology Curriculum Consultant, hasn't resolved itself in the same way, but my involvement with the planning process in meetings has been reduced quite a bit, so her demands don't impact on me directly. She's also become an acting Deputy Principal this term, leaving the Technology planning to the much more flexible James. I suspect Andrew has also had some input in moderating the demands of the technology team on the teachers - at least, the Cowan teachers seem much more comfortable with technology, but I noticed that none of those creative projects they came up with ever got made by the students.

Cowan team seems to have developed its own uneasy equilibrium. Fiona is still the nominal leader, but the teachers usually look to Candace for leadership in any situation.

In team meetings, Fiona continues to hold the chair, and to plod through the agenda in her steady, focused but uninspiring manner. All around her the teachers play with allusions and meanings, and joke over her head and behind her back. She frowns when they become too rowdy, and they slump in their chairs for a few

minutes, then begin again. They'll challenge her and de-rail the train of procedure if it's an issue they care about enough, but basically they've stopped seeing the team meetings as an important part of their teaching and planning activity. It's become just another bureaucratic requirement that they have to attend, and the real planning and operation of the team happen elsewhere.

In recognition of this, the team meetings usually only run for about an hour of the two and a half hours available, then the teachers go to their own desks or form smaller sub-groups to carry out the actual planning work.

It all works, after a fashion, but it's a long way short of the ideals of teacher collaborative planning that were imagined by the developers of the school's program. The teachers who are new to Arcadia this year aren't being inducted into a culture of integrated curriculum by the more experienced teachers, and are tending to default back to a much more traditional teaching approach, with separate timetabled periods for different subjects. The necessary synergy - of culture, values and strategies - between the different facets of the reform package at Arcadia (portfolio culture, teacher collaborative planning and integrated curriculum) is simply not there in Cowan team. As a result the reforms are becoming untenable, and Cowan team is becoming more and more like a traditional high school.

Andrea is still a scary teacher, even if she's not hitting kids any more. She's improved in her preparation and her willingness to work with other teachers, but she still uses sarcasm and verbal abuse very regularly to keep order in the class, and the dislike she conveys so eloquently toward them is returned in spades. If she'd just leave it alone sometimes, just trust the kids and let them make some decisions, just refrain from labelling and name-calling and verbal savagery for a day, these students would love to work and learn and cooperate. They're not the smartest group of students in the school (although who can really say, if they're always labelled as dumb and lazy), but they really do have open hearts and a willingness to be persuaded.

In first term, Emma understood this, and she won them over. She visits the school now and then with her new baby, and the whole class crowds around her and tells her stories of what's happening in their lives, and begs her to come back soon.

But if you talk to Andrea, they're hopeless - disobedient, undisciplined and rebellious, don't have a brain between them: the sooner they leave school and get a job at McDonalds the better. And it's not only us she tells, it's the students.

Andrea is not a bad teacher generally. She's just a bad teacher in this context. She considers herself to be a teacher of senior school mathematics, and expects students to be capable, organised, focused and self-disciplined. With those students, she's kind, caring but no-nonsense. She knows her material, has a fund of resources and strategies, is confident and prepared. Andrea never wanted to come to Arcadia - it was the only job available, and she was the only qualified person available at the end of Term One. Her responses come from her fear and disorientation and desire to be somewhere else. I can understand all that intellectually, but viscerally I still want her out of the school - what effect is she having on the self-concept and love of learning of these 30 human beings? And can that damage *ever* be undone?

Talking to Candace about Andrea, and the different types and approaches of several of our colleagues, I ask, "Do we narrow the parameters of normality and say 'We will only allow these particular kinds of teachers...?'"

"Of course we do - but then again, you've got the accountability factor: you can't have people who don't teach particularly well, who refuse to teach, or can't handle the students, or are violent or whatever. And I think it's good that people are accountable for their actions."

"How is it measured though?" I ask, "Do you think the ways that accountability are measured now are appropriate, that they work?"

"No, I think we're gonna have to work on them, I really do. I think we've got a mismatched system. The kids don't know what the rules are, and I don't think the teachers know yet. I mean, I think I've got some direction, but I haven't changed my

teaching methods...”

I look at her in disbelief, and she explains that although the visible strategies in the classroom have changed to fit the Arcadia model and her different circumstances, the basic principles and beliefs she brings to her teaching are unchanged from her long and successful teaching career. She has always valued student’s responsibility for their own actions and behaviour, active learning and caring teaching, and still teaches that way.

“So what about the parents then...?”, I question Candace a few days later.

“Well, being a cynic, I think many of them would love to see the kids in little uniforms, boaters on their heads, going to school, sitting in straight lines, saying ‘yes ma’am, yes sir’, popping home, doing their homework, and aren’t I a good boy or girl. And that’s natural... I think they want to see that, they don’t want to see them coming out in sweatshirts and f’ing and b’ing and that sort of thing. They pre-empt what it should be, they have a view what it was in their day.”

“Yep. So to what extent are we reactive to that, and to what extent do we try and challenge it?”

“As a state school we’re very reactive, because (1) they’re voters, (2) they pay taxes, (3) they can chuck out the Education Minister... It’s higher level stuff: it all comes down to money and votes. I mean look at the heavy weather we went through in this school - community saying ‘Oh, you shouldn’t do this, you shouldn’t do that’ but I think we are winning the war. We lost the battle, to start with, because we really got known as unbelievably interesting things, including ‘the poofter school’, but, no, I think we’re winning the war, but the war is gonna take 20 years. It won’t change overnight.”

“Mmm, it’ll probably take until some of these kids are the parents.”

“Yeah, either that or you have a dramatic change and information technology comes through overnight. And that’s not gonna happen, even if the Premier says it is. But I really think that we are in a situation where we’ve got a foot in both camps.

Having said that, I think it's working here. I think the kids are far more responsible, far more good." And on that optimistic note Candace hurries off to class.

I'd hoped that our meeting last month would ease the pressure in Carolyn's room, and I tried to go back in with an open heart. But she seems determined that the relationship is to remain broken - we'll tolerate one another, but usually won't bother to be more than barely civil. That's a real pity, because the students naturally tend to take her attitude toward me to be her attitude toward science.

One morning I try to make the first move to change our armed truce. "At end of last term we had that meeting with Fiona and tried to sort our expectations out a bit. There were obviously things that I was being unprofessional about and I apologise for those, but a lot of it too was expectation problems. Every time you were doing a lesson I was cheering because I wanted to support you to teach science and you were spewing because you were thinking it was my responsibility to be doing it or something."

"Oh no, I wasn't spewing, it was more a case of 'I've got this science expert at the back of my class, watching a non science expert'. A lot of the time I felt like you were sitting there thinking, 'she's not talking about that, she's not talking about that'. But it does go back to expectations: I sort of expected more structure and support but then I got to the stage where I couldn't actually trust that it was going to happen. First term I felt fine with science," Carolyn comments, "because it was environmental biological science and I found that interesting, I could teach that with the resources that people shared around, but when it got to the chemistry, I was thinking, 'this is way past me'."

"Yeah, I think one of the things that was really unfortunate was that all my doctor's appointments were on Wednesday and so that really cut into things and then I didn't really cover those and say 'OK...here's some stuff to do'."

"Oh," she says, a bit grudgingly, "I mean that's fair enough, you had a broken leg..."

“Yeah, but in a way maybe that contributed to that feeling of not being able to rely on me to be there when I said I would be, and I guess that’s hard to reestablish...”

Alyx reported Shannon’s situation to the authorities, as she’s required to do by law in this state, and the step-brother has moved out of the house. Shannon is in counselling - she has a lot to grow through, but she’s started on the road.

“I’m a bit worried about her,” comments Alyx one afternoon after school. “She’s a lot happier in herself, and she’s slowly getting a less frightened look in her eyes, but she’s really starting to cling around me. She wants to talk to me every lunch time and stay in the room when the others go to LOTE, and just generally doesn’t want to be away from me. I wouldn’t mind, I guess - I mean she obviously needs someone - but I need time off from kids too, to do my planning and just unwind. The other kids have started to tease her about it too - I think they’re jealous of all the attention she’s getting, and they can’t know the reason.”

“Yeah, it’s hard, isn’t it? There was a kid at the school I taught at in Melbourne. He had cerebral palsy - his mind was fine, but he had to walk with crutches. He’d lived at home all his life, and his Italian mama had waited on him hand and foot and basically made him the centre of the world. He had no social skills whatsoever - expected everyone to treat him the same way Mama did. He sort of latched onto me, and followed me everywhere. The ticking of his crutches approaching started to turn up in my nightmares, like Captain Hook’s ticking crocodile!”

“What did you do?” Alyx asks.

“I sort of tried to gently disentangle myself, but someone with no social skills has no understanding of subtlety, and I really just didn’t have the heart to be as direct as I needed to be. So the situation basically just went on unresolved, and it stressed me out to the max. That should have been quite a fun year, but by the end of it I was just a ball of nerves. The sound of crutches still makes my stomach clench. I ended

up leaving the school at the end of that year - not for that reason, but it was a relief anyway to not have to solve it.”

“Yeah, it’s really hard to think about what’s best for her. She’s already been let down more than once, by her parents when they didn’t see what was happening and rescue her, and I don’t know whether she could handle being rejected - or what might feel like rejection. I don’t think she’s ready to just go off and be a ‘normal’ 14 year old either - she’s sort of missed out on making friends because she’s been too withdrawn, and now they’re all in their little groups.”

“I know, but you also sort of think ‘but she has to start making some new patterns’, you know? I mean, I’d be the last to tell someone to ‘just put it all behind you and get on with your life’ - I know that just hurts people more, ‘cos they don’t actually deal with anything. But if she starts seeing herself as a victim and stays an emotional convalescent all her life, that’s not gonna help her either. I really like the language of ‘survivors’ instead of ‘victims’ of incest - it’s more positive, and it suggests that, although it wasn’t your fault and there was nothing you could do at the time, you *can* go forward and make a new life, like survivors of any other disaster.”

“I’m really not sure what to do about the clinginess,” says Alyx, “I’ll probably just encourage her to go out at lunchtime and recess - even let her know that I need my private time too. But I’ll also really keep supporting her. She really is like a new kid though - instead of having her head down on the desk, she’s up, focused and listening. She won’t usually put her hand up, but if you ask her she’ll answer the questions, and she’s getting all her work done. I’m amazed at the difference, but I s’pose I shouldn’t be - I can’t imagine what her life was like before, and we were expecting her to cope with school as well. How many other kids in this school have stuff like that going on at home? And we just look at them the same as all the other kids.”

“Well, if the statistics are similar to most places - and they would be - in a school of nine hundred there’d be more than a hundred kids who are going through incest or some other kind of sexual or physical abuse. And that doesn’t include the places where home is just a war zone the whole time, or the parents are always drunk

or stoned. I reckon it's amazing that a lot of these kids even make it to school, let alone function."

"True - thank God Shannon at least has a bit more of a chance now."

If this sounds like a happy ending for Shannon, in a sense it is, but there's every chance Shannon will never be fully able to trust - that's been stolen from her, and can never really be given back. But if she can find the courage to love, and someone who will love her and be absolutely safe for her, she will, over many years, learn a new kind of trust.

Talking to Carolyn

I know it's hard to keep an open heart,
When even friends seem out to harm you

Guns 'n' Roses

Inhale - love of life
Exhale - fear of death

Rollins Band

Perfect love casts out fear

1 John 4:18

The school uses a form of portfolio assessment, where students choose samples of their own work to put together as a record and reflection of their learning progress in the school. This fits in with lots of the latest research and theory in learning, and is an important part of the school's package of reforms. As expected, parents aren't entirely comfortable with a system that doesn't yield a nice simple report card with As and Bs,

and of course Ds and Fs, for other people's children!

but the school's developers were committed to a program of parent education and liaison that would make parents more aware of the potential of portfolios and more supportive of the schools' program.

Except that now the students *aren't* choosing which items go in the portfolios. In response to school pressure to look good for parents, and to present a consistent assessment package across all students,

but weren't portfolios about individuality?

teachers are deciding which are, and are not, 'portfolio pieces'. Some teams have even developed checklists of items that must be in each student's portfolio before it goes home. Students are grudgingly allowed to add extra items of their own choosing, but only if they're of a quality that the teachers think will impress the parents.

Perhaps it's strange that public relations pressure should so successfully and completely undermine an assessment reform that has excellent educational grounds and the potential to yield real benefits for students in terms of the kinds of life-long learning, attitudes toward learning and 'learning how to learn' that the school so explicitly values.

Or perhaps not - as Candace said, parents are voters, the school's special funding and innovative structure depend on the government... What it basically comes down to is that the compromises that are made in order to be able to keep the innovative school open and functioning will tend to make it less and less innovative.

Right from the beginning, people have been saying "Give it ten years and it'll be just another state high school, same as all the rest." They cite the cases of two

other innovative schools that were established in this city ten years ago - and now are no different from any school in the state. I hadn't believed them, hadn't wanted to believe them, thought the commitment of the teachers and planners would make it different this time. But I'm starting to see what they meant.

Talking about Cowan Team, Carolyn says: "Looking back I think we've got a brilliant team of teachers. I mean, we had problems in the beginning, basically because we were given a team leader and then the team leader was taken away. And we had to cope with that, and then Fiona was so worried that she wasn't doing what she could do for us, that she was bringing problems on herself. But as soon as... I mean that day when we just pulled it all out on the table was just a revelation and it's been really cool since."

"Yeah, and I think that..." I try to phrase this carefully, "in a sense the meeting in the middle didn't change it back into a standard team, but it actually let everyone value the way it was already working."

"Yeah, it made us use the resources we had on hand, and I think Fiona could then go off happily, knowing that we were coping without her, which was a weight off her shoulders. And we weren't looking at her for things that she couldn't give us."

"And she wasn't expecting stuff of herself that she wasn't able to do either."

"So we just did it ourselves, and I think as a member of the team we've just been so lucky with the standard of professionalism in the group, and sharing resources, 'cos there's heaps of teams around the school who haven't given one worksheet and I think that's just so sad, because I mean my high school English teaching was a full on preparation with all the reading plus all the marking. And I've done less preparation work here than any school I've ever been in, and that's purely because I can rely on the other team members. I've done a lot of the English and SOSE type tasks and content here, whereas my maths in most cases was given to me, one off activities were given to me, we'd negotiate it and all that type of thing. Once

we sorted those problems out it worked really well.”

Something that's really forced itself on my attention this year is the role of trust and relationship in teaching. It's not really something teachers are ever told explicitly - some know it instinctively, a very few see it for themselves, and many will just never understand.

The change in Simon across the year has been just phenomenal. He began with Emma in Term One. They struck some sparks off each other, and had their conflicts, but the conflicts were resolved and the relationship was built, and by the end of the term they had a real mutual respect and liking that meant Simon was working to all of his considerable potential, and was allowed to keep his dignity.

Then Emma left on maternity leave, and Andrea arrived in Cowan Two, and all hell broke loose! Andrea is a classic example of the authoritarian teacher - her will and her authority must be absolute in the classroom, and students must have no opinion that she doesn't give them, no idea that doesn't originate with her. Simon has plenty of ideas and plenty of opinions, and if the relationship is right he'll share them courteously and appropriately. Someone once said to me 'Small children rebel against authority, but teenagers rebel against relationship', and Simon is the embodiment of that truth. He has no problem with authority, within the context of a caring, respectful relationship, but arbitrary authority where no relationship exists will make him blow up. And when he goes, he goes spectacularly.

The conflict became so extreme - and it was so clear to Andrew and Fiona that it wasn't all Simon's problem - that he was moved to Candace's class. Candace has an absolute genius for establishing trusting relationships with difficult boys, and Simon became a different kid. For the remainder of the year he was focused, respectful and very capable in his work - his relationship with me, too, was productive and great.

Tony, in Carolyn's class, is a different kid. He's one of those great, sullen, testosterone-sodden lumps of boys, and he's never going to be the star student that

Simon will be. There's plenty of involvement in the school from home, but it's usually to insist that teachers are picking on poor Anthony, and he really shouldn't be suspended for thumping that kid half his size. But for all that, or perhaps because of it, Tony basically just wants to be trusted and expected to do the right thing. It seems as though there are no positive expectations of him at home, and certainly Carolyn has expected - and received - the worst from him all year. That's why I was so *angry* when Carolyn came in and destroyed the fragile trust and beginning relationship I was working on with Tony. Because, you see, I had seen the power of trust in Candace's and Alyx' classrooms, and I wanted to try to give Tony the same sort of chance to succeed. I'd always believed that a person's final destination in life was a product of their own choices, and I guess I still do, but I'm also coming more and more to see the power of a great teacher (and a not-so-great one) to change the direction of a young person's life. It's a scary responsibility.

Confession is good for the soul. I keep repeating this mantra as I'm 'falling on my sword' with Carolyn. I'm taking more of the blame than I think is really my share, because it seems politic and because I want her to talk about her perspective. It doesn't make it much more fun.

"I think probably one of the problems was that my expectations of all you teachers were too high. I was trying to support you at a really high level of integrating science with other learning areas, exploring the nature of science and stuff like that when I should have been supporting you at the level of 'OK, here's how we teach science' and the content support."

"I think I've got the teaching skills to get the content across," she says, "but I think that sometimes... the ethos of the school is skills and process, not content, and I think sometimes we got so bogged down in content that we weren't teaching the skills that go with science. Things like we've had a whole year of science and the kids haven't done a scientific report."

Rubbish, they did several formal reports in the chemistry section in Term

Two.

“Maybe my science experience was different,” Carolyn continues, “but we were given a task to do and we’d go and set up the equipment. Maybe this is a bit advanced for Year Eights but they have all the skills of doing the equipment, and so to me to make them independent we need to say... ‘OK this is what you’ve got to prove, here’s a suggestion how to prove it, go and do it and then write up the reports’.”

What can I say to that? It’s just so far removed from what I’ve been trying to achieve all year! At least now I realise why she thinks I’m not a ‘whiz-bang science teacher’!

“Yeah,” I reply, “so I think my expectation was too high. I was saying ‘these traditional lab reports are sort of bottom line and then you extend’ but I hadn’t...”

“Yes, you actually have to start at the beginning, I mean you’ve got to know the rules before you break them, and I think that was one of the big problems. The kids that are really into science coped, but the ones who weren’t scientifically minded or academically achieving needed that more grass roots stuff. Just simple things: one of the activities that they really, really enjoyed was when they got into groups to summarise a chapter of the book...”

As I recall, the students absolutely detested that activity, which took about 10 class hours and involved laboriously summarising the words and copying the diagrams of a chapter of the text book on fungi and algae. By the end of it they had some elaborate written summaries, and not a new piece of information in their heads - certainly no new schemes for looking at the plants around them.

“...and we were doing conifers and fungi and stuff like that. Now, they still got the content, but they learnt the skills of working in a group, coming up with the diagramming, actually coming up with a page of notes, and they loved it. It was keeping in all the literacy and literacy skills, group skills, but using a science content, and that type of thing I would have used more myself.”

“Yeah, I think some of the things that I did, as you have pointed out before,
ad nauseum

also were often too talky. Because I was coming in for that short period of time and it was hard to link in with things that were going on, and maybe I should have been making myself available so that we could talk more during the week and get things linked together. 'Cos I think there were lots of things that we could have done in this communication stuff in the last term that would have linked in better with what was going on in the rest of the week."

"I think there was lot of potential there and we just missed it. I mean my attitude to science wasn't that crash-hot to start with - I haven't had positive scientific experiences in my schooling - but from Day One, when we sat here and had our first team meeting, and Fiona said, 'Who'd like a science specialist doing his PhD...?' I was like 'YES!' and my expectation was, this guy was really gonna come in and help...but again, that's going back to expectations isn't it?"

"That's the kind of expectations that we should have got clearer at the start, and it's really unfortunate that it took as long as it did and as much frustration as it did to get to that point. But that's something we've both learned, that maybe we need to challenge those things really early..."

"I think one of the reasons I didn't bring it up to start with," says Carolyn, "was that I just kept looking at you as the expert, thinking, 'I'm not the expert here'. I think maybe it was my self-concept - 'I'm no science teacher, this guy is... so therefore trust his judgment'."

"Where it might have been better to trust your own educational judgment and say, 'There are problems here...' But then again, would I have heard? At that point - I don't know..."

"Have you thought any more about who we might choose as examiners for your thesis?" asks Peter, at our weekly meeting one warm Thursday afternoon.

"I'm still thinking at this stage, I guess..."

...but it'll be a pretty important decision. At Melbourne Uni when I did my Masters, students didn't have any say in who the examiners were, and one of the examiners

my supervisor chose was just totally wrong for the study. I'd tried to do something pretty innovative, by presenting two cycles of my action research into my own teaching practice in a narrative way - something like the people at Bath are doing. One of the two examiners wanted to pass the thesis with credit, the other wanted to fail it. I ended up re-writing the thesis from scratch, in a much more formal structure - so I effectively wrote two complete M.Ed. theses. It was a really useful thing to do, because it gave me great experience in two writing styles and approaches, but I don't want to repeat it, thanks very much!

"I guess it comes down to choosing someone who's working in a similar paradigm," comments Peter, "and also I think you'll need to make your standards for judging your own work really explicit."

"That's what the first part of the thesis is for. In one way it'd be nice to just write a 'real novel', but to me that's not a science education Ph.D. thesis, that's a novel. For the purpose that this is being written, I think it's essential to be very up front about the standards I use to judge the quality of the research. That way even if the examiners use different standards for their own work, hopefully they'll be able to get out of their own box enough to look at where my approach parallels theirs and where it diverges, and be able to judge the quality of the standards themselves, then use them to judge the research."

"Jack Whitehead and the group at Bath have been looking at 'values as standards' - do you see that as a related approach?"

"Yeah, very much so. I guess I basically went into the school this year with a set of educational values and commitments that I thought I shared with the teachers at Arcadia. I wanted to explore how those values could be embodied in my teaching and the practice of the other teachers. I think it's also related to Jack's idea of a 'living contradiction' though - it's saying 'I have all these values, but they're not always embodied in my practice - why not? And what can I do to change that?'"

"That's *what* you were interested in studying," Peter asks, "but is it also your methodology - *how* you intend to study those questions?"

"Yes, I think it is. There has to be a synergy or a connectedness between the

what and the how. I really like Frederick Steier's idea that in a constructivist approach, teaching, learning and research merge to become collaborative social learning, and that's how I'm thinking about it."

"I think another conceptual lens that can be applied to the whole thing is some of the work Ken Tobin and Cam McRobbie have been doing on 'constraints to reform'." Peter continues, "Teachers usually identify the reasons why they can't put their values into practice - why they remain in living contradiction, if you prefer that term - in terms of 'them'; of systemic constraints and pressures from administrators, the department, parents... But some of Ken's work is saying that it's much more often related to the attitudes and expectations of students and teachers and, from what you've said, that's what seems to be emerging at Arcadia too."

"OK, so possibly Jack and Ken could be on the shortlist of examiners, if they're looking at similar things in similar ways."

"Have you thought about Penny Gilmer as another one? She'll be examining Mark Williams' thesis soon."

"I don't think I've met Penny, who is she?"

"She's a professor of chemistry at Florida State who is also pretty heavily into science education - you'll probably meet her at NARST or AERA next year. She's interested in middle and secondary school science education, and I think she'd be quite open to the kind of things you're trying to do."

"Yeah, well I think my approach is probably a bit *less* left-field than Mark's in some ways - perhaps because it's more explicit - so it'll be interesting to see how his thesis is accepted."

Paul said "Three things remain: faith, hope and love, and the greatest of these is love." He also said "Love is patient, love is kind. It's not envious, it doesn't boast, it isn't proud.

I really can't stand the way Carolyn thinks her way of teaching is the best, so much better than mine.

It isn't rude or self-seeking, it isn't easily angered, it keeps no record of wrongs.

Yeah, poor old Tony - Carolyn keeps bringing up that time he swore at her in first term, over and over again. And she goes off her head for the tiniest things!

Love does not delight in evil but rejoices with the truth. It always protects, always trusts, always hopes, always perseveres.

Talk about always trusting. If she'd show just that tiny bit of extra trust in these kids - the kind of trust I was trying to show them... And persevere a bit, and hope for the best instead of always expecting the worst.

Love never fails.

I hate to say it, but I really think Carolyn's a bit of a failure when it comes to loving the kids - and loving me too for that matter. It's kind of sad really...

And then Jesus says "We're not talking about Carolyn here, David, we're talking about you."

Oh.

Of Nurture and Curriculum

Too much love will kill you,
Just as sure as none at all

Queen

It's the most beautiful spring morning we've had so far this year. The winter rains finished late this year, and it's been cold and miserable for so many months that we decide to leave behind the smells of damp clothes and microwaved lunches and air that's been through too many bodies, and talk on the lawn.

It's another School Development Day, and in the pause between the arranged activities Carolyn, Alyx, Andrea and Candace have agreed to talk with me and each other about the impact my presence in their classrooms has had on their teaching and their students' learning.

They're not particularly keen, but I think each teacher realises that this is part of the price they pay for the science support I've given them through the year. I've tried not to present it that way, but in a way I'm pleased that the sense of obligation is in that direction - I'd hate to be asking any of these busy professionals for some of their time at this stage of the year if I hadn't already given each of them forty to two hundred hours of mine.

"I'm gonna throw a question at you while you're questioning us," begins Candace with a grin. "Did you feel that you had equal rights in the classroom with me and the kids?"

"I think so, yeah. In fact it was sometimes comfortable for me to be able to say 'Go and ask the boss' to the kids, because I do see the room as your place and the class as your group, and I try to honour that. I also felt trust from you, though: whatever I chose to do, you trusted that I had good educational reasons for doing it, and supported me."

I don't mention it now, and don't even follow it up with a look, but this basically is a cheap shot at Carolyn, who didn't trust me in the same way. If a teacher passed by the classroom door and saw what we were doing, then later said to her 'That's not Year Eight science, it's Year Nine', she'd always assume that person was right and I was wrong - context notwithstanding. But I'm gonna make a real effort to stop bitching about Carolyn, starting right now. I think we all know that a fair bit of the problem was mine - and are smart enough to know which bits weren't.

“One of the things I was really hoping to achieve here this year - one way I want to measure whether what I’ve done has been successful - was to support you guys in starting to teach science yourselves, so that next year, when I’m sitting at home writing my thesis and you’re still here teaching, you feel much more confident about teaching science. Do you think you will?”

Alyx is the first to speak. She’s very confident in her opinions, and by no means shy. “I feel much more confident. I’ll probably use Darshan’s replacement much more too. I thought I knew it all from my science background but I don’t - it’s all very well having the science knowledge but knowing how to teach it is a different thing. I’ll probably look toward that person for more chemistry based and physics based stuff.”

Alyx thinks for a moment. “In starting off here I probably should have just stuck with primary science and done some simple stuff, but there are so many tantalising offers here and you think ‘Oh yeah, I’ll try that...’. I think I did a lot of things in a mediocre way rather than a few things well. I felt I really didn’t do a good job with science, in fact for the first six months I didn’t feel I was doing a good job here at all, in anything...”

“That’s interesting to hear,” I say, “because from my perspective you’re one of the people who’s jumped onto integration best...”

“Gosh,” she gasps, and I can see she’s genuinely surprised, as well as pleased.

“I could see that you were struggling with it,” I continue, “but you were really making progress, and at the end of the year I think you’ve really got it together quite well.”

“Thanks. Well, I suppose I did, ‘cos we used Waterdeep across the SOSE and language and the environment and the whole bit, and maths.”

“What about the rest of you?” I encourage the group, “Do you think you’ll be confident to teach science next year?”

“Absolutely!” says Candace, “but I still think I’m going to need expert advice

now and then. At least now I know where to go, where to look it up, how to form it, how to use a lab, how to get the information to do the experiments, but I think I need someone with science teaching expertise to bounce ideas off in order to actually integrate them. I really fear, because it's my weaker subject, that I'll tend to go to the safety net of 'Here's the experiment, do it'..."

"Well," interrupts Andrea, "I think it's the science teaching base, as much as anything else."

"Yes it is..." Candace continues, "without that scaffolding, people who aren't science based are all going to have difficulties. There are certain things you can do, but for example I don't know exactly what level I should go to with Year Eights, what they need for Year Nine, what they need for Year Ten, and..."

"There's an idea that Lee Shulman uses," I say. "He talks about pedagogical knowledge - general generic knowledge about how to teach, and obviously all of you have heaps of that. Content knowledge about science - not so much, but you know where you can find it, and Darshan can help you. But then he talks about pedagogical content knowledge - knowing how to teach science specifically, and that's probably where you feel..."

"Yes, I do anyway," says Carolyn. "It's not just to know a particular scientific concept yourself, but to get it over to the kids in the right way, shape and form. I don't have that knowledge, and I haven't got three or four years to spend going back and getting it."

Treading carefully, I ask, "So, is that maybe a weakness of the Arcadia middle school model? That all the teachers have that problem in the areas where they're not specialists? I'd have the same concerns if I came here and had to teach SOSE, for example."

"Yes, I think it is," says Alyx, "I know Year Eight science hasn't been done particularly well in certain blocks, simply because they don't have that base."

"Different teachers have picked it up and run with it differently, though, based on their personalities and their backgrounds - I mean Alyx, you've really taken it, but you already had quite a strong science interest. Candace and Andrea sort of

had each other to work with, as well as me, and the situation's a bit different in your room, Carolyn, because I'm there for that extra time."

"There are certain benefits that are claimed for this school, do you think they're there, and are they sufficient to make up for how damn hard it is?"

The teachers pause for a long time to think about this one. "Gosh, I don't know," says Alyx. "I think there are great things being trialed here. I think, for me, there's too much going on, and I don't think the advantages are outweighing the disadvantages right now. I think that there'll come a time - when the Year Tens, Elevens and Twelves have settled down - we'll have some sort of feel to the school where everything will start to come into place."

"Yeah, the teaching load and the sheer volume of work and preparation and marking are huge," says Andrea. "You're trying to teach high school students in about five learning areas at once, and you're not confident in some of them, and we're also trialing the Student Outcome Statements assessment approach across all eight learning areas - to teach here, you basically don't have a life outside school time, if you want to do it properly."

"OK, the disadvantages outweigh the advantages for teachers," I say, "what about for the kids?"

"Phew, I don't know," puts in Alyx. "In the long run - no, I don't think so. If you have good teachers at a good school, I think Year Sevens get as much, if not more. Because there's a gentleness about primary schools that this school doesn't have, and I feel it's more nurturing at primary schools - this school is quite difficult and hard."

"I think kids - especially my class, 'cos I was feeling stress and pressure," says Candace, "these kids would go home with stress just like I was - their mum or dad would come up and tell me."

I persist with the question, because I think it's fundamental to what all of us have spent this year trying to do. I also think this is in some ways the acid test of a

number of things to which I'm committed as desirable reforms in science education - constructivist teaching, integrated curriculum, portfolio assessment. Can these teachers really be saying that the grand experiment is failing?

"Once the thing finally settles down? Because at the moment you've got kids and teachers trying to re-acclurate, you've got a clash between primary and secondary cultures and all those things. Do you think maybe once it's all settled down and locked in place that it might have some..."

"I think it will be better," concedes Alyx. "I'm a nurturer and I still think there's room for more nurturing throughout the whole school, and more care. I think curriculum's one thing and going headlong into things and having these great evaluations is one thing but I still think there's lots of room for care that I don't see happening here."

"Why do you think that is?" I ask "I think that would be something that they'd value, that the people who set the school up would have wanted to be happening. Why do you think it's not? Just too much stress on the curriculum stuff?"

"Yeah, I think so," puts in Candace, "I think the school's driven towards that, and the teachers are sort of on the edge because all the pressure that goes with that."

"And also," interrupts Alyx, "those things can be evaluated in a tangible way - you can see it on paper. Nurturing stuff... you only see it in the eyes of people and their hair looking shabby, and the amount of sick days people take... but I think that's probably one of the most important things."

"What about nurture for teachers as well?" I ask, "Do you find the team helps with that, or...?"

"Yeah, I do. More than any other group of people at the school, I think the team has a role in supporting teachers. In some ways Cowan has worked in spite of the formal team structure, not because of it, but I think we have supported each other."

"I think what helps is when you finally realise that you're not alone," says Carolyn, "that there are people who are feeling exactly the same way but no-one voices it. If you're going down in a screaming heap there are about three of you who

are down there picking yourselves up.”

“Yeah, that tends to help I guess. Do you find the team itself tends to focus on curriculum stuff rather than nurture and support of teachers?”

“In the beginning we did,” says Candace.

“Yeah, I guess it depends on the team as well,” says Andrea.

“I was pretty happy with Cowan Team,” says Alyx. “We had a few little niggles but that’s OK. I think at this school you have to maintain a lot of your own esteem - you can rely on the team for so much but you can’t rely on it for everything. You have to delve into unknown strengths that you never knew you had, and get it all out, but I think they’re there to support you and everything.”

“As far as the students went, Carolyn, what do you reckon? I mean obviously, Friday afternoon wasn’t that much fun

the preceding Friday, the atmosphere in Carolyn’s room had been bitter and hostile, both from the students toward her and from her to the students

and I actually got some of the snarls when you went out of the room, they had a growl... Given a couple of weeks to chill out after school finishes, what do you think they’ll make of their year?”

Carolyn immediately assumes I’m talking about science, though in fact it was her maths teaching and general approach they were growling about.

“Well, Tony, on his review sheet for the year, put the highlight down as ‘Science with Mr Geelan’, and that’s a nice comment. But in one of the discussions we had last week, they wanted to know how Year Nine was structured, and I said, ‘basically you’ve got your home room, you’ve got your two teachers, you’ve got your teacher for English and SOSE and your teacher for science and maths’, and they sort of went ‘Aw, do we have to do science?’ I just said you need to take next year’s science as a completely different concept from this year’s science. And I said, ‘whether you enjoyed this year’s science or you didn’t, don’t let that cloud your view of science in general. You might latch onto some yahoo, wonderful science teacher

and it'll all come alive for you'."

Well thanks, Carolyn!

I think the kids saw it as 'OK guys, put away your books, now we have to do science', because it was one of the only things that was locked in on the timetable. I think some of the little funny comments they used to make in their journals were quite indicative of how they felt about it, people like Josh who, every single science journal entry he put was 'ho hum, science again', whereas he's very easy to motivate, to get going. Therese and Debbie used to like science because they could argue among themselves about things. Which is fair enough, it's a good point, but when it came to content they weren't really that interested."

Alyx adds, "I think my kids felt science was too much talk. They wanted more fun, more change, more hands-on - like all kids do - they want more experiments, more time in the lab. And yeah, I think less teacher talk... which is probably totally against what we were doing with Waterdeep, because we really had to provide information and ideas there..."

"Yeah," I interrupt, "if the school had more resources - either library access or computers with Web access - we could have got the kids to find a lot of that for themselves, but as it was..."

"But then again," Alyx says, "in the student evaluation that went home with their portfolios, Kyle loved Waterdeep, loved talking about it and listening to it. That just blew my mind, that he was so keen on that stuff that was so much talk."

"I guess we started off with the idea of maybe doing some other stuff and integrating and whatever," I remind Carolyn, "but for some reason it just ended up being this long haul of science each week."

"We tried, especially with that environmental stuff we did quite a bit of other stuff linked around it, but I think that's because I was from a position of strength - I sort of semi-knew what I was talking about. Sometimes I couldn't see the links between the content and the module that we were doing. First term was the

environment stuff which was good, and then there was that space stuff, which again the kids really enjoyed, and I could see the links there, but after that, I couldn't see..."

"Yeah, I think one of the problems a lot of people have noticed this year is that the modules are all on very similar topics. The science that best relates to the topics is really environmental science the whole year, and you can't do that, so yeah, it does get fairly tenuous at some stages. And in fact I think it got so tenuous that it broke and there really wasn't a link between the science and the other stuff."

"See I think the whole school needs to consider that. I mean sure, you can integrate like, literacy and science and social science, but you can't go for broke and say 'integrate everything', because I mean, occasionally you might integrate maths with something else, but it's a separate subject and it needs to be..."

"And the links become so long and so tenuous that the kids are going 'Oh bullshit...'"

"Yeah, exactly."

I presented a paper at a local science education conference this month - it was called 'Anyone can teach science'. I was trying to organise for myself, and hopefully for the teachers and researchers at the conference, how I felt about the teachers with whom I was working at Arcadia, as science teachers. None of them have any formal training in either science or science teaching, and in talking to them I found that several expressed misgivings about the Arcadia middle schooling model that required them to teach science. That's one of the reasons the study took the shape it did - I was responding to these teachers' perceived inadequacy in teaching science.

Most research that has looked at this issue - what a teacher needs in order to be a science teacher - has concentrated on knowledge of science: science content, 'facts' and information and skills. I certainly observed any number of howling factual errors and misconceptions from the teachers I worked with, and if I hadn't been in the room these would have been transmitted to the students uncorrected.

They frequently were anyway - there are only so many times you can correct a person publicly without undermining them totally

But there are at least two other ways to look at what science teachers need. One is provided by Lee Shulman's handy scheme, dividing what teachers know into 'content knowledge' - the scientific information to be taught, 'pedagogical knowledge' - generic knowledge and skill about teaching in general, and 'pedagogical content knowledge' - specific skills, strategies, ideas and information required to teach particular content, in this case science. I would argue that all the teachers I worked with, possibly excepting Robyn, possessed adequate (in some cases excellent) pedagogical knowledge. Teachers go looking for content knowledge in books and CD-ROMs and by asking colleagues and... But several of the teachers expressed their own lack of pedagogical content knowledge in the area of science

and those who didn't express it probably demonstrated an even greater lack!

The second way of looking at what teachers need is really what got me into trouble in the school. Recent theories in science education, particularly those that take constructivism as a referent, have tended to devalue the learning of science 'facts', and to value students' individual and social construction of knowledge and sense-making schemes, based on their laboratory and out of school experiences. At Arcadia, too, teachers were encouraged to integrate science with the other learning areas. Because having a large body of 'content knowledge' is devalued, this perspective has tended to encourage the idea in some quarters that 'anyone can teach science' - you don't need to be a science specialist. But I'd argue that this kind of teaching requires, not less knowledge of science, but more: social constructivist learning approaches and curricular integration go well beyond the knowledge of facts, to a really quite sophisticated understanding of the nature of science and science education. I know that I really only developed such an understanding (if indeed I have it!) during my M.Ed. studies, after completing a science degree and then spending several years teaching science. I tried to support and encourage the teachers I was working with to teach and understand science in these ways, but their own perception of their need - and therefore of my role - was in content knowledge.

They saw me as a provider of 'facts' and 'resources', I saw myself as a model for more constructivist modes of science education. The conflict was fundamental.

Goodbye, Farewell and Amen

Having cast one manuscript into the seas of time, I now begin again. Surely it is absurd; but I am not - I will not be - so absurd myself as to suppose that this will ever find a reader, even in me. Let me describe then, to no one and nothing, just who I am and what it is that I have done...

Gene Wolfe, *The Urth of the New Sun*

“I think it’d be fascinating,” says Candace, “to take what we’ve learnt and then introduce negotiated curriculum. That would be the next logical step, because these kids are used to working in this form. You could say ‘Hey, we’ve got this to learn, these are the skills in science that you have to learn’, and then sort of bring them into the discussion and build ...”

“Yeah, negotiation’s something I’ve been thinking about. Is that something you have to build up to? You almost have to give them skills in negotiation...”

“Oh, I’ve learnt that to my cost, last year. You can’t just go in and say ‘Hey kids, let’s negotiate!’ I did it, Bean and Brodhagen method, right down the line, exactly what they said to do - and it didn’t work. You have to skill-base kids before you can use the skill in order for them to skill themselves.”

I had hoped to be able to introduce negotiation with students this year: it was one of the educational values with which I’d come into the school all those months ago. Why did it become impossible, in even the best and most positive of the five classrooms, in a school that was apparently set up with it as a key goal, to do this simple thing: to invite the students to take some sort of active role in choosing what they are to learn, and the activities they’ll be involved in?

Perhaps Alyx was right - there’s just too much going on here, too many changes of roles and expectations that are mandated by the program of the school. These all need to be *imposed* on students if anything at all is to happen in the classroom that’s different from what teachers and students expect. Schools have spent the last six or seven years *schooling*

Great story from Ivan Illich about the genesis of his whole ‘deschooling society’ approach. After a lecture once, Illich was talking to some students, and one of them said ‘yep, no doubt about it, schools are made to screw you’. Illich misheard him as saying ‘school you’, and a movement was born. But I still hear the other way as a faint resonance in the background

these students in the gentle arts of passive acceptance - and perhaps in spite of our

best intentions to encourage their active involvement, all we've really succeeded in doing is having them passively accept some different structures.

Perhaps the teachers themselves were in a process of change. They, too, have a long history, both as learners and teachers, of being subject to particular educational roles and practices. Some of them - Andrea and Carolyn spring to mind - do not see themselves as living contradictions, because their own educational values and beliefs line up quite closely with traditional models and approaches. Any contradiction they've felt has been in the area of new strategies and structures required by the reform-minded founders of the Arcadia model, that are dissonant from Andrea and Carolyn's own

dominant culture, received interpretation

assumptions. But even the teachers - like Alyx and Candace - whose values and beliefs are most closely aligned with that amorphous creature, the 'Arcadia vision', have had to struggle mightily against their own histories as teachers and learners. The constraints teachers feel are often identified as originating in 'the system', but those who are becoming more critical are beginning to see and accept that the greatest constraints we face come from what we know and who we are.

And I hope I'm critically reflective enough to understand that this applies most strongly to myself - what stands in my way, most days, wears David's face

Perhaps too, though, the students' assumptions and beliefs and expectations and roles

which often reflect those of parents, peers and the broader society

make change difficult. They have learned well the lessons of obedience and the loci of control: there is risk in change, and even more in fundamental changes of who teachers and students *are* in the classroom. The literature speaks facilely of 'active learners' and 'teachers as facilitators', as though the creation of the latter made the former axiomatic, but we are talking of human beings, and the causal links are far more complex and multiple than that.

And why *should* students change their learning roles and educational expectations? What value do *they* receive from becoming active learners? Because,

like it or not, believe in it or not, all these students are bound for the TER - except those who elect not to

and the system, and the teachers, and the parents, and the kids, see those as the failures

- and that's the ultimate norm-referenced test of passive acceptance: memorise this and learn to parrot this and to do this in exactly this way and you will be admitted and accepted

and loved.

All our liberal values and love of learning considered, it's still entirely possible that the Arcadia experiment is doing these kids a disservice in their preparedness for life in the arid market economy Australia is rapidly becoming, if it disadvantages them even one iota in their preparation for that great and fatal sieve at the end of Year Twelve.

I ask Andrea, who will be leaving Arcadia to return to the kind of school she knows and likes, "One of my aims was to support people to the point that they did feel confident teaching science. Do you think if you were staying here next year you'd feel more confident about teaching science, or would you still want some support?"

"I'd be more confident with Year Eight, especially experiments that don't involve lighting gas burners," she laughs. "But there are plenty of kids around who are happy to light the gas burners. I'd be more confident with Year Eight, but if I was taking Year Nine I'd have to have somebody like you come and help me again, 'cos I'd be in the same position, I wouldn't really be confident of the content. I feel that I need to prepare them well, and if I think I'm not preparing them well I get anxious, and it's not good for anybody, 'cos if I get anxious I'm not as... easy to get on with, and the kids suffer. They suffer both ways - one I don't know what I'm doing, and second, I'm a bit cross about the whole thing anyway."

Do I have enough material? The question keeps recurring as I approach the end of the year. The teaching has been important to me,

and to the teachers, and possibly even to the students!

I've learned heaps, maybe I've even grown up a little bit. But this - what I did at Arcadia this year - is mainly about earning my Ph.D. I don't think for a moment that I've been able to kid you, dear reader, that I went through all this stuff - the stress and hassle, the relationship breakdowns, the long trip to Arcadia two or three days a week, puffing and cursing my way around the school on crutches for half the year, all for no pay - just because I love teaching so much that I couldn't stay out of the classroom. At the end of this year, I have to take enough away with me from the school - in my head and my heart certainly, but also in my briefcase and folders and tape recorder and the little impressionist tales I wrote every time something interesting happened - so that I can sit down in 1997 and write me a Ph.D. thesis.

What are those rules for theses again? I have to demonstrate that I know my way around an area of knowledge,

well, I certainly know a hell of a lot more than I used to about philosophy and the history and philosophy of science and constructivism and postmodernism and educational theory and action research and praxis and critical theory and...

I have to make an original contribution to scholarship and I have to...

blast, what was that third thing? When all else fails, check the web site! It says "...a Doctoral degree shall be awarded for a thesis and/or other approved work which in the opinion of the examiners is a substantial original contribution to the knowledge or understanding of any field of study and which demonstrates the capacity of the student to carry out independent research."

As the end of the year approaches, I look at my collection of stories and think 'What if it's not enough?' - and how would I know? How can I measure that exact number and depth and quality of tales that will count as a 'substantial original contribution'? But all I can do is all I can do, so I pray that all I can do will be enough, and keep on teaching and learning and researching, all mushed up together.

There's so much I've learnt this year: now all I have to do is tell someone, in a way that's clear and interesting

and a substantial original contribution.

I see what I'm doing as being about contributing to understanding, rather than increasing the store of knowledge, at least if knowledge is imagined using substance metaphors. The ideas I want to present and represent aren't generally new - and I'm not sure any more that I believe there is anything new under the sun - but I hope the ways I represent them, and the human face the stories put on them, have challenged you and increased your understanding: of Arcadia, of education, of science education and of me.

At the end of the year, Carolyn asked me, "What was your research on again?"

I really didn't want to say anything about the fact that I was looking at teachers and teaching right then - our relationship was difficult enough. Perhaps I lied, a little.

"Um, Life, the Universe and Everything," I laughed. "I was looking at my own teaching, and at the values the school aims for: collaboration, student-centredness, life-long learning, all that good stuff. I was trying to understand, in a rich way, what things support those values and that kind of teaching, particularly in science teaching, and what hinders them."

"I think maybe the kids needed to know more about that. They knew that you were doing this research, but they didn't really know what you were looking for. Some of them came up to me and asked about it, and I told them to ask you. But I think it made them uncomfortable that you were observing them but they didn't know what you were observing..."

Last day of school. The final assembly has been dismissed, and the students have rushed off to their buses and bikes. I've said goodbye to all the teachers, and all the

students, and it's time to go home. My year in the school is finished, and I'm depressed. As I walk toward the car, I ask myself why. Is this just the usual end of year let down, when all the stress and pressure of the year that's been keeping me running lifts off, and my whole system slows down? It feels worse than that though - that feeling usually has some holiday elation and some satisfaction mixed up with it.

I think it's about broken relationship, for me. With Candace, Alyx, Fiona, Andrew and Colin I'll continue to be a friend, and I've already been invited back to the school next year to visit them. I doubt I'll ever see Andrea or Etta again, and that's probably a bit of a relief for both of us in Andrea's case. But it's the barely civil farewell and all the unresolved resentments with Carolyn that are weighting my steps on this final afternoon. There was so much I could have done better, if I'd had the will or the emotional energy or the love, but would it have made a difference? I don't know, and I'll probably never know.

I climb into the car with a sigh, and turn on the radio, and wind down the window to let out the blast of sunhot air that greeted me when I opened the door. And I make a determined effort to think about how it felt, standing by the ice rink this week, when Simon and Tony and Therese and Adrian and Louise and Josh and Sam and Emma came sliding to the wall and asked "Are you coming skating Mr Geelan?"

Section Three

Representing and Reflecting on My Understandings

Today we are trying to live ever closer to the lives about which we write. Many examples are available. Others are forthcoming that try to show not that we can live those lives, but that we have lived close enough to them to begin to understand how their worlds have been constructed... We care less about our 'objectivity' as scientists than we do about providing our readers with some powerful propositional, tacit, intuitive, emotional, historical, poetic and empathic experience of the Other via the texts we write.

Denzin & Lincoln, 1994, p. 582

Chapter Five

Tales of Different Kinds: Representing My Understandings

Introduction - Results?

Section One introduced the concerns, ideas and imperatives that shaped this teaching/learning/research project. Within that section, Chapter One presented an introduction to the personal and professional contexts, and to the concerns and research problems with which I began the study, including an outline of the three research questions. Chapter Two explored some research and theoretical perspectives related to teacher and student expectations, while Chapters Three and Four, respectively, presented critical introductions to, and syntheses of, ideas about (a) constructivism and the nature of science and (b) research methods, with a strong emphasis on their relevance to the educational purposes and values I have chosen for the study.

‘School Stories’, which makes up Section Two of this thesis, is the largest portion of the ‘results’ of the research. The woven-together impressionist tales that make up that ‘novel’ express most fully and richly the experiences and ideas that led to the development of new understandings and changed educational practices for me as a result of the teaching and research. ‘School Stories’ is also intended to be the most widely disseminated form in which the research is shared with other teachers and science educators.

There are other ways of representing these results, however, and also some other evidence that was gathered in the school, but cannot readily be represented in impressionist tales. This thesis - this *bricolage*, this woven net of different strands that is both a product and a part of my on-going teaching/learning/research journey - can be more complete if I choose more than one mode of representation. I have chosen to hold logic, dialectic and rhetoric in tension, and to choose as many different modes of rationality as I need to communicate the things I value. Section

Three, comprising Chapters Five, Six and Seven, constitutes a juxtaposition of other modes of representation and reflection with the tales that make up Section Two.

The current chapter is dedicated to pointing out and making explicit the relationship of the tales in 'School Stories' to the three research questions. In one sense the 'novel' should stand alone as a narrative of my own and others' secret, sacred and cover stories (Clandinin & Connelly, 1995). It is woven from the impressionist tales (Van Maanen, 1988) I wrote during my year in the school, supported (and sometimes challenged) by the survey results and interviews I conducted, and in that sense it contains all the 'results' of the research. In another sense, though, it is important to clarify the ways in which that text addresses the research questions, to show a little of how the net was woven and why it took the shapes and colours it did.

Narrative Nets

As I have noted in the introduction to this chapter, I am a little tentative about applying any level of analysis at all to the narratives presented in 'School Stories'. There is a feeling that they ought to speak for themselves and stand alone, and that any extra commentary from the author serves only to close the work to alternate readings and richer interpretations. Worse, the need for external commentary might suggest that the narrative has failed of its purpose - if it's necessary to explain a story, then perhaps the story itself is not very good.

While this might be a tempting position to take, I wish to suggest that such an approach would be valid only if 'School Stories' was intended as a purely literary work - a novel. It is, however, also intended to form part of my PhD dissertation in the field of science education, and so carries that extra - and probably distorting - weight of expectation. That is why I have repeatedly referred to 'School Stories' as a 'novel', using scare quotes to indicate the mixed intentions with which the work was written. In the formal context of a thesis, it is necessary for me to make clear

and explicit the connection between the research questions and the understandings reflected in the 'novel', for those who have the task of deciding whether I have demonstrated, in this written text, my competence and fitness to be admitted into a particular professional community.

For this reason, I use the three research questions to structure this section of the chapter.

1. *How and why do teachers' and students' established webs of expectations support and/or constrain constructivist-referenced curriculum innovation?*

This question can be broken down further into its component questions, which might be represented by a cube (see Figure One). The cube is bisected along one axis into 'How' and 'Why', along another into 'Teachers' and 'Students' and along the third into 'Support' and 'Constrain'. This leads to eight smaller cubes, which correspond to eight questions.

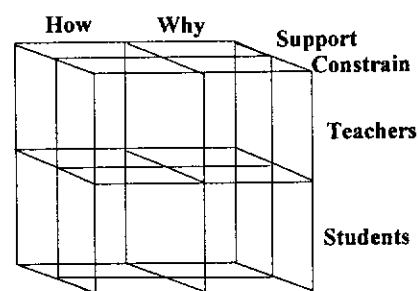


Figure One - Graphic representation of facets of the first research question

In actually addressing these questions, however, it is often difficult to clearly separate the 'how' and the 'why' components - certainly within the individual

narratives these occur together. For this reason I have chosen to address the following four facets of the first research question as ‘how and why’ questions. This makes possible a somewhat simpler two-dimensional representation of the question:

	Teachers	Students
Support	i. How and why do teachers’ established webs of expectations support constructivist-referenced curriculum innovation?	iii. How and why do students’ established webs of expectations support constructivist-referenced curriculum innovation?
Constrain	ii. How and why do teachers’ established webs of expectations constrain constructivist-referenced curriculum innovation?	iv. How and why do students’ established webs of expectations constrain constructivist-referenced curriculum innovation?

Table One - Facets of the first research question

- i. *How and why do teachers’ established webs of expectations support constructivist-referenced curriculum innovation?*

The story of the development of the Arcadia middle schooling approach (pp. 96-97) shows how visionary teachers like Andrew, the foundation principal at Arcadia, are able to take curricular and administrative leadership in ways that support constructivist-referenced approaches to learning. The consultative team that collaboratively developed the Arcadia program included academics and educational consultants as well as teachers, however I believe it was Andrew’s pedagogical concerns and leadership that most strongly supported the constructivist underpinnings of that program.

The successful implementation of these intentions, however, is dependent on all of the teachers in the school, and the tale of my discussion with Andrew about the

induction program for new Arcadia teachers in 1996 (pp. 108-110) indicates a potential problem. Andrew's intention, and the vision of the school planners, was that teachers would be supported and given the opportunity to move toward more constructivist-referenced modes of teaching, however in the hurry and complexity of school, it was already becoming clear by the second year of the school's operation that teachers would be, to some extent, left to 'sink or swim'. Were the curricular innovations, like portfolio assessment and integrated curriculum, sufficient to ensure constructivist-referenced teaching? Probably not, without a commitment and understanding on the part of individual teachers, and without some structured support for teachers new to the constructivist referent.

The tales of Candace that occur throughout 'School Stories' (pp. 87, 141-143, 162-164) indicate the importance of teachers' expectations of students. By expecting the best of students, she encouraged them to expect more of themselves, and to achieve better results in both their academic work and their behaviour and relationships with teachers and fellow students.

The tales of Alyx (pp. 107-108, 135, 147-148, 165-167, 180-184) indicate the importance of a teacher's expectations of herself. Alyx had a busy, emotionally draining and difficult year, but her students had a great year, and were probably in one of the classrooms at Arcadia that most fully embodied the 'Arcadia vision'. This was largely because Alyx expected excellence - and a strongly constructivist-referenced approach - from herself, and always worked extremely hard to ensure that her students received the best education possible.

ii. *How and why do teachers' established webs of expectations constrain constructivist-referenced curriculum innovation?*

Several tales address situations in which teachers' expectations constrained, or even actively militated against, the constructivist-referenced innovations at Arcadia. The

extent to which Fred, the Head of Science, saw science education as being about 'content lumps' (pp. 116-117) is a very clear instance of a situation where a teacher in a position of power, because of existing curricular assumptions, past experience and the 'subject maintenance' (Fensham, 1980) function of schooling was behaving in such a way as to constrain not only his own classroom teaching but that of others.

Similarly, the expectations of Ellen, the Head of Technology (pp. 128-129) - which were related to resources (and their scarcity), expertise (and who may claim it) and 'getting the work done' - acted to constrain the integrated, exciting, constructivist-referenced aspirations of the teachers in Cowan team. This occurred at a stage in the year when the new teachers were just beginning to explore the possibility of teaching in new ways, and thinking about teaching and learning in a more constructivist-referenced fashion, and may have acted to confirm their own expectations that 'it's a nice theory but it doesn't work in practice'.

The conflict between my expectations and Carolyn's (pp. 154-158) grew out of similar conflicts - she felt that what I was doing was too sloppy and informal, because I did not seem to value the highly regimented and 'cookbook' approach that she remembered from her own secondary school science education and would like to have seen in her classroom.

Carolyn's expectations about the necessity for preparing students for the final examinations which provide students with their Tertiary Entrance Rank (TER) at the end of Year Twelve (pp. 117-120) reflect an on-going concern of many of the teachers in the school. It seemed particularly that those teachers who were most comfortable with a traditional conception of schooling, and least comfortable with the innovations occurring at Arcadia, were also most concerned about preparation for the TER examinations.

From my own perspective, it is a pernicious myth, (and one that is increasingly pervasive in Australian education), that the central purpose of education is to serve

the function of selecting which students will succeed and which will fail in gaining places at university. Those teachers whose assumptions and epistemologies were more parallel with those of Andrew and the planners of the school (and with my own) were much less concerned - they believed that the benefits gained by students at Arcadia, in terms of generic skills in independent learning and literacy, outweighed any perceived weakening of the on-going project of cramming students full of disconnected factoids for examination regurgitation.

hmm, I think my bias might be showing!

This expectation - that students might be disadvantaged in the TER race by the innovations at Arcadia - represented a significant constraint on the reforms for both teachers and students.

In a more personal context, the tale of Carolyn's interaction with Tony (pp. 137-139) represents another way in which teachers' expectations can constrain innovation and learning. By expecting the worst of particular students, teachers can often create 'self-fulfilling prophecy' which, because of their actions and attitudes toward such students, causes the students to respond as expected. This tale is in direct contrast to those of Candace's relationship with Simon and Adrian (pp. 141-143) - again an instance of self-fulfilling prophecy, but in a situation where the teacher was open-hearted and courageous enough to expect the best from students who had often done their worst. Similarly, the contrast between the approaches of Andrea and Emma (pp. 171-172), and their consequences for classroom climate and student learning, illustrate the importance of these expectations on the part of teachers.

iii. How and why do students' established webs of expectations support constructivist-referenced curriculum innovation?

While, as I have indicated above, I believe Candace deserves much of the credit for raising the expectations of her students (pp. 141-143); those expectations - that learning is important and can be enjoyable, that their behaviour and learning are their own responsibility but that the teacher is ultimately accountable, that they deserve

to be treated with respect and courtesy and should treat others the same way - all act to support the curricular innovations at Arcadia and make them really work. When Adrian expects responsibility, courtesy and helpfulness from himself (a new experience for him), because Candace has demonstrated that she expects these qualities, that not only makes him more pleasant to be around and keeps him inside the classroom instead of in the hallway or principal's office, it also supports his engagement with his learning. The tale of Simon in Candace's class (p. 171) also illustrates the positive effect of student expectations on the innovations and on their learning. When trusted and able to trust, Simon expected a lot of both his teacher and himself. He took full advantage of the opportunities offered by the program at Arcadia, and achieved learning of a very high standard.

iv. How and why do students' established webs of expectations constrain constructivist-referenced curriculum innovation?

The problems that Robyn experienced with classroom management (pp. 110-111) may not seem relevant to the question of how student expectations constrained the constructivist-referenced curricular innovations at Arcadia, but I believe they are. These problems, as well as arising in the (un)suitability of Robyn's personality for teaching, arose from the expectation on the part of students that the classroom is an adversarial place, in which teacher and students pit their wits and wills against one another. The teacher is responsible for maintaining order and ensuring that learning occurs, while the students' role is to get away with as much misbehaviour as they can, and do as little work as possible. This situation, in other words, arises from the 'myth of hard control' (Taylor, 1996) - the teacher-centred approach that defines these adversarial roles for both teachers and students. Had the roles in the classroom been defined differently - as a collaboration, rather than a confrontation, between the intentions and needs of teachers and students - Robyn may well have been able to continue to teach, and the innovations would certainly have been more effective for all the teachers and students.

Similarly, when the teacher expects misbehaviour and a poor attitude from students (pp. 161-162), very often students will come to share those expectations of themselves. This in turn constrains their learning, in terms of the amount of effort they are willing to put into it, and in terms of their classroom behaviour.

The tale of Shannon (pp. 107-108, 147-148, 166-167) does not directly address the students' established expectations, but the many out-of-school factors that may impinge on students' classroom behaviours and achievement. The teachers, myself among them, tended to have the expectation that all students would be active and involved learners, and if they were not, to blame either the students or ourselves. Alyx, Shannon's teacher, looked in her own classroom practice for the source of Shannon's inability to be involved in her learning, and only later discovered that the source was outside her sphere of influence (except through reporting the abuse).

The expectations of parents, as conveyed to the school both directly and through the students, can also act to constrain innovation. The history of portfolio assessment at Arcadia (pp. 167-168) is one example of such constraint - the innovation started out being about getting away from the use of grades as a motivator, and about valuing the work students did in class, and about giving them a level of meta-understanding of their learning journey. Because portfolios had to go home to parents, however, and therefore had to give a 'good impression' of the school, teachers began exercising more and more control over the contents of portfolios, including more graded work - in effect, taking control of the portfolio, and therefore of the learners' representations of their own learning, back from students. What is not clear from the present study is the extent to which this resulted from an actual expectation on the part of parents, and the extent to which it was simply a result of teachers' construction of parents' expectations.

2. *How effectively can teachers with limited science backgrounds use constructivism as a referent to teach science in integrated middle school classrooms? What can be done to support such teachers?*

The tiny vignette of Carolyn's attitude to science (p. 135) was taken from a comment in an interview with the teacher on whom that character was predominantly based. It shows one weakness of this research question, in a sense, in that the question assumes that the teachers *want* to use constructivism as a referent for teaching science - or, indeed, want to teach science at all. Carolyn clearly did not, so it was very difficult, in team teaching with her, to get a sense of the extent to which her own antipathy for science was passed on to the students, and of how that undermined my attempts to teach in accordance with my constructivist perspective in that classroom.

The longer tale of Therese and Carolyn (pp.143-146) is more directly related to what I came to see as the key problem with trying to encourage and support teachers with limited science backgrounds to teach middle school science. The ways in which such teachers might be lacking in 'content knowledge' about science is one issue, and one that can perhaps be fairly readily addressed with in-service education. This tale, however, points up the gulf between my approach to, and understanding of, the nature of science and Carolyn's. This is not to suggest that I am right and she is wrong, but I would suggest that her epistemology and view of the nature of science, as exemplified in her interaction with Therese and throughout the year, is fundamentally incompatible with a constructivist-referenced teaching approach.

This conflict - not between my science knowledge and my colleagues' relative ignorance, but between competing epistemologies and ontologies - also appears in the 'resources' tale (pp. 150-151). What the teachers wanted and expected from me was concrete 'resources' like worksheets, textbooks and tests. What I expected to offer them was support in constructivist-referenced teaching, in encouraging students to actively explore their own knowledge and to collaboratively construct new knowledge. As I note at the end of another reflection on this issue, "the conflict was fundamental" (p. 188).

In the long discussion with four of the teachers (pp. 179-184, based on the four

interviews presented in Appendix Three), the teachers all indicate that they perceived in themselves a lack of Shulman's (1986) 'pedagogical content knowledge'. They largely interpreted this in terms of particular institutional demands, such as what 'content' was appropriate for a particular school year, and what was needed for upper secondary education, but also in terms of the ability to not only know about something themselves but to communicate it clearly to students.

The teachers also talk about the difficulty of the innovative teaching approach in the school. This is not all directly related to the question of their effectiveness in teaching science from a constructivist perspective, since much of the additional workload resulted from other (constructivist-referenced) innovations such as the integrated curriculum and portfolio assessment approaches, and from the trial in the school of assessing all students in all learning areas on Student Outcome Statements. What it did mean, though, was that these teachers were already stretched to the limit in terms of time, energy and resources - if teaching a particular science concept required some extra research and reading and time for reflection, that was unlikely to happen.

The two tales of trust and relationship (pp. 137-139 and 141-143) describe a facet of the research that I had certainly not anticipated, and which is not foreshadowed in any of the three research questions. It is related very strongly, however, to this question about the effectiveness of constructivist-referenced teaching innovations - if, as was the case for Carolyn, the relationship between teacher and students breaks down, all the innovative strategies in the world will not guarantee learning. On the other hand if, as in Candace's case, the relationships between teacher and students and teacher and colleagues are strong, mutually respectful, caring and loving, it is possible for many other constraints to be constructively addressed. Alyx, too, addresses this issue in discussion (p. 183), and says that she believes the school is falling short of its potential - it's doing many of the 'right' curricular things, but is failing to genuinely care for and nurture both teachers and students.

3. *What virtues of my chosen research methodology allow me to explore these questions richly? What standards of legitimation and representation should be applied to the understandings gained from this exploration?*

The rhetorical device I've chosen for (the rest of) this chapter - pointing out to you the tales in 'School Stories' that provide evidence related to each research question in turn - falls down somewhat for this third question. Because *talking* about the value of the methods was not really a concern of the book (School Stories) itself - it's not a treatise on research methodology, it's a story about school. The evidence for the value of the methodology lies, not in any particular two-page tale, but in the 'novel' as a whole. If reading 'School Stories' helped *you* - as a teacher educator, a teacher, a parent or anyone else who stands in the world in a pedagogical way - to understand in fresh, rich ways the concerns of the other research questions (about expectations and their effect on curricular innovations, and about the ability of non-specialists to teach science in constructivist-referenced ways - but also about love and relationship), then I would submit that it is successful, by the most important standard I wish to apply - what works for teachers.

Summary

This chapter, rather than interpreting the events, characters and understandings represented in 'School Stories', is intended simply to make explicit the links between that 'novelistic' representation of my lived experience in the school - that narrative net - and the research questions. The approach I've adopted for the first two questions is to point readers back to specific tales in the text, while for the third question - about the appropriateness and value of the methodology - only consideration of the whole of 'School Stories', based in the reader's *own* values and pedagogical stance, can link the text to the research question. Chapter Six allows the fictionalised characters to step 'outside' the narrative net, and take on the task of grounding themselves in 'The Real World'.

Chapter Six

The Real World?

Introduction - The Real World?

The camera takes in a broad landscape of low, smoky-blue hills, with a perfectly clear, bright blue sky above. Here and there a window obliquely flashes back the sun, as the point-of-view zooms forward and down, into a new suburb of an Australian city. The houses here are all recent, as the swamps and fields are filled and turned into housing estates, and the camera sees that many of them still have no lawns and fences. Dogs and children play in the streets and yards. In a continuing long zoom - the viewer is made vertiginously conscious of the unnatural changes of perspective - the camera slides up a short street, to a limestone-brick house with green-framed windows and a shiny corrugated steel roof. One window is open, and the viewer is carried into an untidy study, dominated by a computer surrounded by stacks of CD-ROMs and floppy disks.

A copy of 'School Stories' is sitting on David Geelan's desk, open to the beginning. A breeze catches the pages and flips them rapidly until, somewhere near the middle of the book, they slow and stop. The new page is suddenly no longer flat in the centre, but has begun mounding up into a small hill. The process continues, accelerating, so that the shape is soon a print-covered paper ovoid on a stem, which quickly expands out into broad shoulders. Features form on the front of what looks increasingly like a head, and a blocky body rises from the page, followed by two sturdy legs. In a few moments, a creature that looks like David, but composed of paper and print and much smaller, stands on the pages of 'School Stories' and looks around.

After a moment, the David-creature looks down at the page on which he is standing, and extends a hand to it. A tiny, delicate hand of paper rises from the page. He grasps it, and pulls a paper Candace from the pages of the book. Like a chain of

paper dolls, all holding hands, a Carolyn, an Alyx and an Andrea are pulled from the pages of 'School Stories', and into... the real world?

Digression - Pseudonyms

It is important to note, in moving from Chapter Five to Chapter Six, a very subtle change in what is meant when I use each of the pseudonyms I've chosen. In discussing the narratives of experience that together make up 'School Stories', the names used - 'Carolyn', 'Candace', 'Andrew', 'Shannon' - refer to the fictionalised characters who inhabit the 'novel'. This means, for example, that the 'Carolyn' who appears in 'School Stories' is very strongly based in my experiences of a particular teacher in the school where I taught. But 'Carolyn' is not, and is not intended to be, a realist portrait of that teacher. Rather, 'Carolyn' is a *character* with specific narrative and rhetorical purposes relating to making explicit for the reader my developing understandings about the importance of trust and relationship, and about the dangers inherent in conflicting expectations. Similarly, the 'I' who appears in those tales must to some extent be a fictionalised character, strongly based in the (not unproblematic) experiential reality of the David Geelan who is writing this thesis, yet not identical in all aspects. I have had to construct an 'I' as part of the net-weaving, melody-playing, tale-telling process. Like all of this thesis, this chapter is characterised by 'blurred genres' (Geertz, 1983), and by the approach to representation of a *bricoleur*, piecing together a story from 'found objects'.

In this chapter, I want to marshal some of the other evidence that was generated in the course of my research in the school, and use it to enrich and embellish my representation of the textual characters. This material consists of the transcripts of audio-taped interviews with each of four teachers (Appendix Three) and the results of two survey instruments, the Constructivist Learning Environment Survey (CLES) and the Beliefs about Science and School Science Questionnaire (BASSSQ) (Appendix Two). In reporting this evidence, the pseudonyms chosen take on a slightly different significance, in that they become direct substitutions for the names

of actual teachers. Rather than being the words of fictionalised, composite characters like those represented in 'School Stories', the words recorded in the interviews, and the views reported in the surveys, are those of the individual teachers.

I contemplated using different pseudonyms for the teachers, in order to emphasise this shading of meaning and identity, however I felt that (a) this would be much more confusing for readers and (b) this material offers some of the warrants that I need to present for my representation of these characters. While I am suggesting that not every characteristic and every word of the fictionalised 'Alyx' in 'School Stories' comes directly from the real 'Alyx' with whom I taught and whom I interviewed, the character *is* based in the person, and the survey and interview data offers some evidence of the relationship between the two. Be aware, then, that for this chapter, the names used have a slightly different meaning than that they carried in Chapter Five.

I don't wish to claim, though, that the empirical materials gathered - the survey results and interviews - constitute a 'real(ist)' portrait of these teachers either. These materials were not intended for that use, and were not gathered in that way. If my strategies for establishing verisimilitude (Denzin & Lincoln, 1994, pp. 579-580) were those of the quantitative positivist, it would have been necessary to validate the surveys used, to attend to random sampling and sample size, to use more sophisticated statistical calculations. Those moves might have established the verisimilitude of my account within that particular community, however that is not a community with which I wish to identify myself, or whose perspectives I value. Similarly, if I wished to suggest that the interview results were a true and fair representation of these teachers, it would have been necessary to conduct 'member checks', and meet other of Guba and Lincoln's (1989) post-positivist 'parallel criteria'.

Instead, I have chosen to use these materials heuristically, as part of my phenomenological activity (van Manen, 1990) of attempting to be thoughtful (van

Manen, 1991) about my own practices and those of my colleagues - about my lived experience in the school. For this reason I have chosen to represent the four teachers and myself as characters - the paper-and-print David, Candace, Carolyn, Alyx and Andrea⁵ - in this chapter, acknowledging that I am not attempting truly to speak for the Other⁶, but to richly represent my own lived experiences while working pedagogically with others.

Conjectures

The second representational form taken by the results of the research is the five 'conjectures' presented below. These are in a sense the second part of the 'findings' of the study, but that word is perhaps too strong. I regard the research as hypothesis generating rather than hypothesis testing in nature: the term 'conjectures' has been specifically chosen because it reflects the provisional and tentative nature of the understandings generated in the course of the research project.

'Conjectures' are less strongly held than the 'assertions' of grounded theory (Strauss, 1990) or interpretive research (Erickson, 1986), since much of the evidence is so personal, reflecting my largely phenomenological understandings (van Manen, 1990) and consisting of impressionist tales that reflect my own emotions and opinions and ideas. This mediates their applicability to other contexts and situations - readers are required to compare both the context of the research and the person of the researcher in understanding possible resonances of these conjectures for their own educational sites. The term 'conjectures' has been borrowed from Karl Popper's (1953) falsificationist scheme for the nature of science. Popper speaks of science as advancing by 'conjectures and refutations' - the advancement of tentative theories

⁵ Although they remain characters, rather than realist representations of people, I have chosen to refer to these characters without 'scare quotes' throughout this chapter, simply because their constant use is awkward.

⁶ see the discussion of the 'crises of representation and legitimation' (Denzin & Lincoln, 1994) in Chapter Four

about the world for empirical testing and possible refutation or falsification. The relationship of my use of the term to Popper's perspective is, however, rhetorical and metaphorical rather than canonical: within the realm of 'human science' (van Manen, 1991) the falsificationist scheme seems to me to be untenable because of the complexity of human beings and their interactions. As noted in Chapter Three, my chosen referent from the philosophy of science is Feyerabend (1975) rather than Popper.

I have not chosen to pinpoint specific tales in 'School Stories' that support each conjecture as I did for the research questions in Chapter Five, because this is almost impossible: the conjectures are 'grounded' in impressions accumulated over the course of my teaching year at Arcadia High School, rather than in single 'critical incidents'. If I have been successful in writing my account of that year, similar impressions will have been generated or re-iterated in you as you read 'School Stories', and those impressions will be juxtaposed with the different representation of the research below, which draws on the interviews and surveys as well as the tales. This is a key issue: despite the epistemically different status of the tales, interviews and surveys, they have been brought together in a *bricolage* (Denzin & Lincoln, 1994). This constitutes a practical example of Feyerabend's (1974, 1975) 'epistemological anarchy' - the holding in a dialectical tension of philosophically incommensurable perspectives in order to "contribute to the development of our consciousness" (1975, p. 30).

The conjectures are by no means 'proved' by the evidence generated: they are suggested by that evidence (including the impressionist tales, surveys and interviews), and supported - and sometimes challenged - by it. The conjectures are tentative new understandings that I have developed as a result of the research process, and they will continue to be explored in my own teaching practice and future research activities - indeed, this is one of their key purposes.

For each of the first four conjectures I have stated and briefly discussed the

conjecture from my perspective, then ‘discussed’ it with one or more of the four ‘teachers’. The words used by Candace, Carolyn, Alyx and Andrea in these discussions are taken directly from the interview transcripts⁷ with the four teachers who bear those pseudonyms (and who, as noted above, are related but not identical to the four characters in ‘School Stories’ who bear those names). The survey data are similarly ‘discussed’ by the David character (since there was no direct discussion of the survey results in the interviews), in relation to the first and second conjectures.

1. **Many of the constraints faced by teachers in attempting curricular innovations are based in ‘conceptual inertia’ on their own part or that of their colleagues, rather than in systemic problems.**

Teachers and researchers often describe resistance to change as resulting from the pressures of external examinations and State prescriptions, and these are important sources of constraint, which need to be addressed. In the context of the present study, however, my own and others’ key difficulty was in re-imagining what it meant to be a teacher within the new commitments that we were attempting to embody in our teaching, and in escaping from - or at least transforming into new meanings - the patterns imposed by our personal biographies, first as learners and then as teachers.

In saying this, my intention is definitely not to lay blame on the teachers: my own inertia was probably as great as or greater than that of my colleagues. Instead, I want to identify the power of critical reflection by teachers on their own assumptions and practices as a key influence for curricular change. Such reflection calls into question teachers’ taken-for-granted assumptions about what is natural and necessary in education. It requires them to ask questions about the degree and source of constraint acting on their classroom practices, to determine whether it is really as great as they

⁷ The material from the interview transcripts used in this chapter has to some degree been edited for clarity and readability, without changing the intent of the original interview responses. The original, unedited transcripts form Appendix Three

believe, and to find creative, educationally defensible ways of addressing the constraints placed on teaching and learning. It is ultimately empowering.

The five tiny paper people spread out over the desktop, looking at the strewn pages of text, graphs and tables. Prompted by their surroundings, David sits down with Andrea, and asks her whether she felt that there was a lack of structure for her to follow in her teaching at Arcadia - something she'd expressed in a conversation earlier in the year. Andrea responds, "I'm a structured person, so I appreciate structure, I appreciate being able to read up that this is what we're doing and if I have to do anything I know I have to have it lots of time in advance because I get anxious if I haven't got things ready."

"Is that one of the things you miss here generally?", David asks. "Not so much relying on textbooks, it's harder to refer someone to something if they miss something?"

"Absolutely," she responds. "Because usually you can say 'We covered this chapter, or these exercises in that book while you were away...'"

This is one example of a situation in which Andrea's own beliefs about teaching, and her preferred teaching practices, were in conflict with the more fluid, integrated curricular approach that was valued by the Arcadia system. Her perceived constraint arose from her assumptions about 'covering the work', and led her to act in ways that tended to constrain the way the constructivist-referenced innovations were implemented in her classroom. Andrea openly acknowledged the existence of this conflict in a number of conversations, and left the school at the end of 1996.

This desire to teach in ways with which she was familiar was by no means confined to Andrea. When David spoke with Carolyn a little later, they tried, rather warily, to address the question of the gap between the innovative approaches valued at Arcadia, and which David had tried to incorporate in his teaching, and the approaches with which Carolyn was most comfortable:

"There were certain things that I remember doing in science and actually

enjoying,” said Carolyn, “and I would have liked to see the kids do that as well. One of the things another team did - they did electricity, and I always remember really enjoying making the light bulb light up. That’s a very practical thing that I thought ‘if I enjoy it - a non-science person’s enjoyed it - then it would have been good to do with the kids’. And in a way I was a bit jealous - I was thinking ‘my kids are missing out on this, and maybe they won’t get to do it in Year Nine.’”

“You were really rather disappointed with the type of help and support I was able to give you through the year, weren’t you Carolyn?” David asks the question tentatively, and you really get the feeling he’d prefer to just leave the whole issue alone and avoid the potential for confrontation. But he’s also driven by the imperatives of the research, and on this occasion they win. “Would you mind telling me a little bit about why?”

“Right at the beginning of the year,” Carolyn begins, “when they said we were going to have this science specialist coming in, we presumed that this person with this amazing amount of resources would appear, you know, this bottomless pit that we could pick at and get all this stuff. But that didn’t occur, so it was almost like getting your hopes up and then having them dashed on the rocks of not having this person who’s going to come in and be a big whiz-bang science teacher.”

Carolyn had been looking to David for ‘resources’ and ‘packages’ - pre-packaged sets of worksheets and activities for students to complete individually at their desks - while, from his critical constructivist (Taylor, 1996) perspective on learning, David thought he was trying to encourage and support students in the collaborative, social construction of knowledge. This is by no means to suggest that David’s teaching approach is ‘right’ and Carolyn’s is ‘wrong’, but that the lack of congruence between Carolyn’s valued practices and those of the school acted to constrain the constructivist-referenced innovations in that classroom.

One source of such inertia is the conflict between the ‘sacred stories’ of a particular school and the ‘secret stories’ of its teachers - or to put it another way, conflict between the ethical and epistemological perspectives of the teachers and those

underpinning the innovations. Some of the teachers' beliefs about and attitudes toward science were not particularly coherent with those espoused by the principal and by the school community as a corporate entity. The latter 'sacred stories' were explicitly constructivist, and valued a connected, inter-subjective and human approach to science over a positivist, impersonal perspective.

David reaches down, and strains to lift the front cover of 'School Stories' and close the book. Eventually he succeeds, and in the place where the cover had lain he finds a few pages of interesting graphs. He calls all four of the others over, and they perch on the spine of the book as they look over the graphs.

"As you know, guys, I've been doing some research while I've been teaching here this year," David begins. "You've been aware of that, but we haven't really talked too much about the research - we've been more concerned with the teaching. Now, if you don't mind, I'd like us to talk a little bit about some of the information I gathered from you and your students. You remember - this was one of the few times the research actually took centre stage in the classrooms - when I asked everyone to do those surveys. These graphs (Figures Two to Fifteen, Appendix Two, pp. 295-301) represent the survey results."

"What was your research actually on...?" asks Carolyn.

"There were a number of things I was looking at and trying to understand better," David responds. "I wanted, first of all, to look at my own teaching practices as I tried to be a better teacher - more constructivist, but also more involved in negotiation and integrated curriculum. Since I was team teaching with all of you, that meant I also had to be interested in your teaching practices, and in the ideas and theories behind them. That's what I want to talk about now."

"Candace, if we can start with you? I was a little surprised to see that, on the BASSSQ survey (Figure Four, p. 295) your scores were mostly toward the middle of the range. For the four scales of that survey, a higher number corresponds to a more instrumentalist and constructivist, less certain view of the nature of science.

Based on how you taught in the classroom, I would have thought you would be further toward the high end on these scales. Andrea, on the other hand - I would have expected that you'd have a much more objectivist view of science, but you've scored very highly on all of the scales, particularly the fourth. You two were quite surprising, but Carolyn, your results on the BASSSQ seem to me to fit fairly well with what you've expressed in our discussion so far - a fairly certain, objectivist view of the nature of science."

The four paper-and-print teachers stand mute under this examination. Their stories, as characters, have been told in 'School Stories', and David has chosen not to confront them by asking them to respond to this evidence which, in some cases, seems to contradict the way he has construed them. Because, after all, this is a problem for him, not for them.

David continues: "I was especially intrigued by the issue of 'Shared Control' in the CLES surveys (Figures Two, Three, Five, Six, Eight, Ten, Twelve and Fourteen, pp. 295-301). There were some quite large differences in the ways each of you responded on the 'perceived' version of this scale (Figure Two, p. 294) - more so than any of the others. Andrea, you indicated that you share control of the classroom with your students 'seldom', Alyx indicated that this happens 'sometimes' and Carolyn and Candace, you felt that you shared control 'often'. This compares interestingly with the 'preferred' form of this scale, which indicates what you aspire to in your teaching. Andrea only wished to share control 'sometimes', while the rest of you valued this occurring 'often'."

"Turning to a comparison of your responses with those of your students: Carolyn, your students indicated that you shared classroom control with them less than 'seldom', although you felt that you did this more than 'often' (Figure Eight, p. 297). Andrea, you've indicated that you feel your classroom is strongly teacher-centred, with students only sharing some control 'seldom'. This perception lines up quite closely with what your students have expressed (Figure Ten, p. 298), which suggests that you have a good understanding of what happens in your practice.

You've also indicated that you really don't want the students to share classroom control to a great extent, although you would like this to increase from 'seldom' to 'sometimes'. This also lined up strongly with the preference expressed by your students. This is intriguing, because I think Andrew Montgomery and the school planners would have preferred more active student involvement and agency in the classroom than that result indicates."

The espoused, official values of the Arcadia school community - the school's sacred stories - are congruent with the higher ends of the scales on both the CLES and BASSSQ instruments: student-centred, constructivist-referenced learning with a strong humanist flavour is the intention of the curricular and structural reforms in the school. To the extent to which teachers' own values (reflected in the 'preferred' form of the CLES and in the BASSSQ) and, more importantly, their practices (in the 'perceived' form) do not reflect these values, they can be said to be constraining the constructivist-referenced reforms in the school. Clearly, the gap between the 'perceived' and 'preferred' forms of the CLES reflects the teachers' experience of themselves as 'living contradictions' (Whitehead, 1989) - of holding values and experiencing their negation in practice. This is the same tension that I have chosen to refer to as 'conceptual inertia' in this first conjecture, although the latter term is narrower, in that it deals only with the gaps caused by the teachers' own biographies and beliefs, not those attributable to external constraints.

2. **Changing teachers' beliefs and practices is necessary but not sufficient: students' roles, expectations and epistemological perspectives must be explicitly addressed.**

In my own teaching life (Geelan, 1994, 1996), I have several times fallen into the trap of attempting to change what happens in my classroom by changing myself as a teacher. Such changes have consistently failed, simply because, while I had changed my expectations of myself and of the students, they continued in traditional

expectations of me and of themselves. This led to significant frustration on the part of everyone involved.

Rather than simply changing teachers and expecting students to automatically change in response, a more powerful approach is to explicitly negotiate with students, in an authentic, non-coercive way, the new constellation of expectations required by the proposed innovation. Corbett and Wilson (1995) have suggested that teachers and reformers 'make a difference with, not for, students' - the research project reported here has led me to believe that such an approach is crucial.

This need not and should not mean walking into class on the first day of the year and saying 'Let's negotiate' - that can lead to chaos and inequity, since the students are very unlikely to have negotiation skills in the school context: many have been told what to do for their entire school lives. Instead, it involves a conscious, planned programme of activities and approaches intended to *teach* the skills of negotiation, followed by and complemented by an authentic willingness to allow students to participate in decisions affecting their own education (and also an awareness of which decisions can and cannot appropriately be made by students).

David and Candace have wandered away from the rest of the group. Candace begins to talk about negotiation as a value that she has tried to embody in her classroom, but the negation of which she has experienced in her teaching practice (Whitehead, 1989).

"With these kids," says Candace thoughtfully, "my next project would be to take what we've learnt and then start introducing negotiation. That would be the next logical step: say 'Hey, we've got this to learn, these are the skills in science that you have to learn', and then bring them into the discussion and bring them into building"

"Yeah, negotiation's something I've been thinking about," David muses. "Is that something you also have to build up to? You almost have to give them skills in negotiation, because we've spent seven years delivering..."

"Oh, I've learnt that to my cost," Candace interrupts. "I learnt that last year. I did it Bean and Brodhagen method, exactly what they said to do - and it didn't work. So I think there's a flaw in their reasoning: I think you have to skill-base kids before you can use the skill in order for them to skill themselves."

Alyx joins the group, and the discussion turns to issues of nurture and caring.

"I'm a nurturer," Alyx begins, "and I still think there's room for more nurturing throughout the whole school, and more care. I think curriculum's one thing, and going headlong into things and having these great evaluations is one thing, but I still think there's lots of room for care I don't see happening here."

"Why do you think that is?", David asks. "Because I think that would be something that the people who set the school up would have wanted to be happening. Why do you think it's not? Just too much stress on the curriculum stuff?"

"Yeah, I think so," Alyx replies. "I think the school's driven towards that. Those things can be evaluated in a tangible [way], and you can see it on paper, but nurturing stuff - you only see it in the eyes of people and their hair looking shabby, and the amount of sick days people take... but I think that's probably one of the most important things."

It appears that attention to the constructivist-referenced curricular innovations, even with the best of intentions, is not sufficient to ensure that the kinds of values espoused by the school (sacred stories) are actually embodied in the classroom practices within the school (secret stories). It also requires a commitment to caring, nurture and relationships on the part of individual teachers - and Alyx, at least, felt that this facet had not been given the explicit attention it needed at Arcadia.

The other four teachers have wandered away, and are variously kicking at the books and papers on the desk, reading or sitting on a stack of diskettes. David is sitting alone, poring over the graphs of the students' responses to the BASSSQ and both forms of the CLES. He mutters to himself, "Hmm, the perceptions of the students

seem to be strikingly consistent across all four class groups, on all three instruments (Figures Five, Six and Seven, pp. 296-297). Most students see themselves (on the 'perceived' form of the CLES, Figure Five, p. 295) as learning relevant science, learning about the uncertainty of scientific knowledge, having a voice in the operation of the classroom and negotiating with other students somewhere between 'sometimes' and 'often'. But they perceive that they share control of the activities of the classroom only 'seldom'."

"The 'preferred' form of the same instrument (Figure Six, p. 296) indicates that they would like to do each of these things somewhere between 'sometimes' and 'often' - the one change they would prefer is a greater sense of agency and an authentic role in choosing their own learning experiences. It is intriguing, though, that they don't express an even stronger preference for these five 'constructivist values' - only one class expresses the desire to be involved in any of these ways more strongly than 'often'. It is possible to speculate that students' preference for only relatively minor change is the result of the successful 'schooling' (including in Illich's sense! (see School Stories, p. 189)) in traditional educational expectations that they have received - further interview research would provide a valuable supplement to these survey results in teasing out the expectations of students."

"The results for all four classes on the BASSSQ (Figure Seven, p. 296) are even more consistent," David continues. "They indicate that students in general have quite objectivist views about the nature of science and school science."

This result is in spite of the fact that these students completed the surveys in November after spending the entire school year in a science education program that was quite explicitly intended to develop more constructivist perspectives on the nature of science. The results provide evidence to support the conjecture that students' expectations and beliefs must be explicitly addressed - and perhaps also suggest that even explicit attention will not cause these beliefs to change quickly or easily.

3. **Schools are enormously complex environments: attempts at curriculum innovation, particularly those that involve changing teachers' and students' roles and expectations (as opposed to simply changing the 'content' taught), must take this complexity seriously.**

Although most educators would assent to this proposition, I wish to suggest that the richness of narrative accounts has the potential to give readers a stronger feeling for the complexity of school contexts - not only the numerous stakeholders and their complex interactions, but also the beliefs and assumptions which underlie such interactions - than can more traditional research approaches. To put it another way: most educators are aware of the 'technical' complexity of schools (to use Habermas' (1971) terms) - the timetable pressures, falling budgets, rising class sizes, competing demands from governments, parents and employer associations. I am concerned here much more with the 'practical' and 'critical' complexity of schools: the variety of competing assumptions and beliefs that can tend to constrain the development of rich communicative relationships in schools. It is this 'hidden complexity' that the tales can help to describe and make explicit. Oversimplifying the school context can lead to oversimplifying what must be addressed if curricular innovations are to succeed which, in turn, can lead to only partial implementation, or even failure, of such innovations.

As sometimes happened during the year, David, Candace and Alyx have formed an intently talking cluster. Their attention has turned to issues of the complexity of school contexts, and how these can change the meanings of curricular materials and approaches. They're talking about the 'Voyage to Centauri' materials (Appendix One) that David and Candace developed for Term Four.

"I think our project this final semester has been really productive...maybe I should have been starting to do that earlier," David says. "One reason I wasn't was because I was hoping to get teachers to take more of a leading role. But maybe I should have been providing more structure?"

"No, I don't think you can say that," Candace contradicts him. "I think the

thing is we evolved to that together, and when we actually got that rather good idea, it was a bounce of ideas from the two of us. I don't think you could say that you could have done that for us at the beginning, same as I couldn't have done..."

David interrupts: "If I'd come in with a package as finished as that at the beginning, it would have been another prescriptive package...Whereas people have actually sparked off it towards the end this time."

"Yeah," Candace agrees, "I think it's somewhere that you have to go to, from somewhere, and it can't be..."

"Delivered from the Mount", David offers.

"...because that is a personal package," Candace continues. "People may pick that up and say 'that's garbage' because they haven't seen the stuff that goes behind it."

Candace suggests that it was not the written materials at all that constituted the innovative curriculum in our science classes during the final term of 1996, but the complex interpersonal interactions, the skills and relationships we had built up in the course of the year and the congruence of our educational values that really changed our classroom practices. As she notes, in another context people might identify the materials as "garbage" - and they'd be right, because they would be inappropriate for that context. One implication of this perspective is that any form of centralised curricular development and control (something returning to popularity in Australia) faces enormous (insurmountable?) challenges because by its acontextual nature it *cannot* take into account the 'practical' (Habermas, 1971) complexity of school life.

Alyx has already indicated that she believes the school has not managed to 'keep all the balls in the air': in trying to attend to a number of curricular innovations at once, it has failed to adequately attend to the needs of students for care and nurture. David suggests that this is a consequence of the complexity of school contexts - it is exceptionally difficult to attend to, and balance, all of the competing exigencies of the operation of the school, including (and perhaps especially) those related to expectations and attitudes rather than to paper and policy. David asks about the

demands of teaching at Arcadia.

“This is the hardest school I’ve taught at,” Alyx begins, “the demands here are huge, and that’s why I’m going part time next year. I don’t think I could cope full time plus study. I think that I’m getting better at it, I think the second year will be much better, but it’s just a really hard school, lots of things to do - your mind is totally cluttered all the time, weekends, everything, with work from this school, after school...”

“Do you think that’ll change?”, David asks. “Is it like going back to your first year of teaching again?”

“Absolutely, yep. I think it will change, but I think the individual has to change it too. I think if people stay here long enough, and don’t live, breathe and eat this school, and are not married to the school, work out that you have to have some personal social life...”

“So how are you feeling about teaching science next year?”

“Much more confident,” says Alyx. “I thought I knew it all from my science background but I don’t. It’s all very well having the knowledge but not knowing how to teach it... I was just shell-shocked in this school. What I probably should have done at the start of the year was just to stick with Primary Investigations and done some simple stuff. But, ‘cos there are so many tantalising offers here and you think ‘Oh yeah, I’ll try that...’, I did a lot of things in a mediocre way rather than a few things well. Science is one of them I felt I didn’t do a good job. I felt for the first six months I didn’t do a good job here at all, in anything - it took me that long to really work out that I do my best and I can only do my best, until you come to terms with it all.”

From my perspective, Alyx did a great job with science and everything else, but she clearly felt overwhelmed by the complexity of the situation, the changes being demanded of her and the students, but also the tantalising opportunities to teach in new and creative ways. Other teachers concurred - they valued what was happening in the school, but were developing a fuller appreciation of the complexity of school contexts when some of the taken-for-granted, seen-as-natural beliefs and practices

are challenged.

4. **It is difficult for teachers with limited science backgrounds to teach science in ways the science education community would find desirable or even acceptable.**

As I have argued elsewhere (Geelan, 1996, Nov), this is not so much through lack of pedagogical knowledge, or even content knowledge, but through the lack of a rich, powerful and constructivist view of the nature of science. Teachers who have not studied science tend strongly toward an uncritical, positivist scientism, and this is not easily addressed - certainly not through inservice activities aimed at increasing their knowledge of science content or at instructing them in particular activities and strategies. The question of whether it is possible to develop more intensive, and differently focussed, teacher education activities to address teachers' epistemologies and views on the nature of science is an interesting one for further research.

David calls Andrea and Carolyn over to rejoin the discussion. Candace begins to talk about the question of her own knowledge of science and science teaching, and the tendency to default to didactic teaching and cookbook experiments.

"I always accepted that you had the scientific knowledge, David, but we didn't know our parameters. What's happened, though, is that it's sort of integrated itself and fallen over itself as far as I'm concerned. You've come out of science and gone into the integrated approach, and I've gone the other way, I've gone into science, so I think it's been sort of like a cross-fertilization of ideas."

"OK," says David, "one of the aims of this year was to make you feel more confident teaching science next year. Do you feel as though it's done that?"

"Absolutely! But I still think that I'm going to need expert advice. At least now I know where to go, where to look it up, how to form it, how to use a lab, how to get the information to do the experiments, but I really think that I need expertise in bouncing off ideas to actually integrate them, because I really do fear that, because it is my weaker subject, that I will go to the safety net of 'Here's the

experiment, do it'".

Carolyn interrupts. "But I'd like to have seen more of that. We have had a whole year of science and the kids haven't done a proper scientific report. Maybe my science experience was different, but we were given a task to do and we'd go and we'd set up the equipment. Maybe this is a bit advanced for Year Eights but they have all the skills of doing the equipment. To me, to make them independent we needed to be saying: 'OK this is what you've got to prove, here's a suggestion how to prove it, go and do it and then write up the reports.'"

"OK, that brings up questions about the nature of science - what science actually is..." David begins.

"Oh, I've always felt confident with the nature of science," Candace interrupts, "I think that's because of my technology background, but I can now see more connections. For me, it was two things - where to go to get the information, how to actually formulate it so that makes sense to the kids, and is at their level... But I think the other important thing is to make it interesting, and I knew what I wanted to do, I had ideas, but I needed someone to say: 'Yeah but you've gotta do it this way.' It's the science base. 'Cos I haven't got it. Without scaffolding, people who aren't science based are all going to have difficulties."

Theoretical as ever, David says: "There's an idea that Lee Shulman (1986) uses. He talks about pedagogical knowledge - generic knowledge about how to teach, and obviously you've got heaps of that. Content knowledge about science - not so much, but you know where to find it. But then he talks about pedagogical content knowledge - knowing how to teach science specifically and that's probably where you feel that..."

"Yes, I do. It's just actually to get a particular scientific concept over to the kids in the right way, right shape and right form. I don't have that knowledge, and I haven't got three years or four years to spend going back and researching that."

"So, is that maybe a weakness of the Arcadia middle school model?", asks David. "That all the teachers have that problem?"

"Yes, I think it is. I can tell you that science in Year Eight has not been done particularly well in certain blocks, because they don't have that base."

Andrea expresses her concerns in a slightly different way, congruent with her more content-based view of schooling in general.

"I think the kids are a lot more accepting of my lack of science knowledge than I would be in a similar situation, or even more so as a parent, that the teacher wasn't expert in the field they were teaching in. And that's because I come from a pretty traditional high school background where you expect the maths teacher to know the maths."

"When I spoke to you earlier in the year," David says, "you felt as though maybe this school wouldn't prepare them very well for Year 11 and 12 - do you still feel that way?"

"Yeah, I do. I have strong reservations about having people like me design and run a science program for Year Eight. Because I've put three, or two children through high school, another one's in Year Nine currently, and I see what sorts of work they come home with and the sorts of things they're doing, and I'm not competent to do that in science. It was lucky that I was confident to do it in the other three core areas, but... I would actually feel quite uncomfortable thinking that maybe my kid was being taught science by a mug like me, and I think that your contribution was invaluable from that point of view because I could say to them 'I am a mug, but here's Mr Geelan, he knows what we're doing'. I felt that gave the kids much better preparation."

"I guess the argument is that there are other things that balance out for the lack of content knowledge," David suggests.

"Yeah, but what do you do when you get to Year Ten," asks Andrea, "and you've had - say you'd had me two years for science and you get to Year Ten and you get a real science teacher who expects you to know things? The other thing is the assessment program. If Candace and you hadn't been here to guide what sorts of testing program we had, I wouldn't have had a clue. I probably would have picked up a textbook and religiously gone through chapter by chapter and hopefully made up questions that were relevant and could actually reflect what they'd learned."

Carolyn wants to talk about some of the ways that team teaching with David both supported and constrained her in teaching science.

"I think it was good to go over to the lab," she says, "'cos I would never have done that without you there. I mean my big lab expression was melting wax to see solid to a liquid and back, that was about it."

"You sometimes seemed a bit reluctant to take the lead in teaching science in the classroom, though?" David asks. "Why was that, do you think?"

"It was, 'I've got this science expert at the back of my class, watching a non science expert'. A lot of the time I felt I wasn't not doing this properly and that's what you were thinking - sitting there thinking, 'she's not talking about this, she's not talking about that'. That was one of the issues but I think a lot of it was that I expected more structure and support. But then I got to the stage where I couldn't trust that that was going to happen so I would be running around first thing in the morning, going: 'Fred have you got a chemistry book that I can get some lesson out of?', because I still felt compelled that I should do science on a Wednesday even if you weren't there."

"First term I felt fine with science," Carolyn continues, "because it was environmental biological science. I haven't got any science learning but I found that interesting, I could teach that with the resources that people shared around. But when it got to the chemistry, I was thinking: 'this is way past me', but I think I probably could have bumbled along quite nicely by collaborating with Annalise, Steve and Cassandra. With that environmental stuff, I found that - I think because I had a certain amount of content knowledge - I could see the structure of where we were heading, so I could do more. One day when you weren't here I thought 'OK, we'll do the carbon cycle'. And I could link it to what else we'd been doing so that was OK. But once we got to chemistry... I don't know why a kettle boils, so that was my extent."

As Carolyn's final sentence above indicates, the lack of 'content knowledge' on the part of non-specialists teaching science is a significant problem. A teacher who has virtually no formal science background will have extreme difficulty in providing

students with scientifically satisfactory explanations and schemes.

From my perspective, though, the key problem that occurred at Arcadia when non-specialist teachers are asked to teach science was that such teachers have no basis for comparison beyond their own school experiences, and no clearly articulated pedagogical and theoretical perspective from within which to reflect on their teaching practice. They tend to uncritically reproduce the science education practices and approaches of their own childhood and adolescence, rather than reflecting more constructivist/instrumentalist referents in their classroom practice.

5. The chosen/constructed research methodology has led to a deep appreciation and rich understandings of the other four conjectures.

It is difficult to provide evidence for this conjecture in the form of a written text, in that it asserts something about my own understandings. Even if I am able to set out those understandings in a clear and accessible way (which is by no means certain), how do I prove that they are, in some sense, the result of this research project? Even a quasi-experimental approach is impossible: we do not have available an alternative David Geelan, identical in every other respect, who neither taught at Arcadia nor conducted research on his teaching practices, with which to compare understandings. It is even difficult to compare my understandings at the beginning of 1996 with those I have now, in late 1997, as I write up the research.

The evidence for my new understandings must be located in my teaching practice - not in the ideas to which I can give verbal or textual assent, but in the way I teach, learn and research in classrooms. Have my practices changed as a result of this research project, so that I take more seriously the expectations and established roles and practices of the teachers and students with whom I work? Am I more aware of what it means to be a science teacher, and of the types of teacher knowledge that are important to that practice, and is that awareness reflected both in my own science teaching and my work with other teachers? I believe that I *am* more aware of all

these things, and that - increasingly, but by no means fully - my practices reflect that awareness.

With a muffled bang, 'School Stories' springs open again on the desk, nearly knocking Alyx over. The open page begins to glow a faint blue, which begins to pulse steadily and increase. A tiny whirlwind begins to develop above the pages, and the paper teachers start to flap and move. Inexorably they are pulled closer, whirling, and picked up by the miniscule blue tornado. They spiral down into the page, and as David disappears, the whirlwind subsides, the blue glow dissipates, and all that is left is an open book on a desk. The camera pulls back, accelerating away past the dogs and the kids and the unfenced sandy yards, back past the flashing and sparkling windows, to a stationary view of the blue-grey hills and the bright blue sky.

Conclusion

Given the five tentative conjectures outlined in this chapter, and the experiences and understandings represented in 'School Stories', what questions remain to be asked and answered? What are the next steps in my own teaching/research journey, and how might others react and begin to conduct similar inquiries into their own understandings? These questions are addressed in Chapter Seven. In that chapter I also cast a critically reflective eye back over both the research project and this written representation/enactment of it. What was done well, what could have been done better? In what ways were my representations of others - and of myself - fair and unfair?

Chapter Seven

Love and Life, Teaching and Learning: Conclusions, Implications and New Questions

Introduction - The Learning Journey

The conclusions of this research fall naturally into two areas. One is that represented by the first four conjectures presented in Chapter Six. This may be summarised by saying that the path to school reform is far more complex and difficult than it may at first appear. Perhaps this does not qualify as new knowledge - the last three decades of much-hyped and rapidly discarded curricular and social reforms in schools provide plenty of evidence of the difficulty of innovation. I would suggest, however, that the original contribution of this research is in offering a richer, less abstract and theoretical, more 'teacherly' appreciation of the particular kinds and areas of complexity and resistance, as a first step toward addressing them in reforms.

Issues relating to the nature of the challenges facing non-specialist teachers who are required to teach science were also addressed, and I have suggested that, if such teachers are to be asked to teach science, it is important that they be supported in developing a fund of 'pedagogical content knowledge' (Shulman, 1987) and more powerful understandings of the nature of science and school science.

The research also points to the necessity for innovations to be introduced through ongoing collaboration and negotiation between all stakeholders - teachers, administrators, parents and particularly students. Such negotiation must explicitly focus on the nexus between the social forces of school culture and the roles - the sets of interrelated expectations - that each individual brings to the school situation.

The second area of interest, represented by the fifth conjecture, is the methodology employed. I believe that much of the justification for the appropriateness of a research approach must be in terms of the usefulness of the research outcomes for

the purposes for which the research was originally conducted (Donmoyer, 1997, March). My dual purpose in conducting this research was to expand my own understanding of teaching/learning/research, including exploring ways to more fully embody my own educational values in my practice, and to be able to communicate my new understandings to other teachers in ways that would be meaningful for them and would enable them to reflect on their own educational values and practices.

I believe that I have been enabled, through teaching in these classrooms, talking to these teachers, and writing and sharing these tales, to strengthen and deepen and elaborate my own understandings of the processes and antecedents of school education in ways that no other research methodology would have supported. I also believe, based on experience at local conferences and on discussions with teachers, that these stories allow me to *communicate* my newly developed understandings to other teachers in ways that would otherwise be impossible. Much research into science teaching is written in language and couched in ideas that make it either inaccessible or irrelevant to classroom teachers. I believe the narratives of experience that form one 'product' of this research project have the potential to empower teachers to enact positive changes in their own teaching practice and their own educative communities.

In Chapter One and throughout this discussion, however, I have indicated that my enthusiastic, rhetorical affirmation of the value of what narratives of experience can show to teachers and researchers must be tempered by a critical awareness of what they hide. As Bauersfeld notes: "Concentrated and systematic pursuit of one perspective forces other perspectives into blindness" (1988, p. 41). In the next part of this final chapter, I wish to 'question the answers' I have provided in the course of the thesis - to try, through adopting other perspectives, to see into some of the blind spots of the methods and approaches I have chosen for this inquiry. In the remainder of the chapter I will consider the implications of the research for my own future teaching/learning/research activities and those of others.

Critical Reflection - Vices and Virtues

I value the research approach I have adopted for this inquiry into my practice and that of my colleagues. That almost goes without saying - why else would I have chosen an approach that is somewhat different from the norm, with all the risk that such a choice entails? But my valuing of this approach must not be blind or uncritical. There are a number of potential problems and dangers that must be considered in conducting narrative research.

One of these is the problem of my intentions. If I bear any malice (or indeed, an infatuation) toward one or other of the teachers with whom I work, and about whom I write (or toward students or parents), or if I wish to present a particular case, irrespective of my experiences in the school, then my testimony is not to be trusted. What standards can be applied? What standards are appropriate for judging both the representation of the research - this book - and the research project as a whole? How can readers of these tales know that I have tried to capture my lived experience as honestly as I am able, rather than writing a pure polemic to attack an enemy or proselytise a perspective?

I can really offer no guarantees, except my assertion that I have tried to write an honest account. There is some evidence by which to test that assertion - the transcripts of the teacher interviews. These go at least some way to demonstrate whether my portrait of each character rings true, to the extent that the fictionalised characters are derived from the real teachers.

The other standard that applies must be literary: not 'is the account true?' - it was never intended as a realist portrait - but 'does it seem true?' Does it have an internal consistency that gives it verisimilitude (Denzin & Lincoln, 1994, pp 579-580), and does it resonate with your own classroom experience? And is it a good story - engaging, thought-provoking, challenging? But finally, I can offer no guarantees as

to my motives - is this a fatal flaw of the method?

Another potential problem - and one to which I believe I may have succumbed - is excessive reliance on one method of gathering evidence. I value an eclectic approach to research in education (Geelan, under review), and have used the surveys and interviews to complement the impressionist tales I wrote. Had I been concentrating less on the tales as the core of the research, however, I might have seen the intriguing patterns in the students' survey results, and have taken the time to interview some students to tease out the reasons for their beliefs and perspectives. It would have been fascinating to know how their rather objectivist views on the nature of science arose, and to explore what they meant when they indicated that they only wanted their science learning to be relevant to their lives 'sometimes'. That opportunity has been lost - that cohort of students has been separated, has lived through another year, and can never be interviewed just as they were at the end of 1996.

Finally, there is the question of bias and prejudgement. I entered the school with a rich, eclectic and quite well-articulated conceptual framework and set of values - they're outlined in some detail in Section One. I have left the school with those values and perspectives enriched, and with related new understandings, but perhaps my values have not been fundamentally changed or challenged (one important exception is discussed below), and the 'novel' and conjectures that form the research results are almost completely consistent with those values and theories. I have been unabashed in owning my values, but do they make me an unreliable witness, someone who brings his own axe to grind, instead of finding the raw ore on the research site and smelting it there? I'm not sure. This is a judgement for the reader to make. I cannot eschew my values and ideas and become a *tabula rasa* recording instrument for a culture - if I were to try, the best I could do would be to fake it, as so many realist ethnographers have done. I believe it's better to tell you who I am, what I believe, what I think, then let you decide what value to put on my account.

It's what you do every day in life, from sales personnel to bankers - evaluate the account by the information you have about the source.

Of course, I could be lying. This textual representation of 'David Geelan' is, as we noted at the very beginning, entirely my creation. Perhaps I'm not as brave as Cromwell, and will paint over all the warts in my self-portrait. Or, more subtly, perhaps I'll leave a little wart showing to convince you of my honesty, but paint out the huge blemish on the other side of my face, that I *really* don't want you to see. Maybe you need to talk to Peter, or Sue, or my friends, so that you can check the verisimilitude of my self-portrait. All I can offer in text is my word - I've painted the best I can, but I'm an impressionist, not a photorealist.

The one real surprise for me in the whole research project was the importance of love and relationship in teaching. I've discussed this further in the next section, but it was a genuinely novel understanding for me in the context of education. It's possible, though, that I saw it because I was ready, because I'd matured enough, because I was talking about *agape* love with friends. Perhaps all this sensitised me to the magic of what Candace and Alyx did in their classrooms, where someone else - or even me in another year of my life - might not have noticed, or might have used different language to describe what they saw. Does that matter? Is it a problem if my personal life shows me new things in my research site, or helps me write old things in a new way? The conventional wisdom has been "yes, this is contamination", but I wonder.

Implications for My Teaching/Learning/Research Practice

As I noted in the introduction of this chapter, I had two key purposes in mind for this research project. The first of these was to deepen and enrich my own 'connected knowledge' (Belenky et al., 1986) and understanding (Wolcott, 1990) of my teaching/learning/research practices and those of my teacher colleagues, in order to

support changing my practices to more fully embody my values.

The four implications that I see for my practice - as a teacher-researcher who is continually learning from his students and colleagues - consist of two reminders of pedagogical verities, one surprise that shouldn't have been, and an approach to reflection and on-going professional and personal growth.

Reforms are difficult

Four of the five conjectures presented in Chapter Five point, in different ways, to the difficulty of changing what happens in schools. My own experience with attempts to change my teaching practices (Geelan, 1994, 1996) bears this out: when it comes to inertia, the QE II has nothing on schools! What does this mean for my own classroom practice and for my teacher education activities? Certainly not that we should just give up and stop trying: the reforms, innovations and changes we try to embody in our teaching practice are our values, and if our professional lives continue to be conducted in negation of our values, we are in great danger of moral and emotional burnout.

Instead, reforms need to be seen as local, collaborative and contextual, rather than externally mandated, individual and context-independent. The approaches to innovation that are most powerful are neither those that provide 'teacher-proof' packages of hi-tech materials and resources, nor those where courageous individual teachers choose to change what they do. Rather, reforms that are conducted by collaborative, committed groups of professionals, working from common value perspectives, and with a focus on reflection and self-study, are the most likely to contribute to more durable change. Even so, the 'practical' and 'critical' (Habermas, 1971) complexity of school systems and societies, and the conceptual inertia of teachers, students and parents mean that no reforms will occur over night - they will require long periods of time, changes to expectations and education of all

stakeholders.

In the school where I will be teaching in 1998, a like-minded community of Christian teachers will be attempting to develop an upper secondary school curriculum that is academically excellent, focussed on student learning, and reflects the moral and spiritual values of the teachers, students and parents in the school community. The implications of this research project for that next phase of my teaching/learning/research practice are that reforms are difficult, but not impossible, and that explicit attention to the expectations, beliefs and assumptions of teachers and students is essential.

Students are central

The second and third conjectures bring my attention to an issue of which I was already aware (Geelan, 1994, 1996): the central importance of addressing the roles and expectations of students in trying to change what happens in schools. I need this reminder, though, because again and again I fall into the trap of assuming that if I change myself and my teaching practices, that will be enough. It never is, of course, because while I am changing the expectations I have of myself and my students, they are keeping the same old sets of expectations, and are becoming frustrated as I fail (on their terms) to be reliable and predictable.

It is not enough, either, for me to *tell* the students about the new roles and expectations I'm imagining: they have all accumulated many years of experience of 'what schools are like', and what are appropriate roles and practices for teachers and students. From my constructivist perspective, I ought to understand that it will take more than a lesson, more even than a school year, to fundamentally reconstruct the way these students think about their own learning. The difficulty is compounded, of course, if I am making the changes more or less unilaterally in my own classroom, while my colleagues in other learning areas re-affirm the old approaches as hard as

they can. Instead of telling - imposing - I need to negotiate the new roles and expectations with the students in good faith. There will be some things that are not negotiable, and I need to be up front about those things. I need to take the students' needs and concerns seriously, and not be cavalier about their ambitions and need to find a place in the hierarchy. These are both moral issues about the students' freedom and dignity, and pragmatic pedagogical issues: if the students choose not to change, I cannot force them - all I can do is derail their learning by trampling their expectations.

It's more difficult even than that, though, because I've accumulated a fair bit of schooling myself, and *I* have a huge mass of expectations that takes a long time to turn around. So I often give out mixed signals, or say one thing and do another. If I claim to value collaborative construction of knowledge, but then give students individual grades for work individually learned, can I blame them if they stick to what's safe, to what they know?

I am also constrained by external pressures over which I have no control. Is it fair for me to ask students to value new ways of learning and thinking when they'll be rewarded for the old ways? Do I do them a disservice by choosing not to help them play the selection game just as hard as they can?

If I intend to change and challenge 'the way things are done' in my teaching, then I need to be consistent, to take students' needs and ideas into account, and to be willing to genuinely negotiate new roles and expectations, rather than impose them.

Love is the answer

Or at least, a far more significant part of the answer than I had realised. I really shouldn't have been surprised by this: I have seen the power of love in my own life. But it's not something we talk about in the literature of education, and it's not

something my research questions addressed.

It was Candace and Alyx's love for their students, though - their active caring and nurture and the strong, trusting relationships they built - that really made the difference in their classrooms. Their epistemological and pedagogical beliefs and approaches, as measured by the CLES and the BASSQ, were not, after all, so different from those of their colleagues, but their far greater success in implementing the constructivist-referenced reforms in their classrooms was built in relationship. They expected the best of their students, and most often received it from them. Their classroom management was negotiated, relationship based, accountable for everyone involved.

What do I mean, in this context, by 'love'? The term is so frequently used, and in such a wide variety of contexts, that it can become almost meaningless. There are a number of Greek terms for love, which allow some clearer distinctions to be made. *Eros* is described as 'the energy of desire', and is most often used of romantic and erotic love. This is the love I share with Sue, which provides power and energy and security to support my teaching, but does not have a place in the school. *Philos* is 'friendship' or 'fellow-feeling' - beyond acquaintance to an actual affection and liking. Unless I feel this toward my students, they will sense my dislike or indifference, and it will be impossible to inspire them to succeed, to learn and to care. It is possible to teach without *philos*, but not to teach well. *Agape* can be described as 'spiritual love' - an unselfish, even self-sacrificing love for others. Such a love for my students is difficult, taxing, in that it holds others more important than myself, and takes their greatest good as the goal. This does not mean their wishes or desires: they may not know what is in their best long-term interests. Like Van Manen (1991), I am willing to claim that I know what is good for my students, but very aware of the necessity for constant critical reflection to ensure that I'm not indoctrinating or coercing them.

The biblical description of love in I Corinthians 13 (this version is from 'The Message' paraphrase) describes *agape* beautifully:

...no matter what I say, what I believe, and what I do, I'm bankrupt without love. Love never gives up. Love cares more for others than for self. Love doesn't want what it doesn't have. Love doesn't strut, doesn't have a swelled head, doesn't force itself on others, isn't always "me first", doesn't fly off the handle, doesn't keep score of the sins of others, doesn't revel when others grovel, takes pleasure in the flowering of truth, puts up with anything, trusts God always, always looks for the best, never looks back, but keeps going to the end.

This is a significant challenge for me in my own teaching, because I tend to be shy, and to fear becoming too close to those I teach. And of course, like everyone, I tend to be self-centred and to consider my own needs and wishes before those of others. How can I find ways to demonstrate love, caring and trust in my teaching? Van Manen's (1991) 'pedagogical thoughtfulness' seems to me to be a (much longer!) term for 'applied love', and he offers many brilliant suggestions and meditations on how to make thoughtfulness a practical part of teaching. As I return to the classroom, I will have a whole new teaching approach to try to put into practice: I've been working on constructivism for eight years, now here comes love...

Stories are powerful

I have no choice but to go on living the narrative of my teaching life - whether I attend to it consciously or not, that tale will wind on until I stop teaching (probably about the time I stop breathing.) The power lies in choosing to tell tales about my lived tale. By writing stories I make them explicit for myself, make them available for reflection, weave a net of narrative to capture my experiences so that I can examine them. My writing is itself an activity of teaching and learning, as I am

enabled to tease out the influences, ideas and assumptions that are changing my lived story each day. Through creating stories, I experience myself again as a living contradiction (Whitehead, 1989), and both affirm and challenge the values I try to embody in my teaching practice.

But my told tales are not only for me. They are powerful for others too, and the sharing of tales is both a means of reflection on another's experience, and an act of trust. An image that has great power for me comes from a tale I heard: in the former Soviet Union, deep friendships were cemented and enriched when one told one's friend of some thought or action that, if reported to the authorities, would result in prosecution. Such a truth was a gift of trust: it said "I know you, and trust you, with my life and freedom". The stakes are perhaps not as great, but for teachers to take their 'secret stories' (Clandinin and Connelly, 1995, 1996), which may admit that they are not as confident, professional and on top of things as they'd like to be, out of the classroom and share them with one another is a way of developing a professional community of practice in which it is possible to be supported by others we can trust to know our weakness.

The implication for my practice, then, is that I need to keep writing and sharing the narratives of my experience, as part of my professional development and personal growth.

Invitation - Who Will Join Me?

The second purpose I chose for this research was to represent the new understandings and knowledge resulting from the research in ways that were accessible and valuable to teachers. The written account was intended to serve as an occasion for teachers to reflect on *their own* narratives of classroom experience in light of mine, in order to enable them to begin the process of reflective inquiry that constitutes the development of 'living educational theory' (Whitehead, 1989).

This intention grows out of the fourth implication discussed in the preceding section of this chapter. If I find that 'stories are powerful' as an approach to critical reflection on my own practice, perhaps others will find my stories powerful too and, more importantly, be encouraged to begin to write their own stories. Stories are both told and lived. It is through abstracting written narratives from the on-going narratives of our (teaching) lives that we begin a process of reflection and disciplined inquiry into our values and their intersection with our practice; we begin to experience ourselves as 'living contradictions' (Whitehead, 1989) in ways that may not have occurred to us had we continued simply living our narratives of experience.

Once that process is begun, we experience dissatisfaction with this contradiction, and begin - in negotiation with our students, colleagues and other stakeholders - to work to change our practice. In my opinion, this is the most powerful (and perhaps the only truly effective) means of school change. Rather than curricular initiatives being sent - in Clandinin and Connelly's (1995) apt phrase - 'down the pipe' to classrooms from external bodies, teachers who are actively working, with a sense of agency and professionalism, to transform their practices will be much more likely to genuinely change what happens in classrooms. By making their 'secret stories' even a little public - first by writing them down rather than just living them in the classroom, and then by sharing the written tales with others - teachers can be empowered to challenge the 'sacred stories' that constrain their practice.

One important activity that is implied by this purpose of the research is the dissemination of the tales as broadly as possible among teachers and teacher-researchers. (This feels a little like hubris - because I value them, who's to say that others will? The test will, of course, be the teachers' reception of the tales.) One paper reporting the research and incorporating three tales from 'School Stories' has already been accepted for publication by the journal *Research In Science Teaching*

(RISE) (Geelan, in press), and others will shortly be submitted to teachers' journals like the Australian Science Teachers Journal (ASTJ) and School Science and Mathematics (SSM). The research has been reported at a number of Western Australian and international conferences including the 1997 conferences of the National Association for Research in Science Teaching (NARST) and the American Educational Research Association (AERA), and will be presented at the 1998 conference of the Australian Science Teachers Association (CONASTA) and the Australasian Science Education Research Association (ASERA). 'School Stories' has already been made available on the World Wide Web for anyone who wishes to read it⁸, and the full text of this thesis will soon also be available on the Internet in hypertext form.

The hypertext form of this thesis is itself an intriguing product. The text is identical to this paper form, but the very existence of hypertext links that break down the linearity of the reading activity makes it a different mode of experience for the reader. As Denzin and Lincoln have suggested:

This will challenge the traditional relationship between the reader and the writer. In the electronic spaces of hypertext, readers become writers, *bricoleurs*, who construct the text out of the bits and pieces and chunks of materials left for them by the writer. (1994, p. 583)

All of these avenues are intended to invite my fellow science educators and classroom teachers to begin using the power of narratives of experience (Connelly & Clandinin, 1988) in the process of critical reflection and disciplined inquiry with the aim of improving their teaching/learning/research practices. This corresponds with the notion of 'catalytic validity' (Lather, 1986) - "the degree to which a given research project empowers and emancipates a research community" (Denzin &

Lincoln, 1994, p. 579).

Conclusion - Places to Begin

In bringing to an end the written phase of this research project, I have a sense of closure in that the text is complete, the arguments are made. The words and ideas move from my mind to my computer's screen, stir the magnetic particles on the hard drive into new patterns. Those patterns in turn will be translated and transformed, both into a heavy three hundred and fifty page paper book that will impress my daughters, and into a series of connected HTML files that will together constitute a hypertext narrative.

In another sense, though, nothing is finished, closed or complete. As I write this page, it is nearly the end of 1997, the year after I taught at Arcadia. In a few short weeks I will begin to teach again, returning to the secondary school science classroom in a small Christian school near my home. I hold many of the same values - both personal and educational - that I held at the beginning of 1996, and the story of the coming year will again be part of the narrative of my experiences as I seek to more fully live those values in my teaching practice. I will be teaching chemistry and calculus to students who will very soon face their own Tertiary Entrance Rank examinations, and it will be a genuine challenge to find ways to teach for understanding in the face of that massively distorting pressure.

In that sense, the 'results' and 'findings' of this research project are places to begin, not just in research but in my teaching life. If I value constructivist-referenced changes in my teaching, and if my research has, more than anything, demonstrated the great difficulty of enacting such changes in the classroom, that only makes me more eager to attempt the challenge.

In the end, it's all about what Nel Noddings (1984) calls 'caring'. I want to be a little

braver than that, though, and say it's about love. If I can find the strength and the courage to look on all of my students with a love

which I have to borrow from God, who knows I can't do it alone

that cares for their needs, both educational and human, and that disposes me to thoughtfulness and tact (Van Manen, 1991), then perhaps from these starting places I can continue to more and more fully live my values. The tales of that attempt and that commitment will form the next instalment in my on-going learning tale, and I will write it as I have written this fragment of my life.

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Appendix One: Voyage to Centauri

Integrated science curriculum package developed during Term Four for the teachers and students of Cowan Team, Arcadia High School

Concept by Candace James and David Geelan

Written by David Geelan

Preamble

This package, module, program, call it what you will, was developed as a way of providing an over-arching narrative structure for the science lessons conducted in Cowan Team at Arcadia High School (AHS) in Term 4 of 1996. It was intended to supplement the module being studied by the team, entitled '2046', and portrays the voyage of the UNDSV *Intrepid* from Earth to the new colony planet Waterdeep, in the Centauri system. We hoped that the story presented here might spark off other stories in the teachers and students, and it achieved that in a variety of ways. We think the possible links with other learning areas are pretty much limitless, and we'd quite like you to be aware of the rather cute analogy between the small, closed system of a spaceship, and what we're increasingly realising is the small, closed system of our planet.

Acknowledgments

The development of this integrated science and technology module for middle school students would have been impossible without the support of the wonderful teachers and students of Cowan Team 1996. Candace and David came up with the original concept, but ideas and refinements came from everyone, and so did support and encouragement. So thanks to Etta Webster, Robyn Black, Andrea King, Alyx Nilssen, Colin Chapman, Tanya Simpson, Carolyn Young, Fiona Johnson and all the students of Cowan team. We had fun!

Copyright

This package was thought up one crazy Friday afternoon by Candace James and David Geelan, and not discarded the following Thursday at the Cowan Team's planning meeting. David has written the stories, prepared the practical activities, and run around like a headless chook finding equipment for the challenges. We're happy for the unit to be used, modified and pulled to pieces by people at AHS, but it'd be nice if our names stayed on it somehow. And if you'd like to use it outside AHS, we'd like to be asked - we're not hard to get along with, and will only demand massive royalties!

Cowan in Space

“Captain’s Log, Stardate 2001. Our launch from the Cape York Spaceport this morning was smooth and successful. We have begun our fifty year journey to a new life on Waterdeep, an earth-like planet in the Centauri system. There are sure to be challenges and surprises along the way, but we shall meet them with courage and skill.”

Captain P.T. Johnson placed the log recorder on a shelf, tossed back her hair and went to address the crew. The captain’s log was the official version, but it was all a bit too formal and flowery for how she really felt - excited, elated, and a bit scared. The first meeting with the crew in deep space would be an important chance to discover how they were feeling, and how they were working together as a team.

The UNDSV (United Nations Deep Space Vessel) *Intrepid* was huge. It had to be, because it needed to contain all the life support needs - food, water, shelter and air - of 200 people for 50 years, and enough supplies to set up a colony on new world. It also contained a variety of spare parts and materials for emergencies - but the supply was small, just because other, more essential things took up most of the space. As Captain Johnson drove toward the dining hall in her ship buggy (the crew was already calling them ‘bugs’), she crossed the high bridge that passed over the hyperspace drive core and joined one side of the ship to the other.

Looking down 200 metres, she was pleased to see that everything seemed to be working well. The core was surrounded by the bright blue glow of Cerenkov radiation that proved it was working properly. The ship felt comfortable under her feet - accelerating steadily toward the Centauri system.

“All present and correct sir”, said First Officer James.

“Thank you James, and I’ve told you before about calling me sir”, said Captain Johnson.

“Oh, sorry.”

“I’ve called you here this morning to focus on our mission”, said the captain. She looked out at the crew. Dr Simpson, the medical officer, smiled back at her, and so did Dr King, the astrophysicist. Colin Chapman, the brilliant young English soccer player, was kicking a ball in the air. No one quite knew how he had managed to get aboard, but it was rumoured to involve large sums of money. Professor Webster, the biologist, and Dr Nilssen, the Nobel prize winning theoretical chemist, were talking quietly together in a corner. Dr Geelan, the drive technician, was reading a book in another corner. The rest of the crew - engineers, artists, musicians, doctors, construction workers and robotics technicians (but no lawyers) were waiting attentively for her to begin.

Their Cowan ship suits looked nothing like the ones in the old Star Trek episodes that some crew members were addicted to - they were much more comfortable and less formal. After all, on a fifty year journey, the last thing you want is to be dressed up in fancy clothes the whole time. Peoples’ individuality was already beginning to show in colourful patches sewn to the suits, and strange haircuts.

“We are the first colony ship to leave the earth for a new planet”, she began. “Since the nations of the world finally saw sense in 1996 and banned the making and testing of nuclear weapons, all the money that had gone into those programs was funneled back into the space program. The Hubble telescope has made it possible to discover an earth-like planet in the Centauri system, earth’s closest neighbouring solar system. We have been given the task of traveling to that world and, if possible, establishing a human colony there ...” [to be continued]

Hot in Here

“Captain’s Log, Stardate 2006. Today is the five year anniversary of the beginning of our journey. There will be a small party in the dining room to celebrate, and as many as possible of the crew have been given a holiday from their duties...” Captain Johnson laid the recorder down with a small frown as the doorbell of her cabin chimed softly, followed immediately by the sound of someone pounding on the door. Both sounds, of course, would be picked up by the recorder.

Elsewhere in the ship, the officers and crew were wearing less and less of their Cowan ship suits - it was just too hot. Most people had a towel for wiping away the sweat, and although the warmth had been pleasant at first, the interior of the ship was beginning to be uncomfortably hot.

“What is it Han, what’s all the rush?”

“Well sir, uh, ma’am, you know how it’s been getting really hot inside the ship?”

Captain Johnson nodded, absentmindedly wiping the perspiration from her forehead with the towel slung around her neck. “Yes, we’ve had to keep turning up the cooling system, and it’s starting to use so much energy it’s slowing the ship down.”

“I know what’s causing the problem”, said environment control technician Han “It’s the drive core. It was meant to be well shielded, and no radiation is getting out, but heat is escaping. I measured the air around the core, and it’s 10 degrees warmer than anywhere else in the ship.”

Later, Han repeated his findings to a meeting of all the senior officers. Lots of possible solutions were suggested, including getting more fans, turning up the air conditioning even further, and even opening a hatch and letting the heat out into space (Dr King had to point out that this would let the air out too, and while being hot is not much fun, suffocating is even worse.) Unfortunately, none of them, even Dr Geelan, could think of a really workable solution to the problem of the heat leak from the drive core. So they decided that the most sensible thing to do would be to ask the crew.

Challenge 1 - Stop the Heat Leak

Heat is being released from the drive core into the body of the ship. Some way needs

to be found to insulate the core, so that this heat remains inside the drive, accelerating the ship.

There are a variety of different materials available within the ship's stores: your job is to find the best, as quickly as possible.

To do this requires a team effort. There's not enough time for every team to test every material, so each team will test one material, and the results will be compared. It's important that each team work carefully and scientifically: your mistakes *will* effect others.

Method

- ▶ Place 200 ml of water in a 250 ml beaker. Place it on a gauze mat on a tripod and heat with a bunsen burner until it is boiling freely .
- ▶ Now wrap the beaker with your insulating material (careful, it's hot), with a space for the thermometer. Record the temperature of the water every five minutes for 40 minutes, starting immediately.
- ▶ Clean up your lab bench (all good scientists do!), then make a clear graph, on graph paper, of temperatures. time Put time along the bottom axis and temperature up the left axis.

Questions

1. When you compare the graphs, which graph describes the best insulating material: the one with a steep slope or the one with a shallow slope? Why?
 2. Are there other things you need to consider besides the insulating properties? (e.g. flammability)
 3. What is it about a material that makes it a good insulator?
-

Outbreak!

“Captain’s Log. Stardate 2011. Acting Captain C. James speaking. Captain Johnson, along with almost half the crew, has been confined to her cabin with a mysterious illness. The symptoms include high fever, irritability, weakness and prolonged bouts of coughing. The illness attacks suddenly, and no crew member has yet recovered (fortunately, none have died either). We suspect a new strain of virus, but have not yet established how the disease spreads, or developed a cure...”

James looked wearily across at Professor Webster, who was leafing through a set of electron microscope photographs of the strange alien bug that she had discovered in the blood samples of the sick crew members. “I think I can develop a genetically

engineered vaccine that will help the sick people fight off the infection. But if I'm going to protect the well members of the crew, I have to discover how this thing is spreading, and find a way to stop it."

"There are a huge number of different ways that viruses spread - some need very close contact, others can be in water, or even in air." Dr Nilssen looked up from her computer. "I think I may have a theory about how this virus is spreading."

The other officers gathered around as she explained: "I've taken samples of water and food, and none of them contain the virus, so it can't have spread that way. Also, some of the sick are vegans, who only eat fruit and vegetables, while others eat the usual ship diet - so they ate totally different things. I've also interviewed the sick people and recorded the pattern of their movements and who they spent time with over the last three weeks. When I ran that through the computer, it turned out that many of them had been totally away from contact with any other sick person - Major Tom had been working in his own cabin the whole time. The only common factor I could find is that the air ducts to each of their cabins comes from this main duct here." She pointed to a large blue line on the screen.

"We can't shut off the air supply to their cabins", chimed in Chapman, "they'll suffocate!"

"No", said Dr Simpson, "but there might be another way..."

Challenge 2 -Stop That Virus

We don't want to play around with real viruses in the lab - the crew of the Intrepid didn't want to either - so we will *simulate* an airborne virus using smoke. If our filter system stops all visible smoke from getting through or around it, we'll know that it could also stop the mysterious alien virus.

There are several filter materials available in the ship, including cotton balls, tissues, green scouring pads and blue Chux wipers. Each material needs to be tested, and the results compared. Remember, for this job, near enough is not good enough: if any virus at all gets through, people will get sick

EQUIPMENT: 4 x 10 cm glass tubes, filter materials, side-arm flask, vacuum pump, rubber tubing, cigarettes with filters removed, matches.

Set up the tubes and vacuum pump as shown in the diagram. Light the cigarette, and pump air from it through the filter. Observe the side-arm flask to see whether any smoke is passing through the filter, and if so how much. Record the results for each material.

Poisoned Streams

“Hand millennium and shrimp!!” shouted a crew member, staggering down the South Corridor of the UNDSV *Intrepid*. “Purple aardvark briefcase”, replied Dr King seriously. Captain Johnson had no time to record a Starlog message: she was too busy with a ship full of mad people.

It had started suddenly, one evening in 2016. The crew had just sat down to dinner when a young astrogator jumped onto the table and started to talk nonsense. This was not unusual, but when half the crew started, it became worrying!

Dr Geelan and Captain Johnson seemed to be almost the only ones unaffected - perhaps coffee protected people from the bug: these two certainly drank enough of it. “Perhaps it’s something in the air, like that alien virus that attacked us five years ago”, mused the captain.

“No, the extra filtration systems we put in place then are still operating perfectly, so it can’t be the air.” Dr Geelan sipped his steaming mug of coffee thoughtfully.

“What about this theory that coffee protects people?”

“I don’t think it’s that, exactly - I think I’ll run some tests on all the things people eat and drink...” Dr Geelan walked away to the lab, stepping around the crew members who thought they were letter boxes.

“I think I’ve found it”, he reported later, “it seems to be a chemical substance that has contaminated the ship’s water supply, possibly a reaction between the plastic of the tanks and radiation from deep space. Whatever it is, it’s destroyed by boiling, which is why those who drink only coffee haven’t been affected. But if we don’t want to boil every drop of water from those tanks for the next 35 years, we’d better figure out what to do...”

Challenge 3 - A Faster Filter

The ship’s water supply is cloudy and undrinkable - we need to clean it as quickly and efficiently as possible. There is only one type of filter material available for use on the ship - circular filter papers.

There are two main ways that scientists have folded filter papers in the past - we’ll call these the ‘standard’ and ‘fluted’ folds. We want to test which of these ways of folding filters the water most efficiently (we’ll define efficiency two ways - which is quickest, and which makes the water clearest). We also hope that you can invent a new way of folding the paper that is even more efficient than these two:

Standard fold Fluted fold

To make it a fair test, you need to treat all the filters the same way - add 10 ml of the polluted water, and time how long it takes to completely go through the filter. You should also observe how clean the water that has passed through the filter is.

Record your results in this table:

	Time for 10 ml to pass	Appearance of filtrate
Standard fold		
Fluted fold		
Your fold		

Clearly draw your new invented fold - this is important scientific information!

Long Hot Summer

"I'm really worried", Dr Simpson explained to her assistant, Terry. "The crew seems to be getting many more skin cancers than we would expect. We keep burning them off, but more keep appearing."

"Yes, that is surprising", said Terry, "I thought the main source of skin cancer was ultraviolet light from the sun: and we're certainly a long way from Earth's sun now. I think we should tell the captain."

"Captain's Log, Stardate 2021. In this twentieth year of our long voyage to Waterdeep, we have encountered some serious problems. It's finally beginning to really sink in, as we approach the halfway point of our journey, that none of us will ever see Earth again. We knew this before in our heads: now we're starting to learn it with our hearts. Dr Simpson has also informed me that the incidence of skin cancer among the crew is 1000 times what would normally be expected under these conditions. As yet, we have found no reason for this problem..." Captain Johnson laid down the recorder with a sigh. This was the toughest part of the journey for the crew psychologically, and to have an unexplained cancer scare was really not helping morale.

“I’ve asked the crew to do some research into the causes of cancer”, said Dr King, “the ship’s database is too big for one person. If we can track down the cause, maybe we can do something about it.”

When the crew reported back on their findings, we learned that the most probable source of skin cancer was either a fibre like asbestos against the skin, or some form of radiation. “It doesn’t have to be ultraviolet”, reported Matthew, “any radiation that has enough energy can damage the DNA in a cell and make it turn cancerous.” Using the ship’s instruments, Professor Webster detected high energy cosmic radiation from a nearby white dwarf star. “It will take us another seven years to get away from it,” she noted, “what are we going to do to protect ourselves?”

Challenge 4 -Slip, Slop Slap

For the next seven years, hard radiation from a nearby star will pass straight through the ship’s hull, and straight through the crew. On its way through, it will damage their cells in ways that cause skin cancer. These cancers can go on to be life threatening if they’re not treated - this is a serious problem.

There are all sorts of possible ways to protect the crew from this radiation (but the speed of the ship, and the time available mean you can’t turn around and go another way). Hint: Just to get you started, think about the title of this challenge.

The crew has been divided into teams of three people. Each team must choose one way of solving the problem, think about all of its advantages and disadvantages, and prepare a presentation for the whole crew.

Suggested planning steps:

1. Brainstorm as many possible solutions as you can to the radiation problem
2. Discard all but the three best solutions from the brainstorm session
3. Think of the advantages and disadvantages of the remaining solutions
4. Choose one solution, and prepare your presentation

Your presentation should be written out in note form, but it is to be delivered verbally to the whole group.

Points your presentation should cover:

1. the advantages of your solution to the problem
 2. any disadvantages to this solution
 3. why you chose it (this may include some disadvantages of the alternative solutions)
 4. an action plan to make this solution work
-

Spinout!

“WARNING! WARNING! COLLISION IMMINENT!” Sirens began to scream, and the main ship lights went off as the engines took all internal power from the ship to boost the deflector shields. The orange emergency lights came on, pulsing warningly, as the announcement continued to blast through the ship. Crew members frantically strapped themselves into their acceleration couches to prepare for emergency manoeuvres, or a collision.

“What is it, what’s going on?!”, screamed Jade, hurtling down a corridor.

“It seems to be an asteroid”, yelled Dr Nilssen, “Now strap yourself in immediately or you’ll be killed!”

CRASH!! The ship spun off its course as it struck a glancing blow on the massive asteroid, 550 km in diameter, that had unexpectedly appeared in its path. If the ship had hit directly, it and the crew would have been just a messy stain on the side of the rock. Fortunately, the glancing blow only damaged one section of the ship, and the emergency airtight bulkheads prevented the ship’s air from being lost to space. The crew would no longer have any books, videos or computer games, at least until somebody went outside in a space suit, because the library had been damaged.

The more serious problem facing Captain Johnson was the spin that the collision had given to the ship. Because the ship’s main drive was still on, the ship was now slowing down as much as it was speeding up, as the drive spun first forward then backward along the line of its travel. The wild spinning was making the crew members spacesick, and with the gravity in the ship confused by the spin too (think Gravitron), the ship was soon splattered with vomit on every surface, even the roof. This was not the worst problem though, gross as it was - the spinning was causing vibrations that would shake the ship to pieces in a matter of days.

“What can we do?”, wondered Dr Geelan, leaning over the toilet bowl with a green face. He knew the ship didn’t have any spare fuel for the small rockets used for steering the ship - it would all be needed for manoeuvring on arrival at Waterdeep. “We have to find some way to stop the spin, and soo-bluurrgghhh....”

Challenge 5 - Stabilise!

The ship has been hit by an asteroid, and is spinning out of control. It’s making the crew spacesick but it’s also slowing the ship down. We must find a solution to this problem before it causes us to arrive late at Waterdeep.

We don’t have any spare fuel for the attitude thrusters (the small manoeuvring rockets that change the direction of the ship). The problem will have to be solved using the ship’s gyroscopic stabilisers. As members of the crew, your role is to experiment with simple gyroscopes to determine what needs to be done to the ship’s larger gyroscopes.

EQUIPMENT: 20 inch bicycle wheel with handles on the axles, revolving chair

1. One class member should sit on the chair, holding the wheel with one arm on either side. Start with the wheel vertical.
2. A second person should spin the wheel to a high speed (safely!).
3. Once it is spinning, a third person should spin the revolving chair to simulate the spin of the space craft.
4. The person holding the spinning wheel (gyroscope) should try to move it in such a way that the chair stops spinning.

Scurvy Dogs!

“Captain’s Log, Stardate...ruff!” Captain Johnson frowned in annoyance, and tried again, “Stardate urgggh”. Her voice, usually so light and pleasant, seemed to have changed almost overnight to a deep, gruff, hardly recognisable growl. She really didn’t enjoy sounding like a death metal vocalist (even though this had been a secret ambition) - the crew tended to laugh or look shocked when she gave an order, instead of leaping to obey. They couldn’t point the finger though - many of them were having similar problems.

As Dr Geelan looked in the mirror, he noticed something very strange. He’d always been fairly hairy before, but he seemed to remember having two eyebrows last time he looked, not one long one. And he normally only needed to shave once a day, but at 11 am he already had a stubble that George Michael would kill for. That wasn’t so bad, but when he noticed that First Officer James had the beginnings of a moustache, he really began to worry about the health of the crew.

“What’s happening to us all”, growled Dr Black at the meeting called to discuss the problem, “are we turning into animals?” The others had to strain to understand her, because her voice had become so low and gravelly. “I’m trying to find out”, replied Professor Webster, “I’ve tested the air, the water and our food for contamination or poisons, and I can’t find anything. I’ve used all the scopes to test for radiation, and there’s nothing unusual there either. Nothing at all has been added to our environment that’s unusual.”

“But has something been taken away?”, mused Dr King. “I seem to remember reading that one reason Captain Cook was able to sail all the way to Australia was that his crew didn’t get scurvy.”

“What’s scurvy? - sounds gross”, said Jessica, “and why didn’t they get it?”

“Scurvy is a vitamin deficiency disease”, explained Dr King. “In those days, sailors used to live on salt pork and rum, and have no fresh fruit or vegetables. They didn’t get any vitamin C for months and months, and they got sick - their gums got mushy, their teeth started to fall out and they were covered in big sores. Captain Cook started carrying fruit like limes for the sailors, and they didn’t get scurvy. So perhaps we’ve got

some kind of vitamin deficiency too.”

After some tests and a fair bit of thinking, the medical officers and biochemists on board agreed that the problem was fairly simple - what the crew had was a Vitamin K9 deficiency. They decided to test a variety of different foods to measure their K9 levels, so that the crew could start sounding and looking like themselves again.

Challenge 6 -Finding the Dogstopper

Of course, there’s really no such vitamin as K9 (it’s my little joke, geddit?). But the problem of deficiency diseases is a serious one. There are several others besides scurvy, such as rickets and beri-beri.

We will simulate the search for a rich source of vitamin K9 using a test you may have used before - the iodine test for starch. This time, though, we’re going to try to make it more than a yes/no, is there/isn’t there test. We’re going to try to see which foods contain more starch and which contain less - to rank them in order from most to least. Remember, on the ship we have limited garden area, so we need to grow the best food possible to relieve our symptoms (woof!)

To do this, we need to design a fair test. Work with the members of your team to work out how to make the test as accurate as possible, and to get rid of distracting things like the colour of the food, how broken up the cells walls are, whether the food is fresh or frozen or cooked, etc.

A Bridge Too Far

“LOOK OUT, THE BRIDGE IS CRACKING!”

The scream sent shivers up my back as I drove slowly across the *Intrepid’s* central bridge. My heart rate doubled as my bug and its trailer full of recycled food packages tilted to one side and began to slip back toward the 200 metre drop to the hyperspace core, far below. I slammed my foot flat on the accelerator, and the revs climbed as the bug belched thick black smoke from its exhaust pipe, but the wheels began the spin and it slid faster. I leapt from my seat, trying to dig my fingers into the corrugations on the steel floor. I caught a slight grip, and watched, horrified, as the bug and trailer dropped, spinning lazily as they picked up speed, to shatter on the floor below, what seemed like minutes later.

I hung there on the broken piece of the bridge, with my fingers gradually cramping on the tiny handhold I had. Just when I felt them begin to slip, I felt someone grab me and put a harness around my chest. I was never so pleased to see anyone in my life as Dr Nilssen, who had hooked up some ropes and climbed down to save me. We climbed to the deck together (well, she climbed, dragging me), and I lay there shaking for a long time.

“Captain’s Log, Stardate 2036. Flight Lieutenant James Jamerson narrowly escaped death today. The central bridge, weakened by vibrations resulting from our collision with an asteroid ten years ago, collapsed. One bug and a quantity of stores were irretrievably lost, but thanks to the heroic actions of Science Officer Nilssen, Lt. Jamerson was shaken but uninjured. The challenge facing us now is to build a replacement bridge - the operations of the ship are crippled without the bridge, since all personnel and materials have to cross the gap on a makeshift flying fox.”

Challenge 7 - Building Bridges

The central bridge over the hyperspace core has collapsed. One side of the ship is cut off from the other - and the food is on the other side!

Your challenge is to replace the collapsed bridge. The only materials you have available are 20 light aluminium beams (simulated in the laboratory with drinking straws), and rope to lash them together (sewing thread). You must build a bridge 20 m (20 cm) long capable of supporting 600 kg (60 g). It must have a flat bed at least 5 beams wide that the bugs can drive on.

Have you learned anything in school or in your out-of-school experience that might help you to build a strong and simple structure? Share this knowledge with your group members before you plan your bridge design together.

Sketch your bridge design below:

Did your bridge pass the test? If so, what design features made it successful? If not, how could you have improved your design? (look at the successful team’s bridges)

Martians are Red

“You’re looking really red - are you feeling OK?”, said Colin Chapman to Dr Simpson. “No, not really”, she said, “I feel really puffed and exhausted all the time, like I can’t get enough air. Even when I’m just sitting still, I’m gasping for breath.”

“Funny”, said Colin, “I’m feeling a bit the same way - and I can’t kick the soccer ball around the way I used to.”

“Yeah, you’re looking a bit red in the lips and fingernails too - haven’t been putting makeup on have you?”, asked Dr Simpson.

“No way”, he stoutly denied, “I’m not sure what’s wrong - nearly everyone looks like this.”

When the crew met later to discuss the problem of their red lips and fingernails, and their shortness of breath, no-one else seemed to know what the problem was either. Finally, a crew member who had done a SCUBA diving course back on Earth years ago said “Hang on, those are the symptoms of carbon monoxide poisoning. They told us about it because sometimes people had the intakes of their dive compressors too close to the exhaust pipe, and they got really sick - some even died.”

“She’s right you know”, said Dr Simpson when she had consulted her medical books. “You know how blood that’s just come from the lungs is bright red, because it’s full of oxygen, and blood going back to the lungs is dark red because it’s given all the oxygen to the body? Well, carbon monoxide is a bit like that.”

“But it does two things differently than oxygen. Firstly, red blood cells with carbon monoxide in them are even brighter red - that’s why we all look so red. Secondly, the carbon monoxide doesn’t let go of the red cells and go into the body like oxygen does - it just hangs on and hangs on ‘til the blood cell dies. So every time a red blood cell picks up a carbon monoxide molecule, it’s wrecked. That’s why we can’t get our breath - we don’t have enough working red cells left to carry oxygen to our bodies.”

“But where’s this stuff coming from?”, inquired First Officer James. “Um, I think I can answer that”, said Jeff, the ship’s motor mechanic. “The bugs are getting pretty old now, and we don’t have any replacement parts. Instead of being in tune and burning all their fuel cleanly, they’ve started running too rich. That means they’re using too much fuel for the air they’re getting, so they give off carbon monoxide instead of carbon dioxide.”

“What can we do about it?”, asked Professor Webster. “Well, as I see it there are two problems”, said Jeff, “we have to get rid of the carbon monoxide that’s in the air already, and we have to find a way to stop the bugs producing any more. It’s either that or stop using the bugs completely.”

Challenge 8 - Clearing the Air

The bugs are starting to get old and out of tune. They’re producing poisonous carbon monoxide gas, and the crew are getting sick. There are only a few more years until you arrive at Waterdeep - you don’t want to fail now!

Your challenge as a crew is to find a way of removing the carbon monoxide that's already in the ship's air supply, as well as a way of stopping the bugs from producing any more.

Arrival at Waterdeep

"Captain's Log, Stardate 2046. Today, we arrived at Waterdeep." Captain Johnson's voice was low and even, but it throbbed with emotion. The forty five year voyage of the *Intrepid* was over, and her crew had arrived at their new home planet. The challenges of the voyage - alien viruses, asteroids and collapsing bridges - were in the past; what new challenges would be thrown up by this strange new world?

"The *Intrepid* has been placed in a stationary orbit above the most promising looking landing site, and our monitoring equipment - radar, infrared and gamma ray cameras - is surveying the planet and its resources. While the oxygen- and water-rich atmosphere make Waterdeep look a lot like Earth from orbit, we can already see some significant differences. There appears to be a single large continent on Waterdeep, which encircles the equator of the planet like a broad belt. The seas are concentrated to the north and south of the globe, with polar ice caps larger than on earth. The infrared cloud photographs suggest that the average daytime temperature at the equator is 14 degrees, while temperatures at the poles approach -130 degrees. The unusual placement of the land and seas means that the weather is much more violent than on Earth - our instruments have recorded 400 km/h winds in some large cyclones."

Captain Johnson paused to take another look through her cabin window. After forty five years of the Cowan-blue of deep space she, like all the crew, just couldn't get enough of looking at a planet so much like Earth; like home. She sighed, and continued with her report for the log.

"For all that, the planet appears livable, even hospitable. We can farsense no traces of poisonous elements or compounds in the atmosphere or the water - indeed, the oceans seem to be made of pure fresh water. There is plentiful green vegetation, the planet's gravity is about 1.18 times Earth normal, and its day is a little over 26 hours. From the little information we had available in choosing this planet, I'd say we've hit the jackpot. Tomorrow, we'll launch the landing module."

Appendix Two: Instruments and Data - CLES and BASSQ

This appendix presents the two survey instruments used - the Beliefs About Science and School Science Questionnaire (BASSQ) and two forms of the Constructivist Learning Environment Survey (CLES) - and the data obtained.

The five scales of the CLES (Taylor, Fisher & Fraser, 1997) consist of six items each, and all items are scored on a five point Likert scale. This yields a possible range of scores from 6 to 30 (i.e. 6 = 'almost never', 12 = 'seldom', 18 = 'sometimes', 24 = 'often', 30 = 'almost always) for each scale. The scales are:

- Personal Relevance - the extent to which the science learned at school is relevant to students' out-of-school lives and work aspirations.
- Uncertainty - the extent to which teachers and students see science as a human activity involving values and assumptions, rather than an impersonal and objective study of the real world.
- Critical Voice - the extent to which students feel able to have a voice in what happens in the classroom and question the teacher and the discipline
- Shared Control - the extent to which students have a sense of agency about their learning, and an active involvement in choosing activities and assessment approaches.
- Student Negotiation - the extent to which students are allowed to learn together collaboratively through negotiating and constructing models.

The Beliefs About Science and School Science Questionnaire (Taylor & Aldridge, 1997) consists of four scales - Process of Scientific Inquiry, Certainty of Scientific Knowledge, Process of School Science Inquiry and Certainty of School Science Knowledge (for a detailed description of the scales and the way they have been scored,

see below). Coming from a similar value position to the CLES - critical constructivism - the higher scores on each scale correspond to more constructivist, connected, social views of the nature and processes of science. This means that, confusingly, a higher score on the 'Certainty of Scientific Knowledge' scale corresponds to a perspective with more tolerance for *uncertainty* and intersubjectivity. Figure Four compares the teachers' responses on the BASSSQ.

Note: For copyright reasons, pp274-289 which contain the BASSQ and the CLES questionnaires, have not been reproduced.

(Co-ordinator, ADT Project (Retrospective), Curtin University of Technology, 13.11.02)

The two questionnaires used in the research took a number of different forms, as shown in the preceding pages. The Constructivist Learning Environment Survey (CLES) (Taylor, Fraser & Fisher, 1997) was administered to teachers and students during November 1996 in a 'perceived' ("what happens in my science classroom") and a 'preferred' ("what I wish happened in my science classroom") form. The Beliefs About Science and School Science Questionnaire (BASSSQ) (Taylor & Aldridge, 1997) was also administered to all students and teachers (in appropriate forms for each group, as above) in November 1996.

I have chosen to present in detail the results from four of the five class groups surveyed - Carolyn's class, Andrea's class, Candace's class and Alyx's class (teacher names have been used because they are simpler than room numbers for reporting, and because the purpose of the data is to compare teacher and student attitudes and beliefs). The fifth class surveyed had two teachers, Robyn and Colin, in the course of the year, neither of whom completed a survey, and was much less prominent in 'School Stories', and for this reason those results have not been included.

Candace and Alyx's original (November 1996) questionnaires were inadvertently destroyed, and they were asked to complete the questionnaires again in November 1997. If I were using the survey data psychometrically, or in support of the conjecture that teacher attitudes are stable across time, this would be a serious flaw in the research. I am, however, using the survey results heuristically to explore the relationship between teacher and student attitudes and beliefs, and believe they still have value for this purpose.

Constructivist Learning Environment Survey

This classroom environment instrument has gone through a number of iterations under the same name, as the model of 'constructivism' used by its authors has evolved. The current form reflects a social constructivist, or even a critical constructivist (Taylor, 1996), perspective on knowledge and learning. The survey consists of 30 questions,

which are answered in a five point Likert scale, ranging from ‘almost never’ (1) to ‘almost always’ (5). The six scales of the instrument correspond to the six sections of the survey as shown above:

Scale (title in survey)	Question Range
Personal Relevance (Learning about the world)	1 - 6
Uncertainty (Learning about science)	7 - 12
Critical Voice (Learning to speak out)	13 - 18
Shared Control (Learning to learn)	19 - 24
Student Negotiation (Learning to communicate)	25 - 30

Table Two - Scales of the Constructivist Learning Environment Survey (CLES)

The maximum possible score for each scale is 30 which corresponds to the response ‘almost always’ being given for each item and the minimum is 6, for ‘almost never’ on each item. A mean score for any scale of 24 corresponds to ‘often’, 18 to ‘sometimes’ and 12 to ‘seldom’.

Beliefs About Science and School Science Questionnaire (BASSSQ)

This instrument consists of a 40 item questionnaire which uses a 5 point Likert scale, where 1 corresponds to ‘almost never’ and 5 to ‘almost always’. The items form four scales as shown in Table X. Because the scales do not contain equal numbers of items, it would be awkward to compare the results directly. For this reason I have chosen to report each result as a percentage, calculated as follows:

$$\text{reported score} = \frac{\text{raw score} - \text{minimum possible for scale}}{\text{scale maximum} - \text{scale minimum}} \times 100$$

eg. Carolyn's score on the 'Process - School' scale:

$$\text{reported score} = \frac{33 - 9}{45 - 9} \times 100$$

Scale (abbreviation)	Item Numbers (No. of items)
Process of Scientific Inquiry (Process - Science)	1-10 (10)
Certainty of Scientific Knowledge (Certainty - Science)	11-20 (10)
Process of School Science Inquiry (Process - School)	21-31 (11)
Certainty of School Science Knowledge (Certainty - School)	32-40 (9)

Table Three - Scales of the Beliefs About Science and School Science Questionnaire (BASSSQ)

'Certainty' may be something of a misnomer for the scales that are identified using it - a higher score in each scale corresponds to a more tentative, subjective and *uncertain* view of the nature of science. Similarly, high scores for the two 'Process' scales correspond to more human, connected views of how scientists 'do science', and how students should study science.

Table Four summarises the results of both instruments, including both forms of the CLES, for all classes and teachers (November 1996, except Candace and Alyx).

	CLES - perceived						CLES - preferred						BASSSQ			
	Relevance	Uncertainty	Critical Voice	Shared Control	Student Negotiation	Relevance	Uncertainty	Critical Voice	Shared Control	Student Negotiation	Process - Science (%)	Certainty - Science (%)	Process - School (%)	Certainty - School (%)		
Carolyn	24	29	26	25	22	30	30	28	26	27	50	47	75	66		
Carolyn's Class (n=16)	19	22	22	10	20	20	21	26	21	23	50	50	61	61		
Andrea	28	15	23	10	23	30	24	24	19	21	62	80	56	97		
Andrea's Class (n=22)	21	22	21	11	20	19	20	23	19	24	52	47	65	63		
Candace	25	23	28	23	30	30	25	30	26	30	55	55	70	88		
Candace's Class (n=28)	21	21	22	15	23	21	21	23	20	24	52	50	61	63		
Alyx	26	26	28	17	25	30	29	29	23	30	50	65	64	75		
Alyx's Class (n=23)	21	22	21	12	22	21	21	23	20	24	55	50	59	63		

Table Four - Results, CLES and BASSSQ, all classes and teachers, November 1996 (& November 1997)

CLES, Perceived, Comparing Teachers

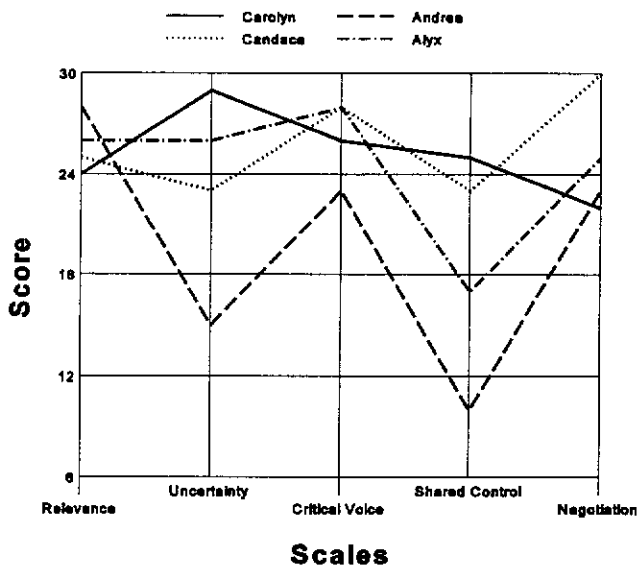


Figure Two - Comparing teacher responses on the 'perceived' form of the Constructivist Learning Environment Survey (CLES)

CLES, Preferred, Comparing Teachers

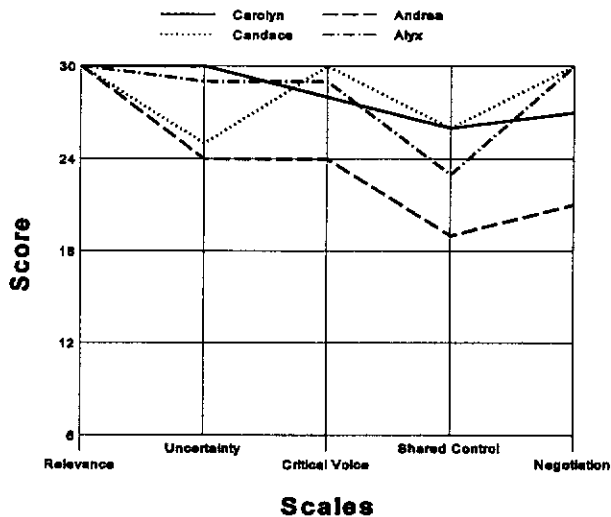


Figure Three - Comparing teacher responses on the 'preferred' form of the Constructivist Learning Environment Survey (CLES)

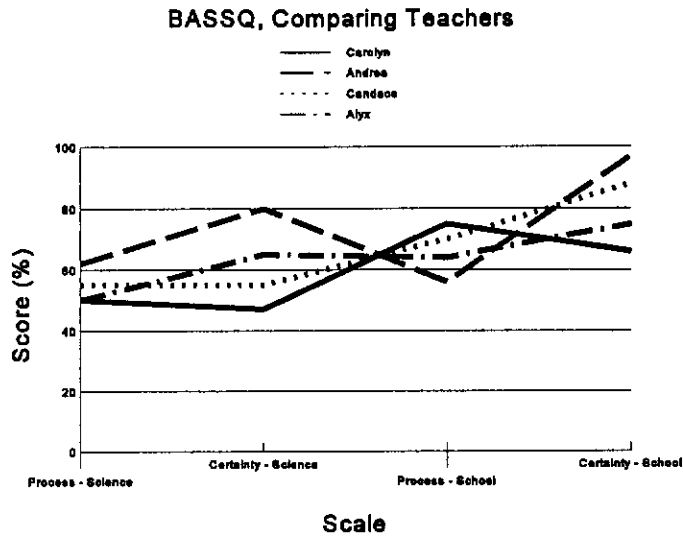


Figure Four - Comparing teacher responses on the Beliefs About Science and School Science Questionnaire (BASSQ)

CLES, Perceived, Comparing Class Means

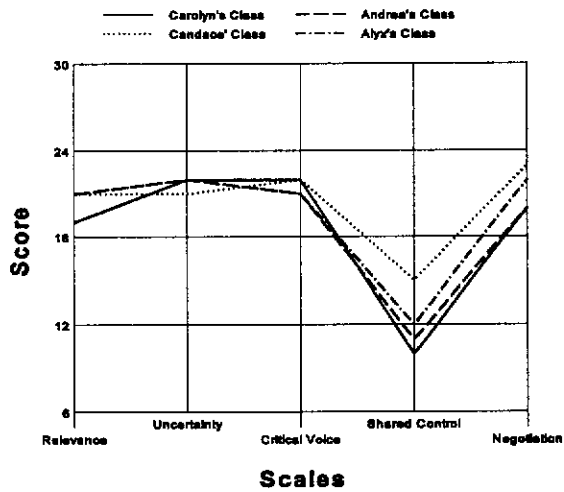


Figure Five - Comparing student responses on the 'perceived' form of the Constructivist Learning Environment Survey (CLES)

CLES, Preferred, Comparing Class Means

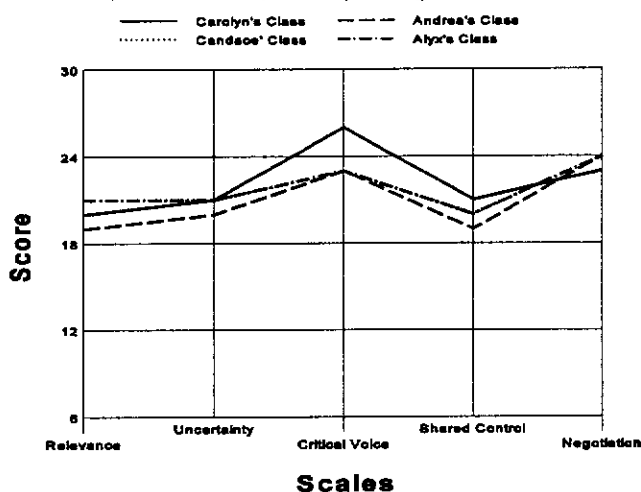


Figure Six - Comparing student responses on the 'preferred' form of the Constructivist Learning Environment Survey (CLES) NB: Alyx's and Candace's classes scored exactly the same results on each of the four scales, so that the line for Candace's class is obscured in this figure.

BASSQ, Comparing Class Means

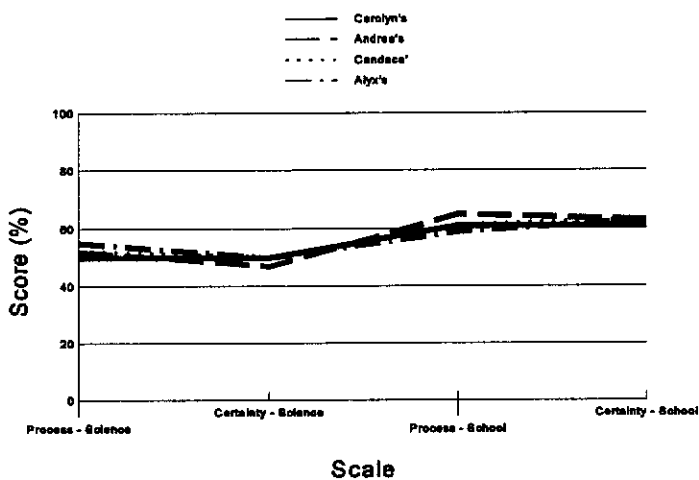


Figure Seven - Comparing student responses on the Beliefs About Science and School Science Questionnaire (BASSSQ)

CLES, Carolyn and class, November 1996

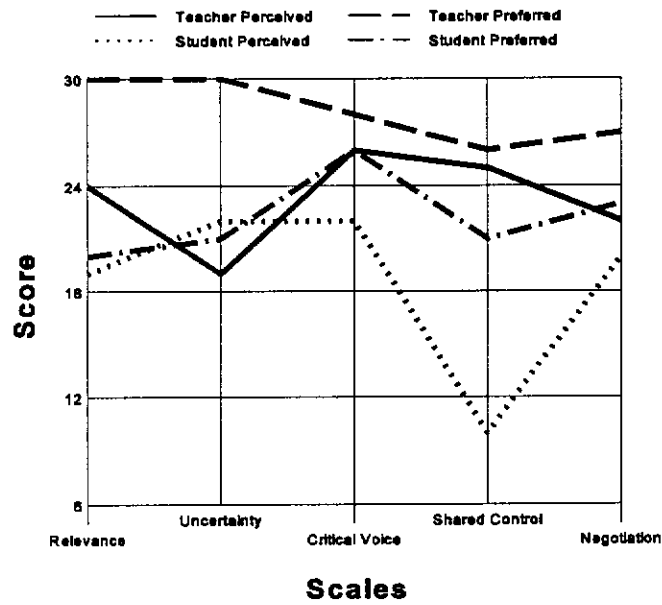


Figure Eight - Constructivist Learning Environment Survey (CLES), perceived and preferred forms, Carolyn Young and class, November 1996

BASSQ, Carolyn and class, November 1996

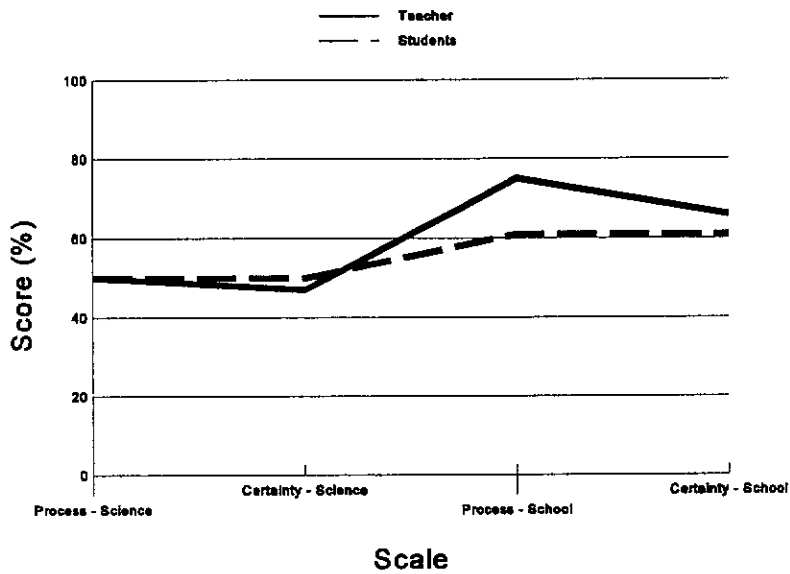


Figure Nine - Beliefs About Science and School Science Questionnaire (BASSQ), Carolyn Young and class, November 1996

CLES, Andrea and class, November 1996

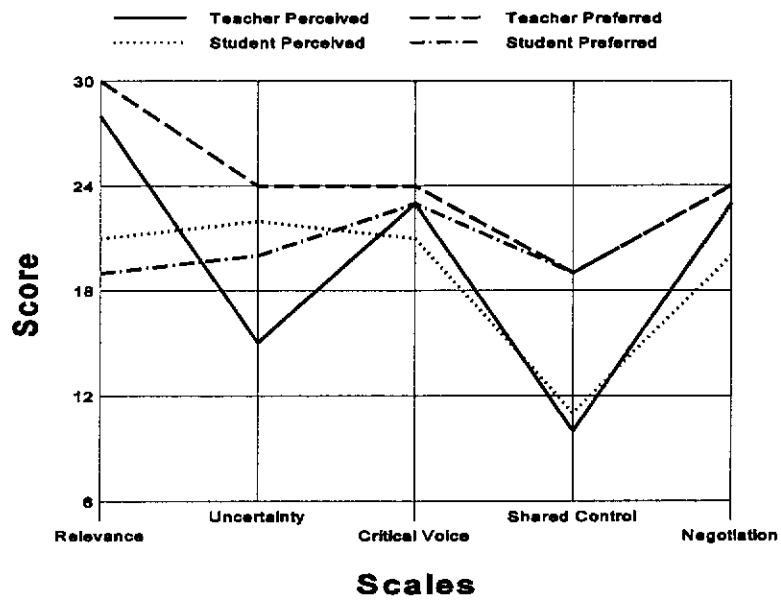


Figure Ten - Constructivist Learning Environment Survey (CLES), perceived and preferred forms, Andrea King and class, November 1996

BASSQ, Andrea and class, November 1996

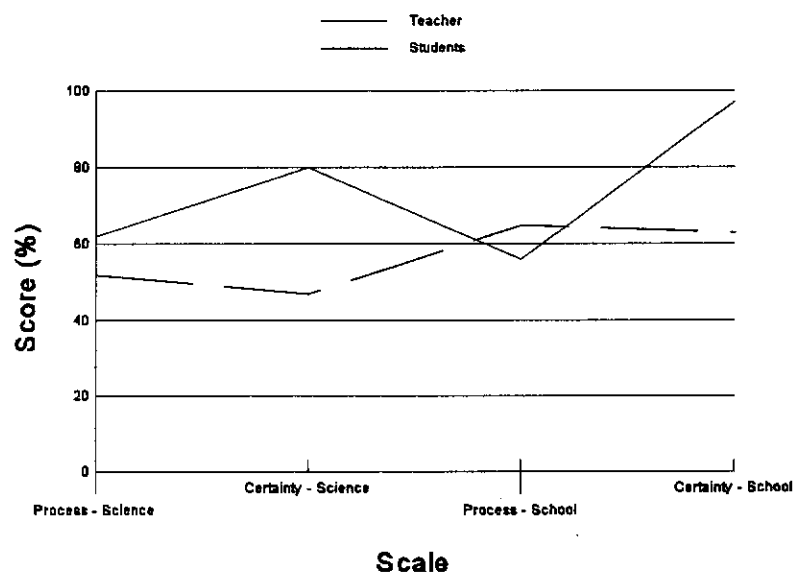


Figure Eleven - Beliefs About Science and School Science Questionnaire (BASSQ), Andrea King and class, November 1996

CLES, Candace (11-97) and class (11-96)

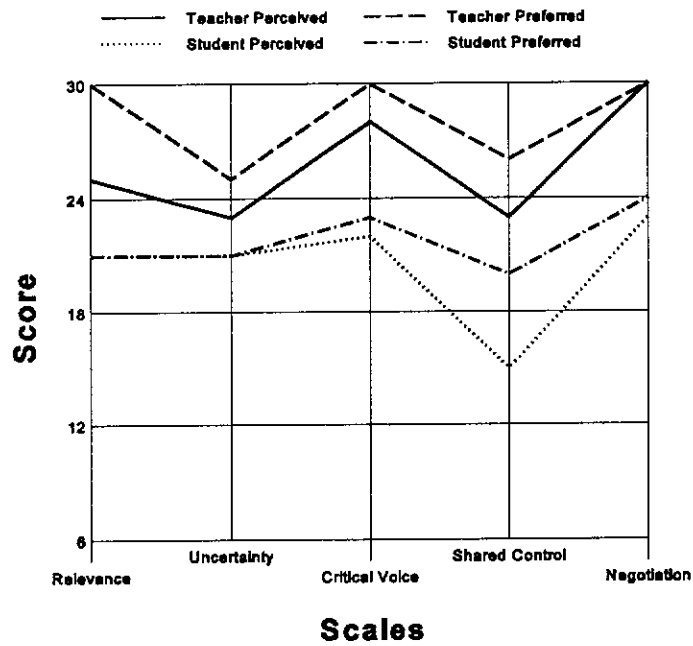


Figure Twelve - Constructivist Learning Environment Survey (CLES), perceived and preferred forms, Candace James, November 1997, and class, November 1996

BASSQ, Candace (11-97) and class (11-96)

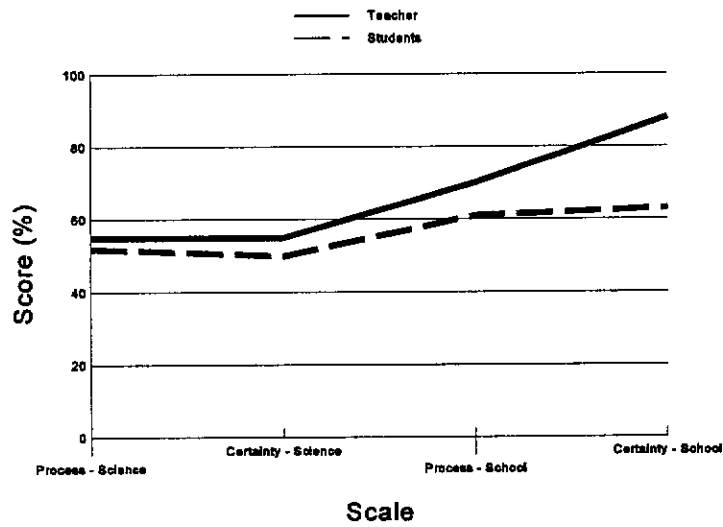


Figure Thirteen - Beliefs About Science and School Science Questionnaire (BASSQ), Candace James, November 1997, and class, November 1996

CLES, Alyx (11-97) and class (11-96)

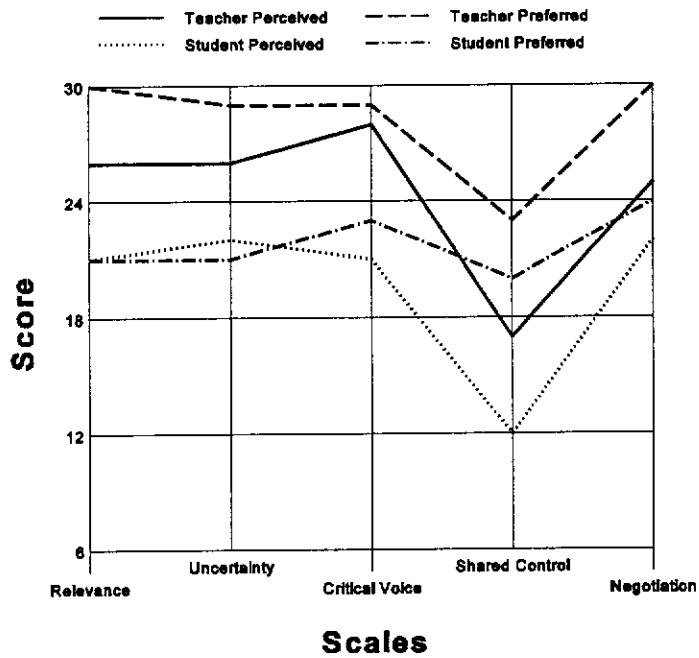


Figure Fourteen - Constructivist Learning Environment Survey (CLES), perceived and preferred forms, Alyx Nilssen, November 1997, and class, November 1996

BASSQ, Alyx (11-97) and class (11-96)

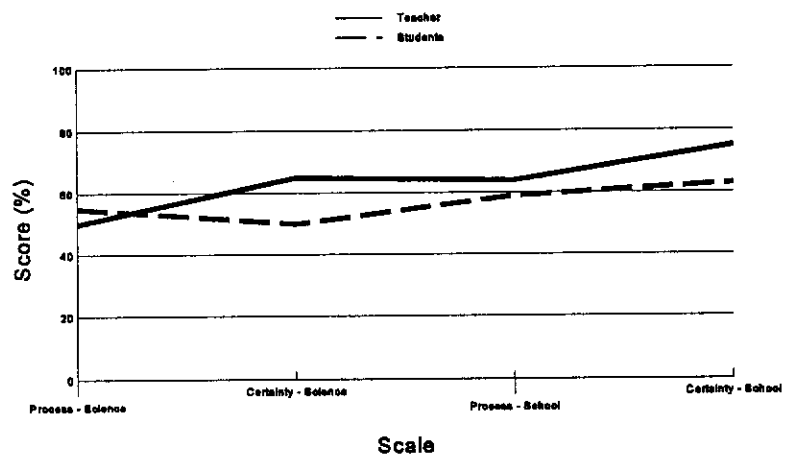


Figure Fifteen - Beliefs About Science and School Science Questionnaire (BASSQ), Alyx Nilssen, November 1997, and class, November 1996

Appendix Three: Teacher Interviews

Appendix Three presents transcripts of interviews with four of the teachers involved in the study, here referred to by their pseudonyms for ethical reasons related to confidentiality.

Interview with 'Candace James' - 4 December 1996

David: Let's talk about the program as a whole for starters - my involvement in the class and the team, um, and how you've seen that evolving or changing...has that...?

Candace: Yeah I think it has. I think basically it's evolved from both sides, which I think's been exciting, because we, I mean, I accepted that you had the knowledge but looking within the team I ... it's evolved in two different ways, it's evolved with the Year 8s differently than what it's evolved with the Year 7s, and ... I can't say too much about the 7s, but with the Year 8s, um, I always accepted that you had the knowledge, the scientific knowledge, but we didn't know our parameters, we had to get used to our parameters, and... but once we actually got used to our parameters, what's happened is that it's sort of integrated itself and fallen over itself as far as I'm concerned, and that you've come out of science and gone into the integrated approach using all the rest of it. I have gone the other way, I've gone into science, so I think it's been sort of like a cross-fertilization of ideas.

David: OK, that's one of the issues I wanted to talk about is, is that...one of the aims of this was to make you feel more confident teaching science next year if you're doing it... do you feel as though it's done that?

Candace: Absolutely! Yeah, but I still think that I'm going to need, on occasions, expert advice somewhere. At least I now know where to go, where to look it up, how to form it, how use a lab, how to get the information to do the experiments, but I really think that I need expertise in bouncing off ideas to actually integrate them, because I really do fear that, because it is my weaker subject, that I will go to the safety net of "Here's the experiment, do it"...

David: Mmm, keeping it separate. What about things like the nature of science, the nature and purpose of science and things like that - do you feel confident with those, or is it more you now feel confident with facts and where to find them.

Candace: I've always felt confident with the nature of science, I think that's because of my technology background - it may be slightly different but at least I...I can now see more connections, I can see... but for me, it was two things - where to go to get the information, how to actually formulate it so that makes sense to the kids, and is ... at their level I didn't have an issue

because I'm at their level, I don't have an issue there. But I think the other important thing with that is to make it interesting, and I knew what I wanted to do, I had ideas, but I needed someone to say "Yeah but you've gotta do it this way" and so... get the science - it's the science base.

David: Well, it's the science... the science teaching base, as much as anything else.

Candace: Yes it is, 'cos I haven't got it, I mean there's no doubt, you can't ... I don't think without scaffolding that people who aren't science based, they're all going to have difficulties. I mean yes, all right, there's certain things you can do, but I do not know...exactly what level I should go to with Year 8s, what they need for Yr 9, what they need for Yr 10, and...

David: Yeah. Well there's an idea that Shulman uses: pedagogical knowledge - general generic knowledge about how to teach, and (Candace: I've got that) obviously you've got heaps of that. Content knowledge about science - not so much, (Candace: Not so much, but getting there) but knowing where to find it and so on. But then he talks about pedagogical content - knowing how to teach science specifically, things that are ... and that's probably where you feel that...

Candace: Yes, I do... I mean, not in the integrated set, that's easy. It is not that it's just actually to get a particular scientific concept over to the kids in the right way, right shape and right form. I don't have that knowledge, and I have not got three years or four years to spend going back and researching that in order for me to do it, and because it's just counter-productive, I think.

David: So, is that maybe a weakness of this (ie the Arcadia middle school) model? (Candace: Yes, I think it is.) That all the teachers do have that problem?

Candace: Oh look, I can tell you that science in Year 8 has not been done particularly well in certain blocks, because they don't have that base. But then, also, same in sport, that's another specialised area, so you've gotta be careful.

David: Yeah, so there's... different teachers have picked it up and run with it, differently, based on their personalities and based on different things - I mean Lisa's really taken it, but she already had quite a strong science interest.

Candace: But you see I've had a strong primary science interest, so I'm quite fine there. Teaching 7s I wouldn't have a problem, not really, it's just getting that extra stuff on top that I had to re-learn, but if somebody whacked me into a Yr 10 - I could do it, eventually, but at what cost, to the kids I had then?

David: Mmm. OK, talking about - you talked earlier about getting our expectations and things...up to speed. I think our project this final semester has been really productive (Candace: Yes)...maybe I should have been starting to do that earlier. One reason I wasn't was because I was hoping to get teachers to take

more of a leading role. But maybe that was an expectation that wasn't - that I should have been providing more structure?

Candace: No, I don't think you can say that - I think the thing is, we evolved to that, and we evolved to that together, and when we actually got that rather good idea, it was a bounce of ideas from the two of us. I don't think you could say that you could have done that for us at the beginning (David: No) same as I couldn't have done...

David: In fact, if I'd come in with a package as finished as that at the beginning (Candace: Oh..) It probably would have been a package, it would've been...

Candace: It would have been another package (David: A prescriptive...) I think so...

David: Whereas in fact people have actually sparked off it, towards the end this time.

Candace: Yeah, I think ... it's somewhere that you have to go to, you have to lead to, from somewhere, and you can't - I mean yeah all right it's....

David: Something that can be delivered from the Mount sort of thing...

Candace: Right - no it can't be, because that is a personal package, people may pick that up and say "that's garbage" because they haven't seen the stuff that goes behind it. But no, we could not have done that at the beginning, I don't think. Now what happened next year, given the same scenario, which is not possible, but... that really ... I don't ... I just wonder whether it would go off the boil - whether it was a one off and here we go. But what it has done for me is, next year, if I end up teaching science, (if I'm in 7/8 I will, if I'm in 9 I won't), it's given me a very good springboard, because it's brought - what it's brought is science into the context of my knowledge of integration, which has ... helped me.

David: And that's one of the big foci of the school, and different people are doing it to different extents, you know...some of the classrooms....

Candace: I still say the kids need base knowledge...

David: ...are not very integrated at all. But yeah, can the base knowledge be delivered in an integrated form, or do you deliver the base knowledge and then start to integrate it?

Candace: Gosh, that's a... I think you've gotta deliver it and then integrate it. Some of it can be done in integrated form, but I don't think all of it can - I think you're gonna have to, you have to use whatever to suit to get it across.

David: You may develop the context and then say "Hey we need to do a bit of science here to actually get into it".

Candace: That's right, I mean you come at it from both ends, you can say "Look this is the content we'll build it this way and we'll write something to suit the content" which sort of happened this time, or you can go the opposite. It really does depend on what you're trying to deliver.

David: And in a way you're modelling life long learning if you do that (Candace: Yeah), because you're finding the problem and then going and researching to answer the question.

Candace: You see now with these kids, my next project ... I mean I won't have these kids, but for these children what would be rather fascinating is take what we've learnt and then actually start introducing negotiation. That would be the next, to me, logical step because these kids are used to working in this form, and say "Hey, we've got this to learn, these are the skills in science that you have to learn", and then sort of bringing them into the discussion and bringing them into building

David: Yeah, negotiation's something I've been thinking about... and is that something you also have to build up to? You almost have to give them skills in negotiation, because we've spent seven years, (Candace: Oh you do) delivering...

Candace: Oh, I've learnt that to my cost, I learnt that last year. You can't just go in...

David: By just going in and saying "Hey kids, let's negotiate!"

Candace: I did it, what I thought was superbly well, I did it Bean and Brodhagen method, I did it right down the line, exactly what they said to do - and it didn't work. So I think there's a flaw in their reasoning (David: Which is?) Which is that you have to skill-base kids before you can use the skill in order for them to skill themselves. But that goes anywhere - that's technology, that's maths, that's whatever...

David: Yeah, it's life - you don't just expect somebody to start doing ...anything.

Candace: Yeah, and ... actually group work - how to group, how to cooperate, how to work with - I mean all that has to be done.

David: Yeah, it's just not a matter of coming in and saying "Hey group work's wonderful, go and work in a group", (Candace: No) there are skills involved.

Candace: No, and I also think that the individuals have to be... um, looked after, too - 'cos some just can't group work, they just can't work in a group. But, as for science, I think I've done rather well, but because I had someone with experience, but the other thing is, not only experience, but who thought in a similar way to me, I think that's important.

David: So there's a certain compatibility there of...

Candace: Yeah, to make this run you've gotta be compatible - you have, because you can do it in the other way but...

David: Well in some other classrooms it hasn't run as well, because there hasn't been that basic...

Candace: It doesn't mean to say it hasn't run...

David: Was that compatibility partly because we already had a friendship from other things that we'd done last year, or...

Candace: Yes, you can't say no, I don't think so, but... I think that was part of it but I also think because one was from strength, and one was strength in another area - you were the strength in the science, and I'm not trying to butt up against you because I knew you were sort of superior in your knowledge there, and I had the strong teaching base of integration and without, with no disrespect I think that you would say that I had the superior knowledge in that area (David: Yeah), so really what we were doing were coming from two areas of strength mixing (David: Depending on each other's strengths) on equal level - it doesn't matter whether you're from Curtin and I'm from wherever, it makes no difference. I think the problem you can have is if you've got two very strong people in the same area - I think that would be an interesting concept.

David: Or if there's not that trust that's built up though, because I think, you know, with one of the other teachers that she hasn't trusted me, and if anyone else comes past and says "Hey I wouldn't teach that content with Yr 8s", she'll believe them (Candace: Oh, trust...), and not accept...

Candace: . But then you see that's all to do with risk-taking - you've gotta be able to take a risk, you've gotta be able to let go of the reins - this is part of life learning, and you can't stand there on your autocratic throne and say "this is my class - you come in but you do as I tell you" - well that's fine, you're gonna get one sort of method of learning and teaching.

David: Yeah, that's right, it's either a true collaboration, or it's....

Candace: Yeah - I'm gonna throw a question at you while you're questioning me - Did you feel that you had equal rights in this classroom with me and the kids? How did you feel?

David: I think so, yeah. In fact it's sometimes comfortable for me to be able to say "Go and ask the boss" to the kids, because I do see it as being your place and your group and I honour that, but I also didn't feel... I felt that trust from you, you know - that whatever I chose to do you trusted that I had good educational

reasons for doing it, and supported me in it, whereas...

Candace: That's funny, 'cos you say "Go and ask the boss", I say "Go and ask the expert"! So there you go, you can see that the kids accepted that - they were happy.

David: And I think maybe that's ... yeah, the kids actually realised that we respect one another - that's probably important as well.

Candace: But they knew who to go - this is good - they knew who to go to get whatever information - if they wanted pure science they just automatically gravitated to you, and of course... and other things to me. So the kids realise that there's different strengths in teachers, and I think that's learning in itself (David: That's a skill in itself) Oh gosh yeah - but then these are extraordinary kids.

David: There's a couple of individuals that I wouldn't mind talking about a bit. One is Adrian that we were talking about this morning. I mean Adrian's still a naughty boy, basically...(laughs)

Candace: I think Adrian's gonna be a naughty boy until he hits.... he'll be 23 going on 9.

David: Probably, yeah. But giving him the responsibilities has helped him to...

Candace: Oh yes, he's very good, actually he's very good in that role.

David: When he's given a responsibility to do something - or when the task suits him (both laugh)

Candace: Actually, he treats responsibility with great respect, and he's different than other kids, because he actually realises that it is a responsibility and he takes it very seriously. The other thing with him is he's different because he accepts whatever - I don't like the word punishment; correction perhaps - he accepts them, and is quite happy to do that.

David: But is that - I think in a way that's a strength of all your group, and of your approach though, that you've made it very explicit: you're responsible for your behaviour - these consequences are logical, you know - so it's not...

Candace: He explodes with others, that's interesting...

David: There's that sort of meta-level of saying "You're responsible for your behaviour - I'm not responsible for how you behave"

Candace: Yeah, that's right, but as well as that you've gotta - I think the kids have gotta understand that ultimately you are responsible for the class and you

have a high level of responsibility - in fact you're the boss (laughs)

David: Yeah, and you can make that very explicit, and say "I have accountability for these things".

Candace: They know that, but, if you saw that young man perform with other teachers it's quite incredible - he turns...he develops horns and a tail. He does, that's his... this is something that I would like to study or go on further and that... with me these kids are great. I just wonder whether, by giving them all this responsibility that they do take, um, responsibility for their own learning, if they hit an autocratic teacher next year, I have great concern because ...

David: Or they'll even try it on with me though (Candace: Oh they will) if you're out of the room or something (Candace: Of course they do), they try it on... and I have to then...

Candace: Fiona, they try it with Fiona. So I wonder whether it's a strength or a weakness from me... which is quite fascinating, because I try and... I'm not a possessive teacher, I don't say "they're my kids and don't you dare come near" I don't do that, I try to encourage them to go to other teachers and respect everybody, all the rest of it but... the interesting issue is: by not being autocratic, by not being this authoritative figure stuck up there that they can hate, am I doing them a disservice. Because they do it...(a) I think they do it because they respect me, they also respect themselves, but they do it because they like what happens in here.

David: I was just going to say - do we undervalue relationship. You know, they have skills with this meta stuff, but they really have a relationship with you. (Candace: Very much so) And I think we undervalue that.

Candace: And I think we undervalue that. I just wonder whether it's manipulative - I question "is it manipulative?" I don't know, I have no idea - I can't teach any other way so therefore I may be manipulative without reason. I try not to be - but if you've got kids that like...

David: I think each other teacher has to develop a relationship, and the first phases are gonna be tough. And your first phases were with this bunch...

Candace: Oh yeah, absolutely, I mean every phase and every new bunch is tough, but...

David: But once the relationship's established...I think Simon's the other one that's interesting to talk about, because he's really - I don't see him as being a naughty boy, in here.

Candace: No he's not, not at all. (David: I see him as...) Very mature, very mature - he's a good 18 months ahead of most of my kids in their immaturity, not in

age. I mean he's got his steady girl friend and... he's really like a little Year 10 in a Year 8 class in a Year 8 body, although his bodies quite big, but he... his father gave insight into that, he said "but with Simon he's always had to respect - he respects people - he doesn't respect many but when he does he'll kill for them", he said, "and you've gained his respect"

David: Mmm, he respects people, not offices or...

Candace: Yeah, that's right, so much so that he said if I'm teaching Year 9 he's requested that he has me again, which'll kill me (laughs), no, but ... so that's interesting 'cos he's a different case, he's totally different, because he will stand up and he will say "excuse me, these are my rights", and this has got him into deep deep water, before he came along to me. But what was quite fascinating was, I was the one he ran to, I was the one he cried on, I was the one he said "I really need it", almost giving me a hug sort of thing, which you wouldn't believe from that kid... 'cos he's a heavy boy

David: So was it naughtiness...

Candace: Frustration, sense of injustice... Oh yes, there's a bit of drama there, he does like to be the drama king.

David: Yeah, I'm just intrigued about whether it's Simon specifically or whether some of the other people who have problems in other classes would respond similarly if they came in here.

Candace: I think they would, because seeing the difference in ... another bunch of Year 7s here, seeing the difference when they changed over into a new environment with a new teacher... (David: yeah, that's a similar experiment) It's unbelievable, it's absolutely unbelievable, I go in and teach literacy there, and it's a different bunch of kids. You know, there's a maturity factor 'cos we are at the end of the year, but I do think the personalities play...

David: Mmm kids are really quite malleable at that....stage as well

Candace: But having said that, fortunately, unfortunately kids have to learn, same as we all have to learn, that we've gotta get on with every type of individual and we're not all the same. So it wouldn't do for them to have seven Candace James' or seven David Geelans, because I don't think that would help them to go out into the real world. I think to have a Candace James then a David Geelan, then a Fred Bloggs, then a Jamie Jemima, whatever - I think that gives them a balanced view. Because I think they need that balanced view....

David: Do we narrow those parameters of normality and say "Only these kind of teacher we will allow to..."

Candace: Of course we do - but then again, you've got the accountability factor: you can't have people who go and don't teach particularly well, who refuse to teach, or cannot handle the individuals, or are physical or whatever - you can't have that because of accountability. And this accountability factor is very good, because now people are accountable for their actions, but then again, it's bringing up a load of questions that never happened before. I mean the old thing of "Sit down, I'll whack you across the ears if you misbehave dadadada", it doesn't happen...

David: How is it measured though? Do you think the ways that accountability are measured now are appropriate, that they work?

Candace: No. No, I think we're gonna have to work on them, I really do. I think we've got a half - a mismatched system. We've got half of this old system, half a new system, and at the moment the kids are in... don't know whether they're in winter wonderland or in summer, they don't know, and I don't think the teachers know yet. I mean, I think I've got some direction, but I haven't changed my teaching methods, at all...

David: So what about the parents then... in all of this...

Candace: Well you see, being a cynic, parents would love to see - many of them would love to see them in little uniforms, boaters on their heads, going to school, sitting in straight lines, saying "yes ma'am, yes sir", popping home, doing their homework, and aren't I a good boy or girl. And that's natural... I think they want to see that, they don't want to see them coming out in sweatshirts and f'ing and b'ing and that sort of thing. They put in... because they've got a pre-emptive...they pre-empt what it should be, they have a view what it was in their day. Particularly if they're not teachers...

David: Yep. So to what extent are we reactive to that, and to what extent do we try and challenge it?

Candace: We're very reactive, because they're voters: (1) they're voters, (2) they pay taxes, (3) they can chuck out the um,... It's up, it's higher level stuff it really is. It all comes down to money and votes. I really think so. I mean look at the heavy whether we went through in this school - community saying "Oh, one shouldn't do this, one shouldn't do that" but we are winning, I think we are winning the war. We lost the battle, to start with, because we really got known as unbelievable interesting things, also including 'the poofter school' which was quite fun, but, no, I think we're winning the war, but the war is gonna take 20 years. It won't change overnight.

David: Mmm, that'll probably take until... some of these kids are the parents.

Candace: Yeah, either that or you have a dramatic change and [information] technology comes through overnight. And that's not gonna happen, even if

Mr Court says it is. But I really think that we are... got a foot in both camps.

David: Yeah, that's.... it's actually working, and that'sone of the things is going to be, measuring the success of that.

Candace: Having said that, I think it's working here. I think the kids are far more responsible, far more good.

Interview with 'Andrea King' - 17 December 1996

- David: I guess the first question is: Do you think it's been a useful program to, um... Well has it been useful enough to cover the hassle of having me come in for science?
- Andrea: Well, it wasn't a hassle, because I don't have science in my degree or in my training, so having you come in and actually provide that support and the expertise was actually essential to me because otherwise the kids wouldn't have gone into the lab because I haven't got enough confidence to take 'em there. And the continuity in that program, particularly this last semester where we've had... you know, every week it's sort of been thematic and it's been relevant and it's been lab work and it's been great.
- David: Would you like to have seen that kind of approach come in earlier? To have... I guess in a sense me structuring it more...
- Andrea: Yeah. Well, I'm a structured person, so I appreciate structure, I appreciate being able to read up that this is what we're doing and... you know, if I have to do anything I know I have to have it lots of time in advance because I get anxious if I haven't got things ready, so yeah...
- David: Yeah, I think that was a thing of expectations, of me not knowing exactly what you wanted as teachers, and I guess you not knowing exactly what I was thinking and... So I guess that finally came clear in the final term of the year.
- Andrea: Oh it was great. (David: Oh, that's good.) It's not that it was bad before that, but it was better, for the structure and for the kids having the booklet full of ... you know, these were the activities. If they missed a week, well, that's what they missed and that's what they actually had to catch up on.
- David: Yeah. Is that one of the things you miss here generally - not so much relying on textbooks, it's harder to refer someone to something if they miss something?
- Andrea: Absolutely. Because usually you can say "Well we covered this chapter, or these exercises in that book while you were away..." And similarly if they're going away, the students usually, often do, you know, they're going on holidays with parents at odd times, say "All right, while you're away we're covering this much work, and you will have to catch it up."
- David: How did you feel about other areas that you're not a specialist in? 'Cos your area's maths isn't it?

- Andrea: Yeah, except that I'm a 'jack of all trades', because I've got a degree in economics, and I started out as a social studies, book-keeping and accounting teacher, and then I moved into school counseling - well actually I didn't get work as a school counselor I worked into remedial education, so that brought in English, so the social studies and English was covered. And then I went back to university and did maths - so three of the four core areas were covered.
- David: It really was everything except science that you felt...
- Andrea: Yeah, and health and Phys. Ed., but we can all do health, but Phys. Ed. was a headache... Once again I worked both semesters with people who were actually more expert - a lot more expert - in the field than I was, and I actually, I s'pose they carried me but, I mean I did my bit, but...
- David: Is that one of the things that you found useful - the team structure? That there has been support in areas like that?
- Andrea: Ah, yeah, that's right, because Carol was the volleyball person, and because I was working with her it didn't really matter that I didn't know anything about volleyball. (David: Mm, you could do some of the other tasks apart from coaching...) That's right. And actually the rules weren't difficult and once she showed me what they were I could then go and referee, well, sort of referee, matches. And similarly with, working with Peter Knightsbridge in softball - he knew about the game and I didn't, and it was a matter of... I actually did a lot of the organisation, you know, sort of scoresheets, all the stuff that he didn't have time to do so we actually worked quite well as a team, I think anyway.
- David: So you think you've probably learned a fair bit in the sport area - do you reckon you've learnt some stuff in the science area?
- Andrea: Oh, yeah, certainly. I've actually... learnt new things, and I've been reminded about things that I probably learnt when I was thirteen and forgotten. And I've actually really enjoyed being over there in the lab with them and watching them interact and get really stuck into doing some hands-on stuff, that was good? I really enjoyed the lab more than I did... here. 'Cos I sometimes thought "Oh, I don't know if I'm saying the right thing" here. Especially when I mucked up that parallax thing, 'cos I thought they were s'posed to be swinging it and they were s'posed to be keeping it steady.
- David: Yeah, I think that happened with all the various teachers... but I think... hopefully most times it was comfortable for the kids to say "Well, I as the teacher am not the expert, Mr Geelan's the expert in this area.." and whatever and I don't think the kids found that too difficult...

- Andrea: No, I don't think they did either. I think they're a lot more accepting... than maybe I would be in a similar situation, probably as a parent, that the teacher wasn't expert in the field they were teaching in. And that's because I come from a pretty traditional high school background where you expect the maths teacher to know the maths or...
- David: Yeah, I did have a student complaining the other day that he felt as though his teacher really didn't know enough maths to be teaching it, and having a real complain, so there are, I guess, some students who are uncomfortable with it, probably the more capable ones I think, who are not being challenged or reached or whatever...
- Andrea: Yeah, that's right, you're probably right...
- David: When I spoke to you earlier in the year you felt as though maybe this school wouldn't prepare them very well for Year 11 and 12 - do you still feel that way?
- Andrea: Um - this is off the record? (Laughs) Yeah, I do... I have strong reservations about having people like me, if you hadn't been here, having people like me design a science program and run one for Year 8. Because I've put three, or two children through high school, another one's in Year 9 currently, and I see what sorts of work they came home with and the sorts of things they were doing, and I wasn't competent to do that in science. It was lucky that I was confident to do it in the other three core areas, but... I would actually feel quite uncomfortable thinking that maybe my kid was being taught science by a mug like me, and I think that your contribution was invaluable from that point of view because I could say to them "I am a mug, but here's Mr Geelan, he knows what we're doing", and so that was... I felt that gave the kids, much better preparation.
- David: I guess the argument is that there are other things that balance out for the lack of content knowledge...
- Andrea: Yeah, but what do you do when you get to Year 10 and you've had - say you'd had me two years for science and you get to Year 10 and you get a real science teacher who expects you to know things. No, it's ... And the other thing is the assessment program - if Candace hadn't been here and you hadn't been here to sort of guide what sorts of testing program we had, I wouldn't have had a clue, you know. I probably would have picked up a textbook and religiously gone through chapter by chapter and sort of... hopefully made up questions that were relevant and could actually reflect what they'd learned.
- David: Yeah, that's one of the other things too I guess is, how do you find Outcome Statements all across the Learning Areas - is that fairly tough

across all...

Andrea: Yeah it is, and the other thing is, the Outcome Statements as they are, in the books of Outcome Statements are quite confusing sometimes, because you know that a kid can actually calculate the area of a square and a rectangle, but not a circle and a triangle, so what do you tick when you come to the box about 'Can calculate the area of plane figures', no he can't, but there's no box above it 'Can calculate the area of a square'. So I had a lot of difficulty actually placing them on the Outcome Statements. One in the algebra which really intrigued me, a Level 5 in outcome statements was actually drawing a graph in the first quadrant, and I had taught practically this whole class to do that, but they actually hadn't achieved Level Two when it actually came to understanding what they were doing. And so when I had to place them on a continuum, I didn't know what to do.

David: Do you think the Outcome Statements don't discriminate enough? That - really only having five across the years, it makes it very difficult to...

Andrea: Yeah, they don't discriminate enough, that's exactly right. And when I did a... actually one test I made my own up, I looked up the broad outline of what you're s'posed to know for each level, and made my own up, now that's OK, except that somebody else would make up another lot, and what do you do about that? I don't know. It means that I think the child is a Level 3 or Level 4 or Level 5, but somebody else might say "But if you go to the actual Outcome Statements he can't do this and he can't do that, so you can't actually do that..." So that is confusing.

David: Quite complex, isn't it? One of the aims of what I was trying to do was to support people to the point that they did feel confident teaching science, do you think if you were staying here next year you'd feel more confident about teaching science, or would you still want some support?

Andrea: I'd be more confident with Year 8, especially experiments that don't involve lighting gas burners (laughs) But there are plenty of kids around who are happy to light the gas burners I suppose, I'd just have to be more conversant with where the main switch is to switch everything off in an emergency. But, yeah, I'd be more confident with Year 8, but if I was taking Year 9 I'd have to have somebody like you come and help me again, 'cos I'd be in the same position, I wouldn't really be confident of the content. I actually feel - I don't know whether it's just a matter of pride or what it is - but I really feel that I need to prepare them well, you know, and if I think I'm not preparing them well I get anxious, and it's not good for anybody, 'cos if I get anxious I'm not as... easy to get on with, and the kids suffer. They suffer both

ways - one I don't know what I'm doing, second I'm a bit cross about the whole thing anyway.

David: Yeah, 'cos you don't feel on top of what's going on and you like to be.

David: How have you felt the support from the science Heads of Area...? Again, off the record!

Andrea: I only actually called on him once. That was the week you had the flu and Candace was somewhere else, and he was great. He swapped his program, and I showed him the experiment we were supposed to do, he raced around, he got the lab ready, because it hadn't been set up, got the food out of the canteen, came over, took Candace's class while I did something, took my class over and I went with him while the relief teacher took them... He was really good - a superb teacher isn't he?

David: Yeah, Darshan is very capable I think.

Andrea: Yeah. I probably couldn't have relied on that happening every week, but just the one time I did need him he was there and he was very good, so that's all I can judge.

Interview with 'Alyx Nilssen' - 17 December 1996

David: Do you think the program has been useful, in general, for me to actually come in and support the science side? Has it been worth the level of hassle of having to have that particular period locked in and that kind of thing?

Alyx: Yeah, I think it's worked really well, I think... I don't think it's been a hassle at all at any time, and I think... even though there are times when people couldn't make it or whatever, it's never been a hassle. I just think it's been positive and good the whole way through and there's been things that you could offer that I certainly couldn't offer. I like, I really liked particularly the Waterdeep program that you developed with Candace. I thought that was excellent, I thought that really got a lot of scientific concepts and things across, and the kids enjoyed it, even... a when there was a lot of talking, sifting through ideas. Yeah, I think it was great.

David: Was it a bit hard for the Year 7s, 'cos it was really sort of, I guess, designed for the year 8s...

Alyx: Some of it was pretty hard for the year 7s, some kids... it would have gone over the heads of some Year 7s. But I don't think all science has to... they don't have to take it all in, I think if they have a touch and taste, and if they can see other people thinking laterally, I think that's also a good thing. And 'cos there was no test to go with it, I think... (Yeah, they're not disadvantaged by that...) Yeah (David: ...it's just an exposure), you can do that. I also think lots of things were... even though not every child had things in front of them, but certainly there was enough time to come up and play with the wheels or "spin this", or... Before you got there I would talk about centrifugal force and I would sort of back up - precede rather than... yeah. So... I think it worked really well. I think there probably... for the weaker ones, maybe... maybe I could have modified some of the stuff a bit more. But I think that when we spoke to the kids we spoke in Year 7 terms, we didn't try and bamboozle them with science.

David: Would you like to have seen more structure like that for the rest of the year? 'Cos you're sort of quite positive towards that package... Do you think that would have been useful?

Alyx: I think... no, I liked the idea of having structured lab work, and then the sort of philosophical questioning - I think there's a place for both, and I really think these year 7s need that grounding in the lab as well as this other stuff, 'cos you know, you have to teach to all dimensions, and the kids that love the lab work, and that couldn't quite come to the same level of understanding as the others in the philosophical thing about

Waterdeep. I think, no a good mixture. Probably what I would do, if I did Waterdeep again, would be to maybe... get the kids to draw the spaceship, and get the kids to do a diary, all the way through maybe, and really embed it into the thing - that's something I could have done better...

David: So maybe if you'd had it earlier, for example, before the holidays for the term, to have time to tie it in with other things more.(Alyx: Possibly, yeah.) And perhaps you're also still working on the skills of integration as well. (Alyx: Yeah, I am.) How are you feeling about all that? About the demands of teaching here?

Alyx (Motions playfully to turn off the tape) How do I feel about it? Um, where does this go to?

David: Not Andrew!

Alyx OK. This is the hardest school I've taught at, I think - the demands here are huge, and that's why I'm going part time next year, 'cos I don't think I could cope full time plus study. I think that I'm getting better at it, I think the second year will be much better. I mean I've got a five year contract here, so they assume I'm coming back in 1998 as a full time teacher. But I'll... it's just a really hard school, lots of things to do - your mind is totally cluttered all the time, weekends, everything, with work from this school, after school...

David: Do you think that'll change? Is it like going back to your first year of teaching again?

Alyx Absolutely, yep. I think it will change, but I think the individual has to change it too. I think if people stay here long enough, and don't live breath and eat this school, and are not married to the school, work out that you have to have some personal social life and then work out...

David: So how are you feeling about... are you teaching science next year?

Alyx Yes I am teaching science next year.

David: You're feeling more confident than...

Alyx Yep, much more confident. What I might do next year too, is use Darshan's replacement much more too, because I didn't use that person as a resource very often at all. I thought I knew it all from my science background but I don't... that's all very well having the knowledge but not knowing how to teach it and... I'll probably look toward that person more - also for more chemistry based and physics based stuff... so I'm doing more in the classroom.

- David: Did you feel like that support was there in the first semester, without mentioning names?
- Alyx It was, I was too bloody busy to go and seek him out, I was just... shellshocked in this school. I mean if I'd started off... what I probably should have done at the start of the year was just to stick with Primary Investigations and done some simple stuff, and just taught primary school science, transitional science... but... 'cos there are so many tantalising offers here and you think 'Oh yeah, I'll try that...'', and I did a lot of things... mediocrity rather than a few things well. Science is one of them I felt I didn't do a good job, I felt for the first six months I didn't do a good job here at all, in anything... it took me that long to really work out that I... do my best and I can only do my best, until you come to terms with it all.
- David: That's interesting to hear because from my perspective going across classrooms you're one of the people who's jumped onto it best (Alyx: Gosh!), the integrating thing, and there are other people that haven't... obviously you could see that you were struggling with it, but you were really making progress, and to see that at the end of the year you've really, I think, got it together quite well compared to... some other teachers.
- Alyx Ta. Well, I think I did, 'cos we used Waterdeep across the SOSE and language and the environment and the whole bit, and maths.
- David: Does all the... are there benefits that make up for the extra work? Do you know what I'm saying? (Alyx: Hmm) There are certain benefits that are claimed for this school, do you think they're there, and are they sufficient to make up for how damn hard it is?
- Alyx (Long pause) Gosh, I don't know. I think there is... I think there are great things being trailed here. I think, for me, there is too much going on here. Too much, and I don't think the advantages are outweighing the disadvantages right now, that's why I had to go part time. I think that there'll come a time when everyone's... when the Year 10s, 11s and 12s and everything has settled down we'll have some sort of feel to the school where everything will start to come into place, but ... Maybe it's my mindset, I mean I'm a primary school teacher and I also am, pretty abject to change, and it's been a big step for me to come here and to have to push myself again with all these things. Um, so quite honestly, no I don't think the advantages do outweigh the disadvantages for me...
- David: For teachers - what about for kids?
- Alyx Phew, I don't know. In the long run - no, I don't think so. I think Year

7s get, if you have good teachers at a good school, kids would get as much, if not more because there's a gentleness about primary schools that this school doesn't have, and I feel it's more nurturing at primary schools, this school is quite difficult and hard, and kids are thrust in here, and I think kids... especially my class, 'cos I was feeling stress and pressure the first semester these kids would go home with stress just like I was - their mum or dad would come up and tell me. I think there's...

David: Once the thing finally settles down? Because at the moment you've got kids trying to re-acculturate, you've got teachers... and you've got a clash between primary and secondary cultures and all those things settling down. Do you think maybe once it's all settled down and locked in place that it might have some...

Alyx I think it will be better. I still think there's room for... I'm a nurturer and I still think there's room for more nurturing throughout the whole school, and more care. I think curriculum's one thing and going headlong into things and having these great evaluations is one thing but I still think there's lots of room for care I don't see happening here.

David: Why do you think that is? Because I think that would be a... something that they would value, that the people who set the school up would have wanted to be happening. Why do you think it's not? Just too much stress on the other curriculum stuff?

Alyx Yeah, I think so, I think the school's driven towards that...

David: And I think the teachers are sort of on the edge ... because of that.

Alyx And also, those things can be evaluated in a tangible, and you can see it on paper, but nurturing stuff you only see it in the eyes of people and their hair looking shabby, or that sort of stuff, and the amount of sick days people take... but I think that's probably one of the most important things.

David: What about nurture for teachers as well?

Alyx I think that's... I mean, I'm on the staff induction committee and ... on the computer I've got ideas for managing stress and what to look for and who to turn to and, just things that weren't talked about or were assumed...

David: Do you find the team helps with that, or...?

Alyx Yeah, I do. Yep, I think - it's been really good, the team. More than any other group of people at the school, I think the team... plus then your

friends that you gather here and talk to and... um, I think when you finally realise that you're not alone, there are people who are feeling exactly the same way but no-one voices it. If you're going down in a screaming heap there are about three of you who are down there picking yourselves up.

David: Yeah, that tends to help I guess. Do you find the team itself tends to focus on curriculum stuff rather than nurture and support of teachers?

Alyx In the beginning we did.

David: Yeah, I guess it depends on the team as well.

Alyx I was pretty happy with Cowan Team, we had a few little niggles but that's OK. I think though at this school you have to maintain a lot of your own esteem - you can rely on the team for so much but you can't rely on it for everything, and you have to delve into unknown strengths that you never knew you had, and get it all out, but I think they're there to support you and everything.

David: As far as the kids in science, what are you picking up as far as their attitudes toward science at the end of the year? As opposed to what they've learned or whatever, how are they feeling toward it?

Alyx OK. I think they felt science was too much talk, I'm pretty sure. They want more fun, more change, more hands-on - like all kids do - they want more experiments, more time in the lab - they love the lab. And yeah, I think less teacher talk... Which is a shame... which is probably totally against what we were doing with Waterdeep, but then again in the student evaluation that went home with their portfolios, one of my children, David, loved Waterdeep, loved talking about it and listening to it. Now that just blew my mind, that he was so keen on that stuff that was so much talk - he really enjoyed that part.

Interview with 'Carolyn Young' - 17 December 1996

- David: Do you think the whole activity has been valuable, of having some science support? And in what ways has it been useful? Or would it have been simpler with the timetable and whatever if you'd actually just done the science?
- Carolyn: Oh no, I think we did more lab stuff with you than I would have done without. It would have been good to go along more with the rest of the team, basically just for the support and because there was a lot of class swapping which would have been nice.
- David: Yeah, no, it sounds from what you have said that the rest of the team gave a lot of science support actually but... where I think the people I was working with in Cowan that wasn't the case, that really none of them felt
- Carolyn: Yeah, see Steve has been doing it, so he's been writing programs and even taking Cassandra's kids to the lab while she did things, and you know organising stuff for Annalise and Giovanna.
- David: OK, so you could have locked in with that. I guess the other cost was being locked into particular times for science.
- Carolyn: Yeah that was... and it was unfortunate that we used to have it in the afternoons, especially Friday afternoon because that was just...
- Carolyn: Yeah, I think it was the lab work, that was good, to go over there cause I would never, I mean my big lab expression was melting wax to see solid to a liquid and back as well, that's about it.
- David: So I mean probably to have done more of that would have been useful. I think we did a reasonable amount but yeah to have been able to get to the lab as much as possible in a way would have been good. Mm If, I guess you're not going to end up teaching science next year but one of the things I was hoping to do was to support people, how would you have felt if you were doing it next year... to have taught science by yourself without support next year. Would you have felt fairly confident or still
- Carolyn: Well if I had been working with a team that I had this year I'd be fine. yeah
- David: Yeah, Did you feel that support from Darshan as well or well it wasn't so much needed cause Steve was sort of taking over?
- Carolyn: Well, see I mean first semester, Fred was sort of like gave out packages

and stuff which were good, but then again cause we were doing separate programs I didn't really didn't seek their support, and same with Darshan, I mean he offered and that I said you know that I had you, so...

David: I think probably at the beginning of... end of last term beginning of this term we sort of had that meeting with Fiona and tried to sort our expectations out a bit. I mean obviously there were things that I was being extremely slack about and unprofessional about and I apologise for those, and you know, I mean no excuses basically it's just dumb. But a lot of it too was expectation problems where you know every time you were doing a lesson. I was cheering because I was thinking, that I wanted to support you to teach science and you were spewing because you were thinking it was my responsibility to be doing it or something.

Carolyn: Oh no, I wasn't spewing, it was more a case of a small part of it was, I've got this science expert at the back of my class, watching a non science expert. Do you know what I mean, and that was a bit, a lot of the time I felt like "I'm not doing this properly and that's what he's thinking". You know what I mean, he's sitting there thinking you know, "she's not sort of talking about that, she's not talking about that", which was one of the issues but I think a lot of it was.. again it goes back to expectations. I sort of expected more structure and support but then I got to the stage where I couldn't actually trust that that was going to happen so I would be running around first thing in the morning going "Fred have you got a chemistry book that I can get some lesson out of", because I still felt compelled that I should do science on a Wednesday even if you were there or weren't. Which I think maybe was the wrong thing to do, because sometimes it was a lesson for a lessons sake, because I didn't have the...

David: Yeah it may have been better to blow the science off rather than, doing it without feeling confident or without having the stuff to do there.

Carolyn: Well it was almost like, first term I felt fine with science because it was environmental biological science and it meant... I haven't got any science learning but, you know what I mean, I found that interesting, I could teach that with the resources that you know people shared around, but when it got to the chemistry, and I was thinking, no this way past me, but I think I probably could have bumbled along quite nicely with you know Annalise, Steve and Cassandra.

David: Yeah, I think that one of the things that was really unfortunate was that all my doctor's appointments were on Wednesday and so that really cut into things and then I didn't really cover those and say "OK...here's some stuff to do"

- Carolyn: Oh I mean that's fair enough, you had a broken leg, like you can't jump off buildings...
- David: Yeah, in a way maybe that contributed to that feeling of not being reliable or not being able to rely on me to be there when I said I would be, and that kind of stuff and I guess that was hard to reestablish....
- Carolyn: I mean I'm not the most organised teacher but in my own specialist area I can teach off the cuff, but with an area that I'm not ... I have to sort of like do my preparation and then have time to get it right in my head first, you know what I mean before I did it and sometimes I wasn't getting a chance to do that so that I felt like I was bumbling along.
- David: So really it would have been far better to have like a term long structure that was really clear and...
- Carolyn: With that environmental stuff, I found that - I think because I had a certain amount of content knowledge - I could see the structure of where we were heading do you know what I mean so I could one day you weren't here I thought OK we would do the carbon cycle. You know what I mean?
- David: Sort of continue ...
- Carolyn: And I could link it to what else we'd been doing, you know so that was OK but once you know, chemistry, you know I didn't know why a kettle boils so that was my extent
- David: I think probably one of the problems was that my expectations were extremely high of all of you teachers, to say "Well just go in there and bloody teach science", you know, and so I was trying to support you at a really high level of, you know, integrating and stuff like that when I should have been supporting you at the level of "OK, here's how we teach science", you know, and the content support. You know what I'm saying?
- Carolyn: I think the teaching skills, I've got the teaching skills...
- David: Yeah that's right.
- Carolyn: ...to get across, but I think that sometimes... I mean the ethos of the school is skills and process not content, and I think sometimes we got so bogged down in content that we weren't teaching the skills that go with science. You know things like we have had a whole year of science and the kids haven't done a report, a scientific report. Do you know what I mean.

- David: They did some in the chemistry section but...
- Carolyn: But not an individual you know, maybe my science experience were different but you know we were given a task to do and we'd go and we'd set up the equipment. Maybe this is a bit advanced for Year 8's but they have all the skills of doing the equipment, and so to me to make them independent... "OK this is what you've got to prove, here's a suggestion how to prove it, go and do it and then write up the reports".
- David: Yeah, so again I think my expectation was high of saying... you know, these traditional lab reports are sort of bottom line and then you extend but I hadn't...
- Carolyn: Yes, you actually have to start at the beginning, I mean you've got to know the rules before you break them, and I think that was one of the big problems. Like with, I mean, you know, the kids that are really into science, they coped but the ones who weren't scientifically minded or academically achieving that well they needed that more grass roots stuff. You know just simple things like one of the activities that they really, really enjoyed was when they actually got into groups to summarise a chapter of the book (David's note to my recall, they hated it!) and we were doing conifers and fungi and stuff like that. Now, they still got the content, but they learnt the skills of working in a group, coming up with the diagramming, the, you know, actually coming up with a page of notes that, and they loved it. You know it was keeping in all the literacy and literacy skills, group skills, but using a science content, and that type of thing I would have, you know ...
- David: Used more because it addresses....
- Carolyn: Mmm, Used more myself. I mean I watched Cassandra do this great activity, can't remember the actual content. It was science but she did jigsaw's with them, the group, and the reporting back and the oral reports and all that type of thing. Where I could cope with that beautifully, using a science text, you know what I mean, but again we did bits, but I would have like to have seen that a little bit more. The same type of thing I use SOSE texts... you know like we'd be doing a newspaper article on population growth or something and we'd do sort of like summarising or graphic outlines, something from that text which I thought that's a perfect way to get science in and start discussion on science, you know. Like they did that, they did a graphic outline on the elements in chemicals, which Annalise did up, again they, the kids themselves found that, because they were doing it and they... you know there was only one kid in class who didn't finish it, you know what I mean? And they got the terminology out and they got the main points and we had gone through and done it step by step on

the board, which would have been, I mean I know it's very literacy based but still it's a skill they need in all subjects.

David: Yeah, no, I think the things that I did, as you have pointed out before, also were often too talky simply because either the preparation wasn't appropriate or I guess it just wasn't linking in because really I was coming in for that short period of time and it was hard to sort of link in with things that were going on, you know what I'm saying, that, and maybe I should have been making myself available so that we could talk more during the week and get things linked together and whatever. 'Cos I think there were lots of things that we could have done in this communication stuff in the last term that would have linked in better with what was going on in the rest of the week and so on.

Carolyn: But I think there was lot of potential there and I think we just missed it, I mean as... I mean my attitude to science wasn't that crash-hot to start with, I mean I haven't had positive scientific experiences in my schooling, but it was sort of, you know, I think from Day One, when we sat here and had our first team meeting, and Fiona said, "Who'd like a PhD science, or science specialist doing his PhD...?" I was 'YES!' and my expectation was, this guy was really gonna come in and, you know, and help...but again, that's going back to expectations isn't it?

David: Well I mean that's the kind of expectations that we should have got clearer at the start, and it's really unfortunate that it took as long as it did to do it, but..., and that it took as much frustration as it did to actually get to that point. But I mean that's something we've both learned about it, (Carolyn: Oh, yeah) that maybe we need to challenge those things really early, to say...and obviously the broken leg didn't really help a lot either.

Carolyn: See I think the reason...one of the reasons I didn't bring it up to start with was, I just kept looking at you as the expert, "Oh, he knows what he's doing, he knows what he's doing..." You know what I mean? And I'm thinking, "I'm not the expert here", and... I think maybe it was my own, sort of like self-concept of, you know, "I'm no science teacher, this guy is... so therefore trust his judgment"?

David: Mmm, where it might have been better to trust your own (Carolyn: To trust my own judgment) educational judgment and say, "There are problems here..." Um, but then again, would I have heard? At that point - I don't know....

Carolyn: Water under the bridge, eh?

David: But, we learn (both laugh nervously)

David: As far as the students went, what do you reckon? I mean obviously, Friday afternoon (the preceding Friday, when the students had left for the year. The feeling in Carolyn's room had been quite bitter and hostile, both from the students toward her and from her to the students.) wasn't that much fun and I actually got some of the snarls when you went out of the room, they had a growl... Given a couple of weeks to chill out, what do you think they'll think of their year?

Carolyn: Oh well here's one thing - Peter, on his review sheet for the year, put the highlights down as 'Science with Mr Geelan', and I thought that's a nice...comment. From the laboratory moron - what did he do, pick up the tripod after he had it burning or something stupid. But no, actually one of the discussions we had last week was, they wanted to know how Year 9 was structured, and I said, "basically you've got your home room, you've got your two teachers, you've got your teacher for English and SOSE and your teacher for science and maths, and they sort of went "Aw, do we have to do science?", a couple of them, and I just said, you know, you need to take science, next year's science as a completely different concept from this year's science. And I said you know, whether you enjoyed this year's science or you didn't, don't let that cloud your view of science in general. I said you might latch onto some yahoo, wonderful science teacher and it'll all come alive for you. No, they didn't seem.... But I think a lot of it came - the kids saw it - I tried not to make it like that, but the kids saw it as "OK guys, put away your books, now we have to do science", because it was one of the only - besides arts and technology it was one of the only (David: Things that was locked in in the timetable) things that was locked in...and, because the Wednesday morning was the, again with the timetable was the only full block of time, and then they had LOTE, and as soon as LOTE was over they'd have science, but that full block of time was used to do the big fun activities, and then it was almost like, "Oh, the fun's over, now we've got science", but that was just ...

David: Just one of the glitches of the timetable...

Carolyn: Yeah, but... No, I think I think some of the little funny comments they used to make in their journals I found were quite indicative of how they felt about it. You know, people like Dean who, every single science journal he put was 'ho hum, science again', know what I mean, whereas he's very easy to motivate, to get going. What else - like Sarah and Debra, they used to like science because they could argue, they could actually argue among themselves about things? Which is fair enough, it's a good point, but when it came to content they weren't really that interested. It was more of a ... I think those three were really the brightest, you know, along with DJ and Christine maybe, and maybe David. The ones who were actually on-spot weren't motivated, they just didn't get connected with it. But then again, it was rather

disjointed. And, my Friday afternoon is never the best time of my week, I'm afraid - I've got DOTT next year, Friday after lunch - but that was difficult. It would have been nicer if we could have been a little bit more flexible with the time. And also I think, because we actually had, I mean, first semester we actually had nearly six hours of science a week, I was thinking 'science overload' (David: very excessive, yeah), we were doing more...

David: Yeah, and I guess we started off with the idea of maybe doing some other stuff and integrating and whatever, but it just ended up being this sort of long haul of science each week.

Carolyn: Yeah, well just "Put your book away and get your science book out", it wasn't...I mean we tried, especially with that environmental stuff we did quite a bit of other stuff linked around the environmental stuff we were doing in science but, again, it was because I was from a position of strength basically, I sort of semi-knew what I was talking about. But then I think, sometimes I could actually see... I couldn't see the links between the content and the module that we were doing. I mean again, first term was, you know like the environment stuff which was good, and then there was that space stuff, which again the kids really enjoyed, and I could see the links there, but after that, I couldn't see...

David: Yeah, I think one of the problems that a lot of people have noticed this year is that the modules are all on very similar topics. You really... the science, is really environmental science the whole year, and you can't do it, so yeah, it does get fairly tenuous at some stages. And in fact I think it got so tenuous that it broke, you know, and there really wasn't a link between the science and the other stuff, which is....

Carolyn: See I think the whole school needs to consider that, I mean surely you can integrate like, literacy and science and social science, but you can't go for broke and say, you know (David: Integrate everything), integrate everything, because like maths, I mean, occasionally you might integrate maths with something else, but it's a separate subject and it needs to be....

David: Yeah, and the links become so long and so tenuous that the kids are going "Oh bullshit", you know...

Carolyn: Yeah, exactly. But um, I think...

David: Well, take it from there - what about other teachers in your position? Coming in, having to teach science and having no support? How would you...

Carolyn: Having no support... I think, any teacher worth their salt can teach

anything, with the right effort, and....

- David: Is it too much though? I mean, other teachers I've talked to it's been flat out doing all of the things that they've been doing and it's just taken 99% of their life...
- Carolyn: I dunno, maybe I'm slack but... (David: Sorry, carry on, I interrupted) It's like...SOSE I sort of got into my head what concepts I needed to teach, like the objectives, I looked at the outcomes and stuff and actually decided "OK, these kids have gotta be able to research, and get a concept of time and change", you know what I mean? And I actually made up a list of like six or seven real SOSE concepts that they needed, and then I thought "OK, what a subject I can actually teach all these concepts around?", and we decided on castles, and the kids loved it, and they got all their ... everything they needed with SOSE. And I figure that I probably would have done the same thing with science. Sat down with the outcomes and actually said "OK, what are the basic skills they need to have"
- David: I was going to say, one of the problems with the science outcomes at the moment is that they are still half in terms of content and half in terms of skills - they've done that much less successfully than the other learning areas, so
- Carolyn: But then again, that's like SOSE, there was a list of skills and a list of content, and... say when I was teaching maths, I said to Fiona, give me that list of areas I need to cover and I will cover them, in my own way in my own time, but I will cover them - and I think it would have been the same, I mean, you know, if I hadn't had you I would have said to Fred, come on just....I mean, I'm talking here a 20-point list to cover the year, so that you can work your way gradually through, and you know that next week you've gotta look at energy, then you go and find a science book with energy - it may not be the best resource it may not be the most up-to-date resource, but... you're getting the kids thinking about it, reading about it, doing things. So as I said, any teacher who can teach can teach anything. I mean, this school proves it I suppose.
- David: Do you - when I spoke to you in the middle of the year you weren't too sure about the concept (of the school), about whether it would prepare them adequately.
- Carolyn: Oh, these kids have got no content, compared to the other schools. I mean, bits, but I think they do have the processes and skills to get that content themselves.
- David: You think that, on balance, it works?

- Carolyn: Yeah. I mean I still don't think I've done the kids justice this year in a lot of ways. I mean, I was quite thrilled when my kids got level 3s and 4s in algebra and I thought "Hey, I taught them this" - they'd never even heard of the word before I got to them and now they're actually level 3, and I thought, well if I can do that, I mean if you can teach algebra you can... I mean you saw me teaching algebra, it was... Quite an experience but it was actually a good experience because I did feel like those kids came out with what they need to know for Year 9, and I think it's the same type of thing in science. There were certain things that I remember doing in science and actually enjoying, and I would have liked to have seen the kids do that as well. Like one of the things the other Green Team did - they did electricity, and I always remember really enjoying making the light bulb light up. Again, that's a very practical thing that I thought, you know if I enjoy it, a non-science person's enjoyed it then it's quite a... it would have been good to do with the kids. And in a way I was a bit jealous, well, not jealous, but I was thinking "my kids are missing out on this, and maybe they won't get to do it in Year 9" - you know what I mean? Because it's presumed.... (David: That they've done some of that stuff already). I've forgotten the question now...
- David: You were just talking about how you felt about the year in general, about their experience I guess.
- Carolyn: Again, I mean in any teaching it's hard not to be enthusiastic about the things you like and you put on this false sense of enthusiasm with the things you know you just have to teach, and I think... obviously sometimes my attitudes weren't... "shit, here goes science again" you know....
- David: And I think the kids did read that sometimes....
- Carolyn: Oh yeah, of course. But then again, it's hard to... control your mouth and your tone all the time, but... I suppose the year's over, it's done, hopefully the kids aren't scarred by it.
- David: I think kids are amazingly resilient actually...
- David: The other thing I wanted to talk about just a bit was the team, the operation of the team, because there were some sort of conniptions in the middle of the year, but... whether you feel like that's settled down now or whether it's....
- Carolyn: Um... I think, looking back on our team I think we've got a brilliant team of teachers, and I respect every single one of them, and... it is a... I mean we had problems in the beginning, basically because we were given a team leader and then the team leader was taken away. And we

had to cope without, and then we had a team leader who was so worried that she wasn't doing what she could do for us, that she was bringing problems on herself, and it was getting our back up. But as soon as... I mean that day when we just pulled it all out on the table was just a revelation and it's been really cool since. The thing is I think again, um, as - I was speaking to Andrew the other day and he was saying that "The Green Team's full of Level Threes", you know, strong personalities and we knew what we were about and what we wanted, so we were quite independent of the school, but we also knew when to rely on each other.

David: Yeah, and I think that it didn't ... in a sense the meeting in the middle didn't change it back into a standard team, but it actually let everyone value the way it was already working.

Carolyn: Yeah, it made us use the resources we had on hand, and I think we - as I said, Fiona could go off happily, knowing that we were coping without her, which was a weight off her shoulders, and (David: It was another expectations thing in a way) and we weren't looking at her for things that she couldn't give us.

David: Yeah, she wasn't expecting stuff of herself that she wasn't able to do either.

Carolyn: So we just did it ourselves, and I think as a member of the team we've just been so lucky with the standard of professionalism in the group, of, and sharing resources, 'cos there's heaps of teams around the school who, you know, haven't given one worksheet (David: Yeah, just sort of done their own thing), and I think that's just so sad, because I mean my, I mean high school English teaching is ... you know, a full on preparation with all the reading plus all the marking. And I've done less preparation work here than any school I've ever been in, and that's purely because I can rely on the other team members. I've done a lot of the English and SOSE type tasks and content here, whereas my maths in most cases was given to me, one off activities were given to me, health was, you know we'd negotiate it and all that type of thing, so it was a case of, just being really lucky to be... Once we sorted those problems out it worked really well.

David: Did you think my... stopping coming to the team meetings was a positive or negative move, in the long run.

Carolyn: I think a positive thing, I think sometimes the other teachers who were coping with their own science felt that you were intruding to a certain extent because, you had nothing to do with them. It wasn't directly relevant to them and they couldn't see - that was one of the big problems about our team meetings, when other people came in, and

they'd be coming up with these whiz-bang ideas, and we're sitting there "Hang on, we're the ones who have to teach this, so we have to know what we're doing here", and I think that was one of the things that, came up, and I think, again, right at the beginning of the year when they said we were going to have this science specialist coming in, we presumed that there would be this person with this amazing amount of resources would appear, you know, this bottomless pit that we could pick at and get all this stuff, but that didn't occur, so... it was like, almost like getting your hopes up and then having them dashed on the rocks of, you know, not having this person who's going to come in and be a big whiz-bang science teacher.

David: Yeah, and I think that expectation that I would be working with the whole team was sort of, yeah, I'd set that up but then it didn't end up, (Carolyn: You were supposed to be with the whole team) the role didn't end up evolving that way, whether because of the way the team was working or whatever, and I think Steve did take that role because he's got the science stuff and he was in here all the time, whereas I was only here those couple of days...

Carolyn: But I think, again, Steve isn't a science specialist he's a language specialist but, being a primary school teacher he's had that experience over the years but also he was doing it at such a simple level we could actually understand it.

David: Exactly, and I think my expectation of levels and things, and whatever... and I wasn't providing support at that simple level because I was taking it as read when I shouldn't have been, I think that was the main problem and therefore people didn't rely on me and therefore I wasn't reliable and so... whatever, and so it was a sort of a synergy of a few things rather than...

Carolyn: I mean I've taught out of my area quite a bit over the years and I think, as long as you've got a structure to follow, you make it through for a while, and then when you're feeling a bit more confident you can start stringing out. I mean I taught A-Level English History in England, and I was just going "hahaha, this'll be a laugh", but I had a text book and I had an outline, and the first couple of weeks was just "Read Chapter Six, write a review", but then I got more confident and I could actually start looking at other textbooks and other sources, and using videos and things like that, but again it was a case of, with a gentle nudge, I felt quite confident.

David: I think the other thing for me too was that people were expecting me to have resources, but I've never really taught Year 7 and 8, and I've never taught in WA, so I didn't really know the texts and resources for here, that were... that people were looking to me for... it was texts and

stuff, and I really had no idea...

Carolyn: Then also sometimes when I sat at the back and watched you teach, my frustration of the lack of actual teaching, and more of the - regurgitation of facts. Do you know what I mean? There wasn't - the interaction wasn't there and the... maybe just the basic skills that I've been taught, or that I've learnt, that you need to get the kids going weren't there, and I found that very frustrating, to sit there and think "Oh, if we could do this with this information", you know what I mean? Or have a quiz, or set anything...

David: Yeah, and I'm sure some of that was from, not proper preparation and some of that was from bad habits picked up from lecturing, 'cos you know, the last couple of years I've been lecturing in teacher education (Carolyn: Oh, yeah), so I tend to just default into lecturing, which is not good at all at this level.

David: OK, I think that's all we really need to talk about, unless there's anything you specifically want to say.

Carolyn: What was your research on again?

David: Um, Life, the Universe and Everything (laughs). I was looking at my own teaching, and at the values the school aims for collaboration, student-centredness, life long learning, all that good stuff. I was trying to understand, in a rich way, what things support those values and that kind of teaching, particularly in science teaching, and what hinders it.

Carolyn: I think maybe the kids needed to know more about that. They knew that you were doing this research, but they didn't really know what you were looking for. Some of them came up to me and asked about it, and I told them to ask you. But I think it made them uncomfortable that you were observing them but they didn't know what you were observing...

Appendix Four: Evolution of the Thesis

This appendix presents a set of email messages between Peter and me, in which the representational approach of the thesis is discussed along with theoretical and methodological issues.

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(Co-ordinator, ADT Project (Retrospective), Curtin University of Technology, 13.11.02)