A Self-Taught Approach to Teaching with Computers:
A Case Study

by

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DECLARATION

This thesis is the work of the candidate and that where reference is made to the work of others, due acknowledgment is given.

Paul D. Chandler

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University.

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Studies from Australia and elsewhere have consistently found that there are many primary and secondary school teachers who have received little or no training in computer use. Also identified are teachers who, in the absence of such training, are willing and able to make use of technology in their teaching. In this study, such teachers are called “self-taught computer-using teachers”, a term which reflects approaches to professional development which are more broadly identified within the literature as occurring within schools. The study is framed within a constructivist epistemology which acknowledges teachers as intelligent and capable professionals who are learning throughout their careers. However, by virtue of being self-taught, teachers’ knowledge about computing and related pedagogy is likely to be ad-hoc, incomplete, possibly inaccurate, and its development is at the teacher’s own initiative.

The literature concerning computers and classroom practice indicates that there are: several modes in which computers can be used as an aid to learning; areas of difficulty and concern which are typically identified by teachers who use computers; and long-held concerns over how effectively computers are being used in schools. In addition, inter-related ‘personal’ factors such as knowledge of computers, pedagogical content knowledge, practical theories of teaching, knowledge of routines, confidence and teaching experience provide a powerful framework for understanding how computers are used (or not used) by teachers.

This study investigates whether, in the situation where teachers begin to use computers in their teaching, it is sufficient to assume that these teachers are capable of making meaning and developing pedagogy and to simply leave them alone in their work for them to do so. This question is explored through an interpretive case study of three school teachers (one primary school teacher and two secondary school teachers) who were mature and experienced, but new to using computers in their teaching and whose knowledge of computers and related pedagogy was self-taught. The
classroom practice of these teachers was observed over nine months, and in addition they participated in a series of semi-structured interviews. These data are interpreted by using an inductive approach, using the ‘personal’ factors which are thought to influence teachers’ use of computers as a conceptual framework.

The analysis leads to several findings: self-taught computer-using teachers can deliver purposeful and structured lessons which maximise student use of technology; computer-based lessons were observed to be frequently predictable, uninspiring and not exploitative of the full range of possibilities offered by the software; teachers’ knowledge in all its forms is a powerful influence on the pedagogy of self-taught computer-using teachers; the use of technology did not induce any belief change or reconceptualisation of the subject area; teachers’ knowledge is central to their ability to manage difficulties and concerns which were present in the computer-based classroom; and when left on their own, the teachers did not engage in activities which would promote growth and development in knowledge and pedagogy. Whilst the findings are situationally specific, the essential issues identified transcend apparent differences such as year level or subject taught.

It is concluded that there is no guarantee that the self-taught approach to teacher learning is of itself a sufficient form of professional development for teachers who are in the early stages of learning how to teach with computers. A range of practical implications of the study are identified, and these are addressed to teachers, school-based teacher educators, educational researchers and educational administrators.
# CONTENTS

TABLE OF CONTENTS ................................................................. (i)

GLOSSARY ................................................................................. (viii)

LIST OF TABLES ................................................................. (xi)

LIST OF FIGURES ............................................................. (xii)

ACKNOWLEDGEMENTS .................................................. (xiii)

PREFACE ................................................................................. (xv)

## CHAPTER 1 - INTRODUCTION

1

### COMPUTER USE AS AN INNOVATION ........................................... 5

### CONSTRUCTIVISM ........................................................................ 7

### CONSTRUCTIONISM ..................................................................... 10

### TEACHER KNOWLEDGE ............................................................. 11

### SHULMAN'S THEORY: CATEGORIES AND FORMS OF KNOWLEDGE ..... 12

### TEACHER KNOWLEDGE AS BOTH EXPLICIT AND IMPLICIT ........ 15

### PRACTICAL THEORIES OF TEACHING ......................................... 15

### OUTLINE OF CHAPTERS ............................................................ 17

## CHAPTER 2 - COMPUTERS AND PEDAGOGY

19

### OVERVIEW OF THE LITERATURE .............................................. 19

### A FRAMEWORK FOR CONSIDERING COMPUTERS AND PEDAGOGY . 21

### WHY TEACHERS USE COMPUTERS ............................................ 22

### WHERE COMPUTERS ARE USED IN THE CURRICULUM .............. 23

### THE SOFTWARE PRODUCTS IN USE AND MODES OF COMPUTER USE 25

### DIFFICULTIES AND CONCERNS WITH COMPUTER USE .................. 29

#### CLASSROOM ROUTINES ......................................................... 29

#### SCOPE AND CONTENT OF CURRICULUM .................................. 30

#### SUITABILITY OF SOFTWARE ................................................... 30

#### CLASS MANAGEMENT .......................................................... 31

#### TECHNICAL PROBLEMS ......................................................... 31

#### FRAGILITY AS A FRAMEWORK FOR UNDERSTANDING

#### SOME ASPECTS OF PEDAGOGICAL CONCERN .............................. 32
FACTORS AFFECTING THE TYPES, EFFECTIVENESS AND FREQUENCY OF USE .............................................................. 33

WORK ENVIRONMENT ................................................................. 35
   Incentive Structures ................................................................. 35
   Social and Professional Situation ........................................... 35
   Subject Subcultures ............................................................... 36

TECHNICAL FACTORS ............................................................. 38
   Numbers and Distribution of Computers .............................. 38
   Technical Capacity of Computers ........................................ 38

PERSONAL FACTORS .................................................................. 40
   Knowledge of Computers ...................................................... 41
   Pedagogical Content Knowledge ......................................... 42
   Knowledge of Routines ........................................................ 43
   Attitudes and Confidence ..................................................... 44
      Knowledge of Teaching Methods ....................................... 45
      Access to the Technology ................................................ 46
      Knowledge of the Technology .......................................... 46
      Classroom Experience with Computers ......................... 46
   Gender .................................................................................. 47
   Teaching Experience ............................................................ 48
      Practical Theories of Teaching .......................................... 50

TEACHER ROLE ......................................................................... 55

CHANGES IN CLASSROOM INTERACTION PATTERNS ............... 56
CHANGES IN TEACHERS' PHILOSOPHICAL POSITION ............... 58
CHANGES IN TEACHERS' ROLE ................................................. 60

SUMMARY .................................................................................. 61

RESEARCH QUESTION ............................................................ 62

CHAPTER 3 - METHODOLOGY ................................................... 64

INTRODUCTION ........................................................................... 64

STUDY METHOD ........................................................................ 64

FUNDAMENTAL UNDERSTANDINGS ......................................... 66
   Ethnographic perspective .................................................... 67
   Naturalistic enquiry ............................................................ 67
   Holistic perspective ............................................................ 68
   Subjectivity .......................................................................... 68
   Participant observation ...................................................... 69
   Inductive analysis .............................................................. 69
   Phenomenology ................................................................. 69

STUDY DESIGN ......................................................................... 69
CHAPTER 7 - ARLENE

BACKGROUND ............................................................................................... 199

SELF-TAUGHT AND COMPUTER-USING .................................................. 200

THE TEACHER IN THE ORGANISATION ....................................................... 202

ARLENE AS COLLEAGUE AND CO-ORDINATOR ..................................... 203

THE YEAR SEVEN PROGRAM ................................................................. 204

CLASSROOM DYNAMICS AND THE NATURE
OF THE YEAR SEVEN COHORT .......................................................... 206

ARLENE'S PEDAGOGY .................................................................................. 208

FEATURES OF TEACHING AND LEARNING IN
ARLENE'S CLASSROOM ........................................................................... 208

Seating Arrangements ................................................................................. 208

The Working Environment of the Computer Room .................................. 209

Lesson Structure ......................................................................................... 211

Instructional Activities ........................................................................... 216

Managing Computer Problems ................................................................. 222

SOFTWARE IN USE; MODES OF COMPUTER USE .................................. 224

PERSONAL ATTRIBUTES .......................................................................... 226

KNOWLEDGE OF COMPUTERS ............................................................... 226

PEDAGOGICAL CONTENT KNOWLEDGE .................................................... 227

PRACTICAL THEORIES OF TEACHING ....................................................... 228

DIFFICULTIES AND CONCERNS WITH COMPUTER USE ..................... 233

EPILOGUE ................................................................................................... 235

ACHIEVEMENT OF AIMS .......................................................................... 235

CONCLUSION ............................................................................................. 236
GLOSSARY

ACCE .................. Australian Council for Computers in Education
ACS ..................... Australian Computer Society
ACOT .................. Apple Classrooms of Tomorrow Project
Apple ][e or
GS computer ..... Early model of computer (circa 1983-1990) developed by
Apple Computers.
AppleWorks .... An integrated software package, incorporating a word
processor, spreadsheet and database, for the Apple ][e
and GS computers (actually Appleworks version 4.3).
CAL .................... Computer Assisted Learning
CAT .................... Common Assessment Tasks. School-assessed tasks
contributing to the overall result of a subject at Year
Twelve level.
Clarisworks .... An integrated software package for the Macintosh
computer (actually Clarisworks version 4). Later
versions of the same product line are now renamed
AppleWorks.

Command line
interface ............ A means of communication between a program and its
user, based solely on textual input and output.
Commands are input with the help of a keyboard.
Contrasts with a GUI interface (see below).

ESL ..................... English as a Second Language. A compulsory study for
Victorian students for whom English was not their
native language.

Fileserver ........... A computer that stores files for access by other
computers, which can access those files because of being
connected to the fileserver via a LAN (see below). A
fileserver often becomes the defacto heart of a computer
network, as users may need to log in to the fileserver

p. viii
before being able to use a computer in any way, as was the case at Outeast College.

GUI ..................... A graphical user interface. A program interface that takes advantage of the computer's graphics capabilities to make the program easier to use. Contrasts with a command line interface (see above). Graphical user interfaces, such as Microsoft Windows and the one used by the Apple Macintosh, feature the following basic components: pointer, pointing device, icons, desktop, windows, and menus.

House Co-ordinator .... At Outeast College, pastoral care, discipline and many activities for students in Years 7-12 were arranged through four cross-age groupings known as houses. A House Co-ordinator was the teacher with the position of responsibility for overseeing the pastoral care and discipline of the students in that House.

Internet ............. A term used in this study as short hand for the use of Netscape Navigator as a Web Browser to access the World Wide Web

ISC ...................... International Student Co-ordinator. A position of responsibility at Outeast College, for the pastoral care and oversight of students who had come to Australia to complete their studies. Similar responsibilities to that of a House Co-ordinator (see above).

IT ......................... Information Technology. An elective subject at the senior years of Outeast College, and a compulsory subject in the junior years.

LAN ....................... Local Area Network. A computer network that spans a relatively small area, often confined to a single building or group of buildings (as at Outeast College). By the use of this technology, computer users can access common resources, such as printing, file storage and the Internet.
Laptop

Computer ........... Portable computer, such as the Apple Powerbook or NEC Versa which were available at Outeast College. Also referred to as a notebook computer.

Microworlds ....... Computer programming language, in the same genre as Papert’s Logo.

OECD ............... Organisation for Economic Co-operation and Development

PE ................... Physical Education - a subject which all students in the Junior School of Outeast College studied. At this level, consisting mainly of physical activities, learning skills for the playing of various sports.

SOSE ............... Studies of Society and the Environment

Sport ................ As a compulsory co-curricular activity, all students at Outeast College spent at least one afternoon per week playing a team sport.

VHS .................. Video Home System, a common videotape format.
**LIST OF TABLES**

Table 1 - Instrumental and Expressive Elements of Computer-Based Teaching ................................................................. 23

Table 2 - Software Types Common in Victorian Schools ......................... 25

Table 3 - Modes of Computer Use ................................................................. 28

Table 4 - Categories Used in The Second and Third Phases of Data Exploration ................................................................................. 92

Table 5 - Advantages of Word Processing ................................................. 166
LIST OF FIGURES

Figure 1 - Changes in Geoff’s Classroom Activity ............................................. 128
Figure 2 - Junior School Technology Room ..................................................... 296
Figure 3 - Computer Room 2 ......................................................................... 298
Figure 4 - At Ease Menu System in the Junior School Technology Room ................................................................. 300
Figure 5 - Software Available in the Junior School Technology Room ................................................................. 301
Figure 6 - Clarisworks Startup Screen ............................................................. 302
Figure 7 - Login Menu in Computer Room 2 .................................................. 303
Figure 8 - Login Prompt in Computer Room 2 ................................................ 304
Figure 9 - The Opening Windows Screen in Computer Room 2 .................. 305
Figure 10 - Menu for Access to Word Processing and Related Software in Computer Room 2 ......................................................... 305
Figure 11 - Illustrations of the Software Available in Computer Room 2 ................................................................. 307
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This study, like any educational research, is framed by the values which the investigator brings to the endeavour; values which, in my case, have been shaped by the school settings in which I have worked for over a decade and, in particular, my experiences at Outeast College\(^1\), Melbourne, Australia which have occupied six of those years. In conjunction with first-hand experience of the school and of the broader Victorian state education context, my values have been shaped by professional reading and critical reflection on that experience and broad literature.

Throughout the course of this study, and in the two years immediately prior to it, my role in the school was that of Head of Information Technology. My brief included overseeing the introduction of the integrated use of computers in all subjects and classes in the school, working with the professional development co-ordinator in identifying technical training and pedagogical development needs of staff, and conducting some of the required professional development opportunities. At various times, I fulfilled the role of system administrator, technician, team-teacher, and curriculum ideas person.

The present study had its origins in my professional reading and thinking over several years related to constructivist understandings of teacher learning and teacher career development, however it was ultimately born out of the political realities of Outeast College. Firstly, that an expansion of computer facilities allowed teachers of non-specialist (computer) classes to access computers for the first time, and that there was a ground-swell of enthusiastic colleagues wanting to take advantage of this. This was not matched, however, by resources (particularly time) to provide thorough staff development opportunities prior to the use of the facilities. No matter that the provision of professional development in computer use

\(^{1}\) Pseudonyms are used throughout for the names of the school, teachers and students in this study.
and pedagogy was my substantive responsibility, the political reality was that the majority of the use of computers in various subject areas at Outeast College would inevitably be by teachers whom I judged to be enthusiastic novices when it came to using computers - that is, self-taught computer-using teachers. In essence, what made this study possible was the presumably not uncommon response of an ‘ordinary’ school to the prevailing political and policy environment which Begg (1992) has described as “do-it-yourself”.

The research, designed as a collective case study of the pedagogy of self-taught computer-using teachers over a nine month period (March to November of 1996), is reported in the chapters which follow. The study was born out of professional curiosity: How were my colleagues using computers in their teaching? What were their classrooms like? What were the key issues which effected their pedagogy and how they used computing? As much as anything, I wanted to learn whether leaving my colleagues to work out for themselves how to use computers in their teaching was worth doing; part of a broader effort of mine to identify suitable strategies for the professional development of computer-using teachers. As such, this thesis is an educational evaluation (Davis, 1980, pp. 26-29) aimed at helping decision makers determine whether the ‘innovation’ is what they want; whether it has done what it set out to do and what aspects of it could be improved, curtailed, modified or reassessed. In short, this enquiry considers whether, in the context of self-taught computer-using teachers, the do-it-yourself professional development model ‘works’, and what changes decision makers should adopt so that this means of professional learning can be improved.

At face value, the work of the teachers which I observed offers nothing surprising. There seemed to be no significant differences between their work in a computer laboratory and their work in a regular classroom; there were no ways of using computers which stood out as remarkably creative. It was that which Olson (1995, p. 51) has described as “superficial accommodation to technology”, however my readings in the field of
teacher knowledge helped me place my observations in a broader context (Borko & Putnam, 1995; Buswinka, 1993; Calderhead, 1987a; Calderhead, 1988; Calderhead & Robson, 1991; Clark & Lampert, 1985; Clarke, 1997; Cornett, 1990; Elbaz, 1983; Garan, 1994; Grossman, 1995; Huberman, 1985; Louden & Wallace, 1990; MacArthur & Malouf, 1991; Miller & Olson, 1994; Munby & Russell, 1990; Olson, 1988b; Olson, 1989a; Olson, 1995; Olson, 2000; Olson, James, & Lang, 1999; Powell, 1991/1992; Raymond & Surprenant, 1988; Reid, 1991; Shulman, 1986; Wallace & Louden, 1992; Whelan, 1992). As I read and re-read the data, relating it to my readings, within the apparent sameness of the pedagogy (comparing teaching in a computer laboratory with that of a regular classroom) were powerful messages for how pedagogy is related to knowledge and, as Olson (1995, p. 51) observed, deeper implications for how subjects are construed and taught.

Case study research is inevitably embedded within a particular situation and this, necessarily influenced by it. What is investigated may relate only to this unique situation, and care must be exercised in generalising findings to other contexts. However, case studies enable existing ideas to be redefined and ‘tested’ in new contexts, and allow new insights to emerge which might then lead to re-examination of familiar situations. In these ways, the nature of the case study, and the outcomes pertaining to a particular situation, can be relevant in other contexts. Therefore, a case study can make a contribution to knowledge in the field, as well as the specific situation investigated. The research in the following chapters has made a significant contribution in a number of ways.

First, it may be that the many examples of teachers’ use of computers which are reported in the literature may be situated in self-taught and do-it-yourself settings, but this is seldom stated explicitly (as discussed in Chapter One). Compared with projects such as the Apple Classrooms of Tomorrow (ACOT) research (Sandholtz, Ringstaff, & Dwyer, 1997, p. 7) which infused schools with very high levels of ‘high-end’ technology, Outeast College was very ‘ordinary’. Classes could be booked into one of
three computer laboratories which gave them access to what I would
describe as ‘good-ordinary’ equipment (refer to Appendix One). This study
places on the scholarly record that the response made by one ‘ordinary’
school to the prevailing political and policy environment was to
encourage teachers to be self-taught and computer-using. The insights
from the study arise out of ‘ordinary’ teachers’ responses to working with
‘ordinary’ equipment with ‘ordinary’ classes. The commitment to research
in natural settings has delivered a particular range of findings which
complement the findings of research into ‘special’ or contrived settings.

Secondly, constructivist understandings of teacher learning and
development are everywhere present in the scholarly literature on
professional development. Is it sufficient to assume the do-it-yourself
position that teachers “… are more active than passive, more ready to learn
than resistant, [and] more wise and knowledgeable than deficient” (Clark,
1992, pp. 76-77) and then to simply leave teachers alone to get on with
their work? This study ‘tests’ this hypothesis in the specific context of
three teachers at Outeast College.

Thirdly, there are many studies which consider the factors limiting or
promoting a teacher’s use of computers (e.g. Becker, 1994; Cumming,
1988/89; Downes, 1993; Marcinkiewicz & Regstad, 1996; Norton, McRobbie,
& Cooper, 2000; Olivier & Shapiro, 1993; Olson, 1989a; Tyler-Wood,
Putney, & Cass, 1997; Wright, 1987) which are discussed in Chapter Two.
In this study I identify those factors which are pertinent to the three
particular teachers because of them being self-taught in their computer use
and pedagogy of computer use. From this, the importance of content
knowledge, pedagogical content knowledge and practical theories of
teaching to the pedagogy of self-taught computer-using teachers is
discerned. Findings particularly pertinent to a general audience are of
central importance for both content knowledge and reflective practice.

The world of technology moves fast, and the reader will find little
reference to Internet technologies, for instance, in this thesis. In contrast,
the *Real Time* report (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999) has shown that information retrieval and access through the Internet is a prominent (perhaps even the primary) component of computer use in schools today. This thesis is set in an era time when the dominant form of computer use in schools was word processing (Shears, 1995), but it reveals issues of the relationship between knowledge and pedagogy, and makes recommendations relating to the professional development of teachers which transcend the particular technologies available.

In these ways, the research completed has made a significant contribution to the field.

In the opening paragraph of this preface, I indicated that the research completed was shaped, in part, by the professional context in which I have worked and by the related professional literature. Now, as a result of having submitted these case studies of teachers using computers to systematic examination, the research completed has added to my personal understandings of concepts and issues associated with professional development and teacher learning. Consistent with Begg (1999), the use of the first person pronoun throughout this thesis is a deliberate recognition of the subjective (i.e. constructivist) nature of research and knowledge, and the impact of this research project on my professional development. Hence, outcomes of the research completed will impact on the professional contexts involving the professional development of computer-using teachers in which I work in the future, as well as the nature and direction of research in the field in which I will continue to be engaged.
CHAPTER 1 - INTRODUCTION

It has been consistently noted that there are many primary and secondary school teachers, in Australia and elsewhere, who have received little or no training in computer use (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999; Plomp & Pelgrum, 1992; Shears, 1995). In addition, Grundy, Bigum, Evans and McKenzie (1987), for instance, identified a significant cohort of teachers who, in the absence of support, were willing and able to tackle the technology on their own, make their own meanings, and develop their own understandings. I call such teachers self-taught computer-using teachers. They are teachers who have learnt how to use computers out of their own enthusiasm, but have not had any substantial training in the technical aspects of using computers, nor any relating to the pedagogy of computer use. Nevertheless, they feel comfortable to learn any software for use in their classrooms, are distinguished by being willing to ‘have a go’ and are not generally intimidated by computers.

In addition to studies of teachers using computers, the notion of teachers being self-taught is not unknown to the educational community. Grossman (1989a; 1989b) has studied teachers who have entered the teaching profession without completing a pre-service teacher education program (that is, they are self-taught in terms of pedagogy). Mullins (1998) and Huberman (1995) have found that teachers tend to be insular and self-reliant, endeavouring to solve problems in their own teaching through personal reflection. Whelan (1992) studied the implementation of a Legal Studies syllabus by experienced teachers who had no formal studies in either the discipline on which the subject was based or in Legal Studies curriculum or pedagogy. Teachers of Science without a background in Science content or pedagogy have been studied by Louden and Wallace (1990) and Wallace and Louden (1992).

More generally, the concept of self-taught computer-using teachers is associated with a prevailing approach to curriculum and professional
development in Australian and New Zealand schools, as described by Begg (1992). He has observed that in the past resources for schools, including professional development, had been the responsibility of central authorities, but a trend emerged in the early 1990s which saw simultaneous reduction in the financial resources available to the education sector, the devolution for curriculum and professional development to schools, and the publication and dissemination of new curriculum and syllabus material. As a result, Begg considers that teachers and schools have almost universally been forced into a position of “do-it-yourself”. In a political and policy environment such as this, being self-taught is a common form - perhaps the most common form - of professional development.

In this study, I use the term “self-taught computer-using teachers” to describe those teachers who have had little (if any) formal studies in computer use, curriculum studies or pedagogy relating to computer use (cf. Honey & Moeller, 1990; Whelan, 1992). There are several things, however, which my use of this term is not intended to imply. Firstly, it is not assumed that such teachers are consciously engaged in a process of developing themselves as teachers (cf. Clark, 1992; Thiessen, 1992). Secondly, such teachers are not assumed to be especially autodidactic or metacognitive in their professional development in whatever form it may take. Thirdly, it is not assumed that such teachers are necessarily engaged in the use of computers to further their own skills or knowledge, and fourthly, it is not assumed that the teacher is especially equipped to reflect on, and learn from, the experience of using computers. It is assumed, however, that self-taught computer-using teachers are those who are new to using computers.

Whilst “self-taught computer-using teachers” is meant as a descriptive term, identifying a particular cohort of teachers, it is a term which deliberately draws attention to knowledge and its development. By virtue of being self-taught, these teachers’ knowledge about computing and
related pedagogy is likely to be ad-hoc, incomplete, possibly inaccurate and its development is at the teacher’s own initiative.

There are many studies in the literature of computer-using teachers who, one would assume, would be accurately described as “self-taught”, among them MacArthur and Malouf (1991), Wright (1987), Goodson and Mangan (1995), Shears (1995), Cumming (1988/89), Paul Olson (1988a), John Olson (1988b; 1989a; 2000), and Sandholtz, Ringstaff and Dwyer (1997). Even so, little attention seems to have been paid to what might be learned by attending to these teachers as “self-taught”. In the abstract to his thesis, Whelan (1992) has commented that an “exploration of teachers’ work and teachers’ thinking literatures shows scant attention to the part played by teachers’ knowledge of the discipline(s) on which the subjects of the school curriculum are based”, which Borko and Putnam (1995) have also found. The reasons why limited attention has been paid to self-taught computer-using teachers (and teachers in a do-it-yourself setting more generally) from the perspective of their knowledge of the relevant disciplines are hard to explain, however, there are several factors which might be important.

The first is a largely unexamined assumption that training and support are needed if teachers are to effectively use computers in their teaching (e.g. Edwards, 2000; Jaber & Moore, 1999; Wang, 2000). Literature on teacher development (Clark, 1992; Huberman, 1992; Robinson, 1989) draws attention to teachers being wise and knowledgeable, and yet a deficit model in relation to computers is presumed, almost without question. In contrast to this presumption, and somewhat counter-intuitively, Whelan (1992) found that content knowledge (in that case, of Legal Studies) was not important in order for teachers without a background in the discipline to satisfactorily teach the subject. The teachers in Whelan’s study were able to base their pedagogy on factors other than a detailed knowledge of the content of the subject. That content knowledge is a necessary precursor to pedagogy is often unchallenged, particularly where computers are concerned.
Secondly, computer use is considered by some to fit best with constructivist-compatible teaching approaches (Honey & Moeller, 1990; Norton, McRobbie, & Cooper, 2000; Riel & Becker, 2000). Thus, teachers with particular philosophies and teaching approaches might be expected to more naturally use computers in their teaching, with perhaps less external encouragement or requirements for professional development.

Thirdly, evidence has been emerging over a number of years (Becker & Ravitz, 1999; Confrey, Piliero, Rizzuti, & Smith, 1990; Ringstaff, Sandholtz, & Dwyer, 1992; Sandholtz, Ringstaff, & Dwyer, 1994) that the use of computers in teaching can encourage a reconceptualisation of the subject area and induce changes in the teacher’s role, behaviour and methods. Thus, one could be led to think that immersion in technology of itself is an adequate form of professional development.

A fourth explanation of why limited attention has been paid to the importance of the knowledge of a discipline to self-taught computer-using teachers is to be found in the purported advantages of the do-it-yourself approach. Certainly there are numerous disadvantages in this approach, as Begg (1992) has commented, including a devaluing of genuine professional development opportunities, a lack of resourcing, insufficient modelling of new skills, insufficient opportunities for reflection and feedback, and an implicit emphasis on adaptation rather than adoption of new syllabi. And yet Begg notes that the do-it-yourself approach does have advantages related to local control of a change process: personal ownership, being close to the workplace, and addressing personal issues. Indeed, according to Begg it honours them as constructivist learners who are, as Clark (1992) notes, “more active than passive, more ready to learn than resistant, more wise and knowledgeable than deficient and more diverse and unique than they are homogeneous” (pp. 76-77). Thus, it could be assumed that teachers are implicitly capable of teaching any content in any discipline area (including teaching with computers), or are at least able to initiate the learning which is necessary.
In this study, that which Eisenhart (1988, p. 100) calls the general ethnographic question - “why is ... teaching and learning occurring in this way in this setting?” - is applied to the pedagogy\(^2\) of self-taught computer-using teachers. This involves the documentation of the pedagogy of three self-taught computer-using teachers as they worked in the particular context of Outeast College, one of whom worked in a primary school setting, and two of whom worked in a secondary school setting\(^3\). The pedagogy which was observed over the course of nine months, and was described in interviews, is interpreted to provide an understanding of the relationship between teachers’ knowledge and pedagogy. The findings constitute an evaluation of the self-taught approach to computer use, and the do-it-yourself approach of professional and curriculum development more generally, from the perspective of teacher’s knowledge and its acquisition.

The remainder of this introductory chapter has two purposes. Firstly, the theoretical frameworks which have guided the enquiry are outlined. Secondly, the structure of the thesis and the focus of each chapter is discussed.

**COMPUTER USE AS AN INNOVATION**

The primary theoretical framework which has informed this study is the conception of innovations. Rogers (1962) defines the concept of innovation in the following way:

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\(^2\) I understand pedagogy to mean “the function, work or art of a teacher; teaching” (The Macquarie Dictionary, 1991).

\(^3\) In the state of Victoria, where Outeast College was located, ‘primary school’ is the first seven years of schooling (for students aged five to eleven, approximately), and ‘secondary school’ is the subsequent six years of schooling (for students aged twelve to seventeen, approximately). Note that whilst this sets the context for the classes and teachers which have been studied, it does not represent the organisational divisions of Outeast College which are described in Chapter Four.
an idea perceived as new by the individual. It really matters little, as far as human behaviour is concerned, whether or not an idea is “objectively” new as measured by the amount of time elapsed since its first use or discovery. It is the newness of the idea to the individual ...

For self-taught computer-using teachers, computer use in the classroom is a ‘new’ and as-yet largely untried idea, so for them it is an innovation. More specifically, the use of computers by these teachers also constitutes a deliberate, intentional change which results in new or different configurations for learning or teaching, which exemplifies Millikan’s (1988) understanding of an innovation. It is accurate, therefore, to describe this study as the evaluation of an innovation. This is not a curriculum innovation in which teachers are viewed as blind, mechanistic implementors of already-established curriculum programs, a view which has been soundly discredited (Cornett, 1990; Marsh & Stafford, 1984, ch. 5; McCutcheon, 1992). Rather, it is an innovation in the sense of teachers participating in an evolutionary and adaptive change. This is a view of innovation which arises from a constructivist understanding of teachers (see later in this chapter) as knowledgeable, rational professionals who are continually learning from their experiences and capable of making informed choices (Reid, 1979). This understanding of teachers is embraced by what Bents and Howey (1981) describe as “modern adult learning theory” (p. 33) and is the centre piece of contemporary understandings of professional development (Clark, 1992; Huberman, 1992; Robinson, 1989; Thiessen, 1992).

There are a number of ways in which innovations have been studied. Some scholars have considered the organisational context related to the implementation of an innovation (Fullan & Stiegelbauer, 1991). Others have studied how individuals interact with an innovation (Hall & Hord, 1984; Moersch, 1995; Puk, 1996), or the stages individuals move through as they learn to incorporate the innovation into their teaching (Sandholtz, Ringstaff & Dwyer, 1997). The objective in this study was to understand and interpret the innovation, and as such it draws on the tradition in
educational evaluation which has grown out of the work of Stake, Partlett, Hamilton, Hastings and others (Davis, 1980, pp. 26-29). Research in this tradition values the understanding and documenting of an innovation (rather than ‘testing’ it), providing a thorough and detailed exploration of the innovation in action. Such an approach can help decision makers determine whether a particular innovation is what they want; whether it has done what it set out to do and what aspects of it could be improved, curtailed, modified or reassessed. In other words, in the setting where teachers are expected to teach a subject in which they do not have formal studies, in either the discipline on which the subject was based or in curriculum studies in the subject, I consider whether the do-it-yourself form of professional and curriculum development can be considered to be desirable.

Grunberg and Summers (1992) have identified three eras in the study of computing in education as an innovation. The first era was a focus on understanding and minimising factors of resistance. During the second era, there was a focus on studying the teacher in the context of the social organisation of the school rather than as an isolated agent. The most recent era has seen a focus on how the innovation fits with the teacher’s working conditions and value system. There is an increasing realisation that to understand the change fully, one must study the detail of practice as well as the systemic issues, and to acknowledge, with Hativa (1995), that teachers are the most important decision makers regarding the adoption and use of technology in schools. It is within this third and most recent era of studying computers as an innovation in education, informed by constructivist epistemology and ethnographic case study approaches, that the present study is located.

CONSTRUCTIVISM

The second theoretical framework which has informed this study is an epistemological one. Epistemologies, that is, theories of knowledge which
are philosophical positions on how human beings come to know their world, inform us of how teachers’ knowledge might be said to be acquired and integrated with other knowledge. Constructivism is an epistemology which has received considerable attention in recent decades, in the work of proponents such as von Glasersfeld, according to Yager (1991). von Glasersfeld (1988) himself has traced its origins as far back as Vico in 1710, and Ridgway and Passey (1991) have identified constructivism as central to the works of theorists such as Piaget and Vygotsky.

In their chapter in the Second Handbook of Research on Teacher Education, Carter and Doyle (1996) discuss important shifts in the epistemological positions relating to teacher knowledge which have occurred. Up until the mid 1900s, teacher knowledge and learning was conceived in terms of a model of technical rationality. In this model, teaching was seen as a matter of technique, and that skilled practice is only possible when skills based on systematic, specialised, scientific and standardised knowledge are employed. Thus behavioural views of teaching, learning and knowledge predominated. Later, an understanding arising out of cognitive psychology emerged which re-focused the emphasis from the behavioural domain to that of thinking and cognition. The effect of this was to add skills such as diagnosis, prescription, problem solving and decision making to the necessary repertoire of the teacher; however, the model was still fundamentally one of technical rationality. The third, and most recent, way of understanding teacher knowledge and learning is what Carter and Doyle (1996) refer to as a “biographical perspective” (p. 122). This biographical perspective which has emerged, in part as a reaction to technical rationality, emphasises personal construction of knowledge and its situationally specific applications, moving the locus of enquiry closer to the individuals who hold the practical understandings of teaching.

The central tenant of constructivism is that we come to know our world by interacting with it (Brookes, 1987). In the constructivist paradigm, knowledge is not a representation of an observer-independent world.
Rather, individual learners construct understandings of concepts, situations, people, etc. which are viable in the experiential world of the knower (von Glasersfeld, 1988, p. 1). Knowledge arises neither from the subject nor the object, but rather through their interaction. It can be said that there is no pre-defined body of knowledge, a state of affairs referred to as “subjective realities” (Brookes, 1984, p. 24; Gunstone & Baird, 1988, p. 238). Stern (1992) expresses these core ideas by saying that,

... the self is made up and determined by inner structures which the self itself (so to speak) is able to design, build and alter …

and Knowles and Holt-Reynolds (1994) (quoted by Carter & Doyle, 1996, p. 122) have explained that,

people construct ideas as they learn, and they use prior knowledge, experiences, and beliefs, as well as interpretations they generate in the moment, as the stuff out of which to build those ideas.

To adopt a constructivist epistemology for teacher knowledge is to assert with Clark (1988, p. 7) that such knowledge is robust (insofar as it proves to be viable), idiosyncratic, sensitive to the particular holder, incomplete, familiar and sufficiently pragmatic to have taken the learner to where he or she is today. Certainly, it is to emphasise the personal rather than corporate nature of knowledge (Sidani-Tabbaa & Davis, 1991, p. 2) and to acknowledge that knowledge is not constrained to the learning of propositions and rules at identifiable moments in time, but includes the rather more ad-hoc accumulation of experiences, beliefs and interpretations.

Since constructivism is strictly a philosophical position on how human beings come to know their world, it is not in itself best described as a model of learning. There are a number of specific models of learning which are constructivist, and these include Piaget (von Glasersfeld, 1988), Wittrock (Osborne, 1984; Osborne & Freyberg, 1985) and Kelly (Cohen & Manion, 1989, ch. 14; Pope & Gilbert, 1984). This study, however, is not aligned with a particular theorist, but with the central tenants of
Constructivist understandings influence this study in a number of respects. The methodology is congruent with constructivist understandings of knowledge, as discussed in Chapter Three. Teachers are viewed as professionals who are learning throughout their lives and careers. As innovators, teachers are viewed as participating in an evolutionary and adaptive change rather than as mechanistic implementors of already-established curriculum programs.

**Constructionism**

At this point in the discussion, it is important to clarify the term constructionism which frequently appears in the literature on computers in education. Constructivist understandings have been a major contributor to the discourse of computers in education, particularly through the work of Seymour Papert (himself a student of Piaget), his development of the computer language Logo (and its successors), and the communication of his ideas through the work *Mindstorms* (Papert, 1980). Papert (1990) explains that constructionism embraces two related concepts. Firstly there is the constructivist notion that knowledge is not transmitted but constructed, that “knowledge is something you build in your head”. The other dimension is an understanding that the best way to go about building knowledge is to build something tangible - something “outside your head” (such as a computer program in the Logo language) - that is also personally meaningful. To Papert, constructionism also means that learning does not occur through a fragmented process where knowledge is divided up into little pieces; rather, Papert considers that learning consists of engaging in personally meaningful, holistic projects.

Constructionism is epistemelogical in the sense that it asserts a belief that internal knowledge structures are best built through the manipulation of, and interaction with, tangible objects. Constructionism and Logo also harbour some other intellectual baggage, as Olson (1987, pp. 6-7) discusses. He notes that Logo has grown out of theories of artificial intelligence
which purport that the one-to-one interaction between a computer and 
person can be a more intelligent arrangement than the relationships 
among students and teacher in a classroom. Although there is a strong 
relationship between the two, I regard constructionism as a somewhat 
narrower epistemology than constructivism, which also implies some 
particular arrangements for teaching and learning. Therefore, I 
deliberately use the broader term ‘constructivism’ throughout this study to 
identify the broad philosophical position taken on how human beings 
come to understand the world.

TEACHER KNOWLEDGE

The third theoretical framework which has informed this study is that of 
conceptions of teacher knowledge. The most fundamental assumption 
which I have made is that teacher knowledge is more multi-dimensional 
than simply the content of a particular subject, and has been conceived of 
and described in various ways (e.g. Elbaz, 1983; Shulman, 1986). This 
understanding of teacher knowledge is elaborated on in this section.

Drawing on the biographical perspective of teacher knowledge (Carter & 
Doyle, 1996) discussed earlier in this chapter, the second assumption 
which I have made is that there is a strong relationship between 
knowledge and pedagogy. Early research on pedagogy stressed the 
importance of teacher behaviour, seeking, for instance, causal linkages 
between specific teaching practices and student outcomes (Isenberg, 1990, p. 
322). Increasingly, the importance of teacher thinking on pedagogy has 
been studied. The development of the field has been in response to a 
growing realisation that teacher behaviour is substantially influenced and 
even determined by teachers’ thought processes (Clark & Peterson, 1986) 
and even that “classroom practice is a direct reflection of teachers’ 
thinking” (Wright, 1987, p. 109). Such views portray teachers as active, 
engaging and rational professionals (Isenberg, 1990) and as sense-making 
constructivists (Halkes, 1986).
Couched within the constructivist paradigm, this study attends to the issues of knowledge pertaining to computer use in teaching. This study is informed by the concepts of content knowledge, pedagogical content knowledge and practical theories of teaching, together with the nature of knowledge as being both explicit and implicit, all of which are discussed in the sections which follow.

**Shulman’s Theory: Categories and Forms of Knowledge**

Lee Shulman’s work in the “knowledge growth in teaching” project has led to a highly influential theory of teacher knowledge (Shulman, 1986). Within this theory, the categories of content knowledge are described as:

- **content knowledge**: the amount and organisation of knowledge per se in the mind of the teacher.
- **pedagogical content knowledge**: the particular form of content knowledge that embodies the aspect of content more germane to its teachability.
- **curricular knowledge**: the range of programs designed for teaching particular topics and subjects at a given level, the variety of instructional materials available, and the set of characteristics which serve as indications and contra-indications for the use of particular curriculum or program materials in particular circumstances.

Shulman’s overall theory of teacher knowledge (Shulman, 1986) has met with some criticism. Munby and Russell (1989, p. 76), for instance, consider that Shulman’s work embraces technical rationality as a model of knowledge production and use. Johnston (1994) asserts that it embraces an epistemology which is concerned with the accumulation of propositions. Certainly, the thrust of Shulman’s theory seems to suggest how one might go about atomising teachers’ knowledge for the purposes of improving teacher education programs.
Whilst such criticisms are important, for the purposes of this study, Shulman’s work highlights two important concepts. Firstly, it is relevant to observe that to a certain extent, an atomic view of knowledge cannot be completely dismissed - certain facts, skills and procedures are important when using computer technology or even managing a classroom where relatively delicate and expensive objects are present - and this consideration is highlighted by Shulman’s notion of content knowledge. Secondly, as Borko and Putnam (1995) make clear, Shulman’s work has highlighted the scant attention paid to the impact of content knowledge on pedagogy.

Thirdly, some important insights into teachers’ use of computers are gained by a consideration of pedagogical content knowledge. Wilson, Shulman and Richert (1987) state that,

successful teachers cannot have an intuitive or personal understanding of a particular concept, principle or theory. Rather, in order to foster understanding, they must themselves understand ways of representing the concept for students. They must have knowledge of the ways of transforming the content for purposes of teaching ... teachers must have a knowledge of the subject matter that includes a personal understanding of the content as well as knowledge of ways to communicate that understanding to foster the development of subject matter in the minds of students.  

(p. 110)

Shulman (1986) further explains that

within the category of pedagogical content knowledge I include, for the most regularly taught topics in one’s subject area, the most useful form of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, the ways of representing and formulating the subject that make it comprehensible to others. Since there are no single most powerful representations, the teacher must have at hand a veritable armamentarium of alternative forms of representation, some of which derive from research whereas others originate in the wisdom of practice.  

(p. 9)
It is clear from these quotes that content knowledge is a necessary precursor to pedagogical content knowledge - pedagogical content knowledge is a restructuring of content knowledge, “a unique interface of content and pedagogy, an understanding of how topics and skills can be organised and taught to pupils” (Kagan, 1992, p. 158). Grundy, Bigum, Evans, and McKenzie (1987, pp. 43-44) have commented that teachers using computers need to understand computers at a personal and professional level as well as at a classroom or teaching-tool level, thus emphasising both content knowledge and pedagogical content knowledge.

Fensham and Lui (1999) have noted that the concept of pedagogical content knowledge is rather vaguely defined, meaning that over time researchers from varying perspectives have given different meanings to the term. The concept drawn from Shulman’s own work does provide some helpful ways of understanding the classroom use of computers by teachers. Just as Grossman (1989b) notes that it is important for new teachers to be able to re-think subject knowledge from a pedagogical perspective, and Albion (1996) has drawn attention to the need for student teachers to rethink subject knowledge from a “pedagogy-with-computers” perspective, it seems reasonable to suggest that the same might be true for teachers who are new to using computers. It is this which is highlighted by the concept of pedagogical content knowledge. In the context of computer use, Olson (1988b) has coined the term “ideaware”, which he describes as follows:

software is, at the heart, “ideaware”, and the more the “idea” of the software is transparent to the teacher, the more likely the challenge to “ideas” in everyday practice can be discerned by the teacher … (pp. 55-56)

Such a conception of ideaware is essentially that of pedagogical content knowledge.

I now move to a discussion of teachers’ knowledge as conceptualised in both implicit and explicit forms.
**Teacher Knowledge as Both Explicit and Implicit**

It should be self-evident that knowledge such as facts relating to content, curriculum or instruction will be explicitly held and capable of articulation by the knower. Not all knowledge, however, is of this type. Marland (1994) states that it is generally accepted that there is something about teachers' knowledge which enables them to navigate the complex tasks of preparation for teaching and actual classroom interaction (as it often seems to be by intuition, or involving split-second decisions), that it is highly complex and multi-dimensional, and that it does not lend itself to any simple or deterministic description. Such tacit or implicit knowledge is well described by Sackett (1987):

> I take tacit knowledge to be that which is unarticulated (and perhaps unarticulatable [sic]) by the knower, to be of sufficient complexity to resist statement in propositional form as rules of performance, to find expression in the knower's performance without a self-conscious awareness, but, nevertheless, to be describable and observable by others. (p. 214)

**Practical Theories of Teaching**

In his review of the literature on teacher thinking in the *International Encyclopaedia of Teaching and Teacher Education*, Marland (1995) comments that it is broadly accepted that the classroom actions of teachers are guided by internal frames of reference deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences. Halkes (1986) and Marland (1993; 1994) have observed that a range of terms is used in the literature to talk about the internal frames of reference, and a clear cut terminology has yet to emerge. The range of terms used include: teachers' cognitions, constructs, subjective imperatives, practical knowledge, beliefs, images, dilemmas, interactive thinking models, metaphors, rules of practice, knowing-in-action, personal practical knowledge, practical theories, subjective understandings, tacit knowledge, theories of action, theories-in-use, wisdom of practice, craft knowledge, and folkways of teaching. Many of
these are used almost interchangeably, although they arise from very different theoretical frameworks (Halkes, 1986). Marland (1994) values the diversity of terms used because each one highlights a particular feature of teachers’ knowledge.

As Marland (1994) and Clark and Peterson (1986) have noted, there are two characteristics common to all of these terms: that what is being identified is something which is at best partially articulated, that is, it is implicit. They are also context-specific, intensely personal and possess considerable explanatory and predictive power for the teacher concerned. That is, according to Marland (1994) they have the characteristics of a theory. Because they directly relate to a teacher’s practical action, in line with Marland, Kennedy, Forlin and Sturman (1997) I use the term *practical theories of teaching* to describe these internal frames of reference.

A teacher’s practical theories embrace a wide variety of factors: commitments to educational goals, beliefs about learners and learning, the students, the subject matter taught, roles and responsibilities, conceptions of different disciplines, the role of the teacher, images of ‘good’ and ‘not-so-good’ lessons, notions of how one should act, and knowledge of strategies and situation-action consequences (Clark, 1988; Marland, 1994). However, such theories can also be seen to embrace the wider context of a teacher’s unique conceptualisations and constructions of a professional world (Munby, 1987). Practical theories develop out of personal experiences - while growing up, going to school, travelling, working and interacting with people (McCutcheon, 1992). Strategies for revealing practical theories of teaching have concentrated on teacher talk (e.g. Marland et al., 1997) and inductive analyses of classroom practice (e.g. Briscoe, 1991; Bullough, 1991; Calderhead & Robson, 1991).
OUTLINE OF CHAPTERS

In this chapter, the theoretical frameworks which have informed this investigation have been outlined.

In Chapter Two, a review of the literature concerning that which is known of computers and classroom practice is presented. The findings are presented using the following headings, which are also used for structuring the analysis of data in Chapters Five, Six and Seven: (1) why teachers use computers, (2) where computers are used in the curriculum, (3) the software products in use and the modes in which a computer can be used, (4) the concerns and difficulties over computer use (5) concerns over the effectiveness of computer use, and (6) considerations of the teachers’ role and classroom interaction patterns when using computers.

At the end of Chapter Two, the key research question for the study is articulated.

In Chapter Three, the methodology is discussed. This discussion identifies the epistemological and ontological understandings of the study as that of a constructivist epistemology within an interpretive paradigm. Particular research methods are subsequently discussed. The study design is a collective case study (Stake, 1994, p. 236) of nine months duration, during which data were gathered from interviews along with video recordings of classroom interaction.

In Chapter Four, the study context, Outeast College, is discussed, including a description of the school, the curriculum environment, the computer resources and my role in the school and in the study.

Chapters Five, Six and Seven concern the three teachers who participated in this study. In each chapter, I present the teaching and learning which I observed occurring by providing a rich descriptive account of pedagogy and teaching circumstances. Interpretation of the data is also provided in
an effort to understand the relationship between teachers’ knowledge and pedagogy.

In Chapter Eight, the three case studies are compared, and conclusions drawn on the suitability of computer-using teachers being self taught. The adequacy of the do-it-yourself approach to professional development is discussed, and a range of practical implications of the study are identified which are addressed to teachers, school-based teacher educators, educational researchers and educational administrators.
CHAPTER 2 - COMPUTERS AND PEDAGOGY

In this chapter, I review appropriate literature concerning the relationship between computers and pedagogy that informs an inquiry into the pedagogy of self-taught computer-using teachers. In keeping with this purpose, several related areas are not reviewed. One such area is the literature on the broad aims and rationales of schools and school systems for using computers in teaching, and the corresponding social and political influences and implications, which would place the study of pedagogy in a wider context than is the focus of this study. Other areas not reviewed in detail are the catalogues of purported advantages of computer use (Owen & Lambert, 1996) and studies which endeavour to establish that computer use results in the improvements of either the process or outcomes of education. In my reviewing of the literature, I have found few generalisable and pertinent findings, because the studies in this area document particular people and situations, and thus the findings are specific.

This review begins with a broad overview of the literature, followed by a statement of the framework which I have used for understanding what is known about computers and pedagogy. This is followed by a discussion of the elements of this framework, which constitutes the majority of this chapter.

OVERVIEW OF THE LITERATURE

There is a vast amount of literature published on the use of computers in education. An ERIC search showed in excess of 55,000 entries for “computer use in education”. Indeed, studies of computers in education have, for over a decade, been inseparable from the study of education in general. A report from the Centre for Educational Research and Innovation of the OECD [CERI] (1989) states that researching how teachers use computers and what effects computers have on teaching is almost as
broad as asking how teachers use books and how books affect learning (p. 14).

It is therefore surprising to observe that there have been few large scale studies or reviews in academic compendia which discuss the details of classroom practice with computers. The *Yearbook of the National Society for the Study of Education* in 1986 considered computers in education (Culbertson & Cunningham, 1986). More recently, Hativa (1995) reviewed the research into pedagogical issues of computers in schools in the *International Encyclopedia of Teaching and Teacher Education*. In the late 1980s, a large-scale, cross-country survey was conducted for the International Association for the Evaluation of Educational Achievement (widely known as the IEA COMPED study). The results have been summarised by Plomp and Pelgrum (1992), however Australia was not surveyed. Despite the data being nearly a decade old, it is still widely cited in the literature for comparative purposes.

In Victoria, computer use in schools began in the mid 1970’s (Bigum, 1987b; Walker, 1991). A number of comprehensive early studies were conducted (Anderson, 1984; Bigum et al., 1987; Fitzgerald, Hattie, & Hughes, 1986). These concentrated on describing levels of deployment and issues of access; only Bigum et al. discussed classroom practices in any detail. In the years immediately prior to the data collection for the present study, studies were conducted by Bishop (1994) and Shears (1995). Bishop surveyed 143 Victorian primary school teachers, and reported on changes to curriculum content, classroom organisation and teaching style. Shears surveyed 176 Victorian schools (both primary and secondary) and provided detailed statistics on computer use. Shears compared his results with the COMPED study and identified some of the issues emerging from schools which had begun to use laptop computers extensively. More recently still, Lankshear and colleagues prepared an Australia-wide multi-site case study of computers and literacy (Lankshear et al., 1997a; 1997b; 1997c; 1997d), and whilst issues of pedagogy and curriculum are at the heart of their brief, their study - like those preceding it - has a greater
concern for the ‘why’ of computers in education rather than a detailed description of the ‘how’.

These reviews also indicate that whilst much helpful investigative work has been done, very little research has considered computers and teaching practice. Indeed, much of the research into computer education is still in the form of journal articles and edited books, not yet in the more permanent form of bound texts and references to guide the practitioner or researcher. I would also re-iterate the finding stated in Chapter One: that I have been unable to identify any other studies which consider self-taught computer-using teachers from the perspective of being self-taught. Certainly, there is much exhortation for teachers to teach in particular ways, and many practitioners who report ‘I did it this way’. Olson (1988b) has commented that

> tales of exemplary practice are common - each an object lesson in the classroom possibilities of microcomputers. These stories encourage the spread of the technology, but they do not reveal what it was like for people to do things in a new way. (p. 15)

In keeping with these limitations of the available literature I have not sought to detail any particular model of teaching with computers, or to provide a catalogue of such models. In the remainder of this chapter, I present those elements of the literature which are helpful in portraying teachers doing things in new ways.

**A FRAMEWORK FOR CONSIDERING COMPUTERS AND PEDAGOGY**

I have found it helpful to understand computers and pedagogy by considering: (1) why teachers use computers, (2) where computers are used in the curriculum, (3) the software products in use and the modes in which a computer can be used, (4) the difficulties and concerns with computer use which are commonly reported by teachers, (5) factors affecting the type, effectiveness and frequency of computer use in teaching,
and (6) changes to the teachers’ role when computers are used. These six aspects of computer use in teaching provide the structure for the discussion in the remainder of this chapter, and the structure for the summary of the analysis in Chapter Eight.

**WHY TEACHERS USE COMPUTERS**

My reading of the literature suggests that there is no discrete set of reasons why teachers use computers. Perhaps teachers recognise possibilities for computer use such as those identified in Hativa’s (1995, pp. 360-361) review: less domination by the teacher from the front of the classroom, teachers expecting more of students, more complex material being presented, better individualisation of learning, better management of student learning and assessment, encouraging students’ independent work, promotion of a more student-centred class, and the teacher being more of a coach and facilitator than transmitter. Perhaps teachers are obliged or encouraged to use computers by education systems, schools or by the syllabi they teach. As likely as any other are the personal and idiosyncratic reasons which teachers have for trying out new ideas and ‘tinkering’ with their practice, which Huberman (1995) believes is integral to teachers’ work.

I find that the framework used by John Olson (Olson, 1988b, 1989; Olson & Eaton, 1987) provides insight into why teachers use computers. Drawing on work by Harré (1979), Olson has developed a distinction between “expressive purposes” of computer use and “instrumental purposes” of computer use. Expressive purposes are those directed to the formation of an impression of oneself in the eyes of others (Olson, 1988b, p. 30), such as a way for already avant-garde teachers to continue to express their commitment to modernity. Instrumental use of computers is that which is out of necessity or mandate (Olson & Eaton, 1987), such as covering curriculum or maintaining credibility. These concepts provide a framework which helps to get beyond superficial rationales and to describe
teachers’ deep motivations for using computers. Further examples of these are given in Table 1. This framework for understanding why teachers use computers contributes to the theoretical framework within which analysis was conducted (Chapters Four, Five, Six, Seven & Eight).

<table>
<thead>
<tr>
<th>Instrumental</th>
<th>Expressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>• teaching about computer operations</td>
<td>• students work on modern equipment: teacher is up to date</td>
</tr>
<tr>
<td>• promoting problem solving</td>
<td>• students have fun: teacher teaches an interesting subject</td>
</tr>
<tr>
<td>• producing better writers</td>
<td>• computer-literate students have privileges: teacher is discriminating</td>
</tr>
<tr>
<td>• rehearsing maths facts</td>
<td>• teacher is familiar with software: teacher is highly competent</td>
</tr>
<tr>
<td>• teaching spelling</td>
<td>• tutoring student in basic concepts</td>
</tr>
<tr>
<td>• students work on modern equipment: teacher is up to date</td>
<td></td>
</tr>
</tbody>
</table>

Table 1- Instrumental and Expressive Elements of Computer-Based Teaching
adapted from Olson and Eaton (1987, p. 191)

I now turn to a brief comparison of the differences of computer use in different subject areas and year levels.

WHERE COMPUTERS ARE USED IN THE CURRICULUM

There is no difficulty in locating literature advocating the use of computers at all levels of schooling and in all school subjects. There are, however, relatively few studies which take a large scale survey approach to reviewing exactly how, and where, computers are being used. In the IEA COMPED study, Plomp and Pelgrum (1992, pp. 188-190) found that computer use was highest in Mathematics classes, followed by Science classes and language classes in the mother-tongue. Hativa’s (1995) review of the literature has shown that lower in the school, self-exploratory activities are more common, whereas in the upper levels of the school, the use of computers as ‘productivity tools’ is more prevalent. Shears’ (1995) study - particularly relevant because his work was conducted in the year immediately prior to the data being collected for this study and in the
context of the same education system - found that in the primary\textsuperscript{4} years of schooling, around 80% of primary teachers use computers in their teaching.

At the secondary\textsuperscript{5} levels, Shears (1995) provides more detailed information. He indicates that the classes where computers are most frequently used are English, followed by Mathematics, Studies of Society and the Environment (SOSE), and then Science classes. Shears’ study indicated that in the final two years of secondary school, the use of computers in English declines markedly, being located in a lower rank position than the use of computers in Science. By way of contrast, Newhouse’s (1998) study of a laptop computer program found that in the upper levels of secondary schooling, computer use was highest for subjects requiring document production (e.g. English), because students and teachers both perceived that it improved quality, quantity and ease of production. This resonates with my personal experience of computer laboratory environments, including the situation for Outeast College teachers (refer to Chapters Five, Six and Seven). Shears offers no explanation of the result with respect to the study of English (or indeed any other subject), and within the constraints of the present study, it will have to remain unexplained.

In summary, I observe that one would expect to find computers being used across the range of classes and subject in any school, and that the greatest variation in computer use would seem to be between primary and secondary levels, and then between different subject areas. I take up this discussion later in this chapter, in the context of subject cultures.

\textsuperscript{4} In the Victorian context, the primary school represents the first seven years of schooling (labelled year Prep, and then One to Six), and thus includes Geoff’s Year Three class (discussed in Chapter Five).

\textsuperscript{5} The secondary school represents the final six years of schooling (labelled Years Seven to Twelve). Therefore, Arlene’s Year Seven class (discussed in Chapter Seven) is regarded as ‘lower secondary’, and Howard’s Year Eleven class (discussed in Chapter Six) is regarded as ‘upper secondary’. 
I will now proceed to a discussion of the third aspect of computers and classroom practice - the software products which are in use.

**THE SOFTWARE PRODUCTS IN USE AND MODES OF COMPUTER USE**

Shears (1995, pp. 15-17) collated a list of the most frequently available software titles in Victorian schools. These are shown in Table 2, in which I indicate not only the title of the software package (from Shears), but the type of software (my own interpretation, drawing on my experience of these).

<table>
<thead>
<tr>
<th>Primary Schools</th>
<th>Secondary Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software Title</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Carmen San Diego</td>
<td>Simulation game</td>
</tr>
<tr>
<td>Clarisworks</td>
<td>Integrated package including word processor, database, spreadsheet and drawing tools</td>
</tr>
<tr>
<td>Children’s Writing and Publishing Centre</td>
<td>Writing and publishing package</td>
</tr>
<tr>
<td>Logo/LogoWriter</td>
<td>Programming and problem-solving environment</td>
</tr>
<tr>
<td>Maths Blaster</td>
<td>Simulation/drill-and-practice</td>
</tr>
<tr>
<td>Kid Pix</td>
<td>Writing, designing, publishing</td>
</tr>
<tr>
<td>Microsoft Works</td>
<td>Integrated package including word processor, database, spreadsheet and drawing tools</td>
</tr>
<tr>
<td>Stickybear</td>
<td>Typing tutorial</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 - Software Types Common in Victorian Schools, circa 1996
These data are important for two reasons. Firstly, they provide a basis for describing the technical environment of Outeast College in Chapter Four. Secondly, Shears’ interpretation of these results in terms of pedagogical issues are particularly informative. With respect to the software used in primary schools, Shears (1995) has observed that

an interesting aspect … was the popularity of many titles that had been current since computers were first introduced into schools in the early 1980s … This may reflect a somewhat conservative approach to the software choices … or possibly the lack of innovative educational software that appeals to teachers …

It could also be a reflection on the software that teachers find suitable for classes which have limited computers. While it might be expected that word processing software would be more prominent, experience would suggest that this is only the case where better access to a computer for writing is possible. (p. 15)

With respect to the software used in secondary schools, Shears (1995) further found:

it is worth noting the limited number of titles that are subject specific. Beyond the generic titles such as typing tutors, spreadsheets, word processors and Logo, there is not a lot of software listed that would indicate wide use across subject areas such as Science, Music or Graphics, or even a lack of knowledge or access by teachers to the available software applications in those areas. (p. 16)

Thus, according to Shears, the range of software in use may be indicative of lack of innovative approaches, funds, or commitment to use of computers broadly across the curriculum. These are representative of both the difficulties of using computers which are frequently reported, and widespread concerns over the effectiveness of the use of computers. Both of these themes are discussed later in this chapter.

A number of classification systems have been developed to describe how computers can be used as an aid in teaching and learning. Terms such as “computer aided learning”, “computer assisted instruction” and
“computer based learning” have been used for many years. Taylor’s (1980) classification of the computer as a tutor, tool or tutee has been widely used to describe how computers are used in the classroom, but some observers have found this three-fold classification limiting, and a number of extensions of it have been developed (e.g. ACS/ACCE, 1994/1995; McDougall, 1993).

I have found two documents particularly helpful in classifying computer use. The first is the position statement on computers in schools developed by the Australian Computer Society and the Australian Council for Computers in Education [ACS/ACCE] (1994/1995) which, like Shear’s work, is contemporaneous with the data gathering of the present study. This statement nominated five modes in which information technology resources can be used in teaching and learning. This is an expansion of Taylor’s model, and describes the five modes of: support, exploration and control, tutorial, resource and link. The second document is the Real Time report (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999, pp. 111-116, 157-159) which presents several domains in which computers could be used, namely, informational, creative and communication uses, together with educational programs and games. Table 3 summarises the classifications used in both the ACS/ACCE statement and the Real Time report, using the modes discussed in the ACS/ACCE as a framework. It is clear from the ACS/ACCE document that the modes of computer use presented therein are not definitive, the authors commenting that schools may be able to identify further modes, and that in some applications or learning situations, modes can overlap. The ACS/ACCE description of different modes of computer use is drawn upon in the analysis of the classroom practices observed in the case studies (Chapters Five, Six and Seven).

I now proceed to a discussion of the fourth aspect of computers and classroom practice - the difficulties and concerns with using computers in teaching which are commonly reported by teachers themselves.
### Mode Description

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Support</strong></td>
<td>In the support mode, a student uses the computer to enhance the presentation of work. The computer can help by increasing the accuracy that the student might otherwise be able to achieve. There are a great number of tools that are currently used in schools, or which are available, for example: word processors and other office applications, presentation graphics, computer aided drafting and design, desktop publishing, and spelling and grammar checkers. In essence, the computer in support mode enables the student to create or file information which is usually transferred to paper. Images could quite easily be put on paper using a pen or pencil, but the computer increases the accuracy the student can achieve. In so doing, the computer has an important role to play in raising the self-esteem of students, and in giving them confidence to continue to succeed in their learning. Meredyth et al. (1999) refer to creative uses, such as creative writing, developing pictures and graphics, and producing music or sound.</td>
</tr>
<tr>
<td><strong>Exploration &amp; Control</strong></td>
<td>In the exploration &amp; control mode, the student is able to examine and build situations. This kind of work is often associated with adventure games, where an important historical event is encapsulated in software. Students can explore this crucial moment in time and place, whilst making their own decisions about the events that unfold. Other software enables students to control a real, experimental situation, in a science laboratory, for instance, by using robotics. Several environments for exploration or control are available, and these include Hypercard, Logo, and MicroWorlds. In each case the software provides a framework within which students can explore a situation. Additionally, these applications can be used by students to construct models of the real world, and experiment with variations within these models. Meredyth et al. (1999) refer to the use of educational programs and games, which is a combination of the exploration &amp; control mode and the tutorial mode.</td>
</tr>
<tr>
<td><strong>Tutorial</strong></td>
<td>In the tutorial mode, the student will expect to learn new knowledge or skills. This mode is characterised by the information system presenting information at an appropriate level and pace for the student.</td>
</tr>
<tr>
<td><strong>Resource</strong></td>
<td>In the resource mode, the computer is used to access information and other resources. Examples of using the computer in a resource mode include: using a computer based library catalogue, using a database package to investigate relative population densities by country and latitude, and accessing the Internet. When using the computer in resource mode, students are developing questioning skills; they solve problems by stating them and re-shaping them to fit different resource frameworks. Meredyth et al. (1999) describe this mode as informational uses of computers.</td>
</tr>
<tr>
<td><strong>Link</strong></td>
<td>The link mode is typified by the computer being used for communication between individuals. This represents an important role for computers in life for the coming century. In utilising digital communications, we see a personal involvement and a picture of relationships, missing from the other modes. Examples include the use of electronic mail for the low-cost exchange of textual messages, and extend to desktop video conferencing for visual personal communication. Meredyth et al. (1999) describe this mode as communication uses of computers.</td>
</tr>
</tbody>
</table>

**Table 3 - Modes of Computer Use**
DIFFICULTIES AND CONCERNS WITH COMPUTER USE

Referring first to Shears’ (1995) catalogue, and then to other sources (as indicated), I have identified five areas of pedagogical concerns\(^6\) typically identified by teachers themselves or by their Principals. My purpose is not to provide resolutions to them, but rather to identify them as the basis of a framework in which the difficulties and concerns of self-taught computer-using teachers can be discussed. These areas of concern are: classroom routines, scope and content of curriculum, suitability of software, class management and technical problems.

\textit{Classroom Routines}

In his review of the literature, Hativa (1995, p. 361) has drawn attention to the relationship between teaching routines and use of computers. He has commented that

\begin{quote}
the basic problem with the use of computer technology is the attempt to incorporate it into the curriculum by adapting it to an existing infrastructure. Significant and innovative use of computers does not articulate well with the basic features of many classrooms. \hfill (p. 362)
\end{quote}

Olson (1988b, pp. 89-90) has also stressed the importance of routines. MacArthur and Malouf (1991) studied classrooms equipped with computers and found that classroom routines were important for how computers are used. Schofield (1995) and Cumming (1988/89) reported that computer using in classrooms required a change of teaching routine and disrupted the classroom’s traditional social organisation. This in turn led to concerns over discipline and management issues (see below), and a teacher’s response to such issues might be to discontinue with the use of computers.

\(^6\) Note that whilst Shears’ work relates to laptop computing, Albion (1999a) has noted that all Shears’ conclusions, except those related to portability, apply to the educational use of computers more generally.
Scope and Content of Curriculum

Shears (1995, p. 126-127) noted that a common complaint of teachers when using computers in their teaching is that it reduces the time available for the teaching of the content of the subject. Becker (1994) found that teachers were concerned that computer use changed coverage of curriculum topics and down-graded the salience of some content in exchange for computer activities. Some of the teachers in Schofield’s (1995) study were of the opinion that computer use would add little value to current practice.

In terms of that which teachers actually teach, Newhouse (1998) found that, in a laptop computer program, most students developed skills in a haphazard way, relying on information gleaned from other students. This can be explained, in part, by teachers perceiving themselves as needing to both teach a subject and simultaneously be a technical trainer (Goodson & Mangan, 1995; Richards, 1997). In response to such a concern that computer use will change scope and content of the curriculum in undesirable ways, Goodson and Mangan found that whilst the introduction of computers into classrooms initially sets off ‘hard’ cultural clashes relating to the scope and content of the curriculum, over time (due to experience) the dichotomies came to be perceived as less marked.

In summary, concerns that computer use will change scope and content of the curriculum in undesirable ways are fairly commonly held by teachers, and yet long-term immersion in a program of using computers may allay such concerns.

Suitability of Software

That teachers consider that there is a lack of suitable software is often reported in the literature, for instance by Shears (1995, p. 126-127) and Newhouse (1998). It may well be that there is a lack of suitable software; I do not seek to either prove or refute either assertion. I would suggest,
however, that this issue is rather more complex than a perceived lack of suitable software would suggest. As Richards (1997) notes, it is important for teachers to be able to connect knowledge of software to applied knowledge in different curricular and disciplinary areas. In short, it could be that some of the complaints regarding a lack of suitable software might arise from ‘immature’ pedagogical content knowledge. However, it is clear that suitability of software is a widely held concern.

**Class Management**

A number of authors have found that some teachers find that computer use in teaching causes problems in terms of class control and discipline. Shears (1995, p. 126-127) found that class disruption and lack of class control were frequently reported as difficulties and concerns. Schofield (1995) and Lynch (1999) have found that some teachers believe that computer use in teaching is a threat to the teacher’s sense of competence and authority, because of their poor knowledge of the technology and of relevant pedagogy, and therefore had an impact on class management.

The issue of confidence of using computers in teaching is discussed in a later section of this chapter, but it is important to note that concerns over management and discipline issues are clearly strongly held by many teachers.

**Technical Problems**

Shears’ (1995, p. 126-127) research identified a variety of difficulties and concerns of a technical kind: equipment failure, time consumed by printing, teacher’s lack of knowledge to fix problems, lack of technical assistance and the expectation that teachers will do more non-teaching tasks. Schofield (1995) found that teachers reported a lack of familiarity with hardware and software, and this gave rise to technical problems, and had an impact on competence and authority. D’IIgnazio (1995) has argued
that computers are fallible devices and prone to problems, and that to view computers as a ‘solution’ is an inappropriate mindset for teachers to adopt. The source of the difficulty may be with the technology, or it may be with the teachers’ mental attitude and teaching focus, however technical problems are issues which teachers consistently report.

Fragility as a Framework for Understanding Some Aspects of Pedagogical Concern

Lankshear et al. (1997a, pp. 14-15) use the term “fragility” to discuss a range of difficulties and concerns with computer use. Fragility is concerned with classrooms being conceived of as complex and self-organising systems. Effective self-organising systems depend on assigning roles successfully between all their main components; when a component (teacher, student, computer, software) is fragile, the behaviour of the classroom is unable to reorganise in a way that allows computer use to continue.

In these terms, technical problems will only result in fragility if teacher or students are unable to change what they do to compensate for the difficulty which has arisen. Indeed, for all of the five areas of difficulties and concerns with computer use - classroom routines, scope and content of the curriculum, suitability of software, class management and technical problems - it is conceivable that the teacher or students might be able to change how they are working in order to minimise any difficulty or concern which may arise.

The fact that the various problems and concerns can be listed and seen to be important limitations to computer use is evidence that many teachers struggle to adjust their way of working in order to minimise difficulties. The robustness of teachers’ existing knowledge for teaching is an important framework for understanding this apparent inability to change. I discuss this in detail in the section on practical theories of teaching later in this chapter.
I now proceed to a discussion of the fifth aspect of computers and classroom practice - that of the factors affecting the effectiveness and frequency of computer use in teaching, together with a discussion of the possible explanations. It is within the context of this discussion that the attributes or qualities which should be possessed by teachers new to using computers are discussed.

FACTORS AFFECTING THE TYPES, EFFECTIVENESS AND FREQUENCY OF USE

Concerns over both low levels of use and ineffective use of computers in teaching is a problem which has dogged the introduction of computers into schools throughout the relatively short history of this innovation. In 1989, an OECD report (CERI, 1989) indicated that the potential claimed for microcomputers in education had not been realised, even in those countries where computers were then relatively commonplace. McCoy and Haggard’s (1989) review also reported wide variation in both the amount and type of use of computers by teachers and a reluctance by teachers to incorporate technology into their teaching. More recently, Marcinkiewicz (1993/4), Marcinkiewicz and Regstad (1996), Tyler-Wood, Putney and Cass (1997, p. 20) and Scheffler and Logan (1999) have claimed, in reference to the USA, that: relatively few teachers have integrated computers in their teaching, actual use falls short of what is expected, and that exceptional availability of computers is not matched by increased computer use. Russell (1992) indicates similar findings in Australian research. In another study from the USA, Becker (1994) has further claimed that only five percent of those teachers who use computers may be thought of as exemplary, a point with which Newhouse’s (1998) Australian case study concurs.

The effectiveness of computer use can also be explored by asking whether the use which does occur might suggest any real structural change in teaching or schooling. Plomp and Pelgrum (1992, pp. 188-194), in the IEA
COMPED study, could not identify any such change. Ridgway and Passey (1991) commented that

desirable educational events that can occur in some classrooms are extremely rare in classrooms in general. We have a long list of exciting ‘existence proofs’ related to [information technology] and little evidence of generalisability across classrooms ... [furthermore] ... those IT activities which are regularly observed in class seem a waste of teaching time. (p. 5)

My intention here is not to validate the claims related to levels and effectiveness of use, as there is no benchmark for what would constitute ‘good use’ identified or proposed. Rather, the intention of the above review has been to recognise that concerns over levels and effectiveness of use have been consistently and broadly raised.

Indeed, such concerns are not confined to computer use, but apply to just about every technological innovation introduced into the classroom. Cuban (1986), Hativa (1995, p. 259) and Miller and Olson (1994) consider that there is no precedent for technological innovations in schools being perceived as effectively used. They view the introduction of computers into schools as the latest in a long line of attempts to penetrate schools with various technological innovations: audiovisual technologies, the microelectronics revolution and the use of Logo in the curriculum have all been lauded as instruments of change in an educational revolution of unparalleled magnitude. More generally, Robinson (1989) has written of the consistent failure of innovation projects in education and the emergence of the phenomenon of “innovation without change” (p. 289). The common themes are that the technologies have consistently failed to make any major changes to teaching and learning and, beyond the initial years of enthusiasm, use in schools is consistently lower than expected.

Having identified computers as the latest in a long line of technological innovations over which there has been concern as to the effectiveness and frequency of use, I will now present a review of the various explanations which have been offered for this phenomenon. There are three groups of
factors which have been seen to be influences on the effectiveness and frequency of use of computers in teaching. These are features of the work environments, the technology itself, and personal factors, and I will address each in turn.

**Work Environment**

*Incentive Structures*

Becker’s (1994) research has revealed that the following factors associated with the work environment are important: a network of computer-using teachers at the same school, organised support (for instance, the presence of staff development activities, and full-time co-ordinator of computing), and smaller class sizes. These factors are congruent with the incentive structures which need to be made to make any change or innovation successful (Fullan & Stiegelbauer, 1991).

These considerations provide some explanation of why it may be difficult to put teachers in contact with a computer-based teaching environment; however they do not fully explain why there are instances of computers not being used effectively, even where organisational structures have been addressed.

*Social and Professional Situation*

The social and professional situation of the computer-using teacher may have an important bearing on the extent and amount of use of computers. Hativa (1995, p. 361) noted that many teachers feel uncomfortable about working in a laboratory because it is perceived as the ‘territory’ of a sub-group of staff, typically the teachers of Computer Science, Mathematics or the Physical Sciences. Consequently, the laboratory is under utilised by the majority of teachers and over utilised by a particular subgroup of staff. Lynch (1999) also found that, when working in a computer laboratory
which was perceived as the province of specialist computer teachers, teachers thought themselves and their students to be subject to the rules, routines, expectations and knowledge of someone else. This compromised their position as ‘experts’ and led to a deal of inhibition on the part of the teachers. Jacobsen (1998) and Watson (1993) found that the very character which makes a teacher an enthusiastic computer-using teacher appears to inhibit colleagues - that is, the nature of the innovation has become embodied in the user of the innovation to the detriment of its spread.

In summary, it is important to consider the social dynamics of the situation, particularly in relation to perceived ownership of both the innovation and the physical space, when seeking an explanation for under utilisation of computers.

Subject Subcultures

Goodson and Mangan (1995) have studied the use of computers in a number of school subjects from the context of subject subcultures, and this provides an interesting perspective on the impact of the work environment on the extent to which computers are used. Although sociologists such as Lacey (1977) have discussed the existence of subject subcultures over 20 years ago, Grossman and Stodolsky (1995, p. 5) describe subject subcultures as “an emerging line of research” which they regard as part of a reaction against a tendency within educational scholarship to treat teaching as a generic activity, and teachers as more-or-less interchangeable parts within a school system. Goodson and Mangan (1995) define a subject subculture as

a general set of institutionalised practices and expectations which has grown up around a particular school subject, and which shapes the definition of that subject as both a distinct area of study and a social construct. (p. 615)
Researchers into subject subcultures (Goodson & Mangan, 1995; Grossman & Stodolsky, 1995; Stodolsky & Grossman, 1995) work under the premises that subject subcultures find expression through a variety of different expectations and practices and also through different pedagogical styles and classroom organisation. Such research proceeds on the assumption that in most cases, teachers perceive their pedagogical styles as a limited arena of personal choice, in which they have the freedom and power to make minor variations in curriculum and pedagogy, and are inevitably constrained by both the fundamental culture of teaching and the subject subculture. Grossman and Stodolsky (1995) consider that

though far from complete, when taken together, our research and the research of other scholars … provides support for the idea that high school teachers work in somewhat separate arenas, defined by the subject matter they teach. The issues and concerns of the typical Math teacher are not the same as those of the typical English or Social Studies teacher, nor do they work under the same constraints. (p. 8)

Subject subcultures are an element of the work environment which can contribute to how computers are used (or not used) by teachers because they identify teachers as working within “a limited arena of personal choice”.

A consideration of factors concerned with the work environment are clearly important when seeking an understanding of the types, effectiveness and frequency of use of computers in teaching. Incentive structures are an important consideration. The social and professional situation, particularly in relation to perceived ownership of both the innovation and the physical space, is always important, and may contribute useful explanations in some settings. Subject subcultures provide a framework for understanding resistance to change in respect to the values and practicalities embodied in antecedent subcultures.
I now turn to a discussion of the technical and personal factors to seek a further understanding of this problem.

**Technical Factors**

**Numbers and Distribution of Computers**

Both the IEA COMPED study (Plomp & Pelgrum, 1992) and the school principals surveyed by Shears (1995, p. 22) consistently identified insufficient numbers of computers and inadequate finance to purchase more as among the major difficulties with the implementation of computers in schools. To redress this difficulty, some schools have invested heavily in computer equipment to provide greater numbers of computers in the school. Jones (1995), for instance, reports on a school which has adopted a ‘laptop computer’ program to provide one-to-one levels of access. Newhouse (1998) has recently published a longitudinal evaluation of such a program, and has reported that, even when each student and each teacher had access to his/her own computer, actual use falls short of what is expected - little wonder that Albion (1999a), for instance, has seriously called into question the validity of laptop computer programs. Newhouse has wondered whether changes will come about due to the avalanche of computers into schools, or whether changes in teaching and learning to encourage greater and more effective utilisation should be effected before embarking on such schemes. More generally, however, it has been consistently identified that actual use falls short of what is expected, even when computers are abundant (CERI, 1989; Tyler-Wood, Putney, & Cass, 1997, p. 20).

**Technical Capacity of Computers**

Hodgson (1995) has commented that limited technical capacity of computers has been put forward to explain under-utilisation. Such an argument, proposed, for instance, by Woodrow (1992), involves
generalisations such as schools typically using older equipment, and the perceived unsuitability of command line interfaces (such as DOS) compared with ‘Windows style’ interface, which Hazari (1993, p. 27) considers to be somewhat of a presumption. ‘Windows style’ environments have become a standard in classroom computing and, as Hazari notes, they certainly require a more powerful computer to operate than do Command Line Interfaces.

I have not found any relevant large scale study on the specific issue of whether the limited capacity of computers is an important consideration in the under-utilisation of computers in teaching. However, I would observe that whilst computer technology has developed considerably over the last 20 years, the assertion that actual use consistently falls far short of availability has been continual. Even if it is presumed that schools are in possession of equipment which predate current models by some years, I would expect to detect some change in the disappointment expressed by some commentators over this time. The charge that computers, on the whole, are inadequately used in schools has persisted over this time.

The technology, insofar as it may be unfamiliar or be found difficult to use, may account for some of the under-utilisation of computers in teaching. In consideration of this point, Hativa (1995, p. 361) has discussed an interesting analogy between computer use in schools today, and the efforts to turn television into an educational tool in past years. Hativa notes that the level of use of this technology was also well short of ideal, with teachers citing inconvenience of broadcast schedules and lack of appropriate programming as common problems. He comments that one would have thought that these problems would have been solved by the availability of videotape recorders, and by removing the barriers the use of television as an educational tool would have increased. Hativa notes that the resolution of the perceived barriers has not resulted in significantly expanded use of video technology. As Russell (1992) has commented in the context of computers, the provision of hardware and software is a necessary but not a sufficient condition for the use of computers.
I now turn to a discussion of a broad range of ‘personal’ factors which may have some bearing on the types, effectiveness and frequency of use computers in schools.

**Personal Factors**

There is a body of research which has sought to identify personal factors or traits which act as useful predictors for a teacher using computers effectively in his/her teaching (Albion, 1996; Albion, 1999b; Downes, 1993; Dunn & Ridgway, 1991; Enochs, Riggs, & Ellis, 1993; Jacobsen, 1998; Marcinkiewicz, 1993/4; Marcinkiewicz & Regstad, 1996; McCoy & Haggard, 1989; Olivier & Shapiro, 1993; Tyler-Wood, Putney, & Cass, 1997). This literature tends to be restricted to quantitative studies, employing data gathering techniques such as Likert scales and questionnaires, and analysing these using multivariate and correlational techniques. As such, this literature has several limitations: the body of work is at present too sparse, there is little consensus about which factors ought to be considered, and genuinely large and diverse populations have not been surveyed. From the point of view of identifying personal traits from which effective use of computers can be predicted, the research is largely inconclusive.

When the statistical studies are considered alongside more qualitative studies, however, it is possible to identify a group of factors which need to be carefully considered in trying to understand the levels and effectiveness of use of computers in the classroom. The same body of literature can be looked at to discern the desirable attributes or qualities of self-taught computer-using teachers. In the following sections, I will discuss the following personal factors: knowledge of computers, pedagogical content knowledge, knowledge of routines, attitudes and confidence, gender and teachers’ experience.
Knowledge of Computers

The first personal factor to be considered as an influence on the extent and effectiveness of use of computers is the teacher’s knowledge of computers. Both international and Australian research has identified that teachers’ knowledge of computers is frequently acquired, in large part, through being self-taught (Meredyth et al., 1999, p. 146; Plomp & Pelgrum, 1992; Shears, 1995; Tyler-Wood, Putney, & Cass, 1997), and some would consider this to be problematic. Becker (1994) has found that formal training in using and teaching with computers was an important predictor of computer use, Jaber and Moore (1999) comment on several large-scale studies to suggest that “training and support are needed if teachers are going to successfully use computer-based technology in their teaching” (p. 254), and in Larner and Timberlake’s (1995) study, teachers consistently indicated that knowledge about computers was critical.

Newhouse and Oliver (1992, p. 27) and Umbach (1997) have contrasted computers with previous educational technologies. They consider that to use video players and overhead projectors, one does not need to know a significant amount about the technology and how to operate it. They consider that computers are much more complex than earlier technologies, and therefore significant amounts of knowledge of the technology are required. Newhouse and Oliver, however, comment that there is some debate over how much teachers need to know in order to make effective use of the technology. Johnson’s (1997) work provides some clarification, finding that a minimal level of skill (e.g. basic word processing) was important. Beyond that basis, however, much more important was what he termed an ‘openness’ to using computers and a readiness to learn about them whenever possible, and an interest in improving pedagogy.

From my reading of the literature, I believe that whilst knowledge of computers is frequently identified as problematic, it is actually discussed rather less than other factors (as discussed in Chapter One). Knowledge of
computers is viewed as an influence on other factors. The relationship between knowledge and self-confidence is discussed later in this chapter. Scheffler and Logan (1999) cite other studies which indicate that training leads to increased computer use, but it is unclear whether the important factor is the knowledge acquired, the confidence which is engendered or some other factor. Olson, James and Lang (1999) found that teaching unfamiliar subject material created role insecurities, as did new approaches to teaching. In the context of Science teaching, Carlsen (1992), has observed teachers to behave in such a way as to ensure close control of discourse when teaching unfamiliar content. Also in the context of Science teaching, Tobin and Espinet (1989) found that knowledge limitations affected planning and implementation of classroom practice.

In the specific context of computer use in education, I have found no reference in the literature which disputes that a certain level of knowledge is required, however I believe there is a consistent lack of clarity as to what that should be. This is consistent with Borko and Putnam’s (1995, pp. 43-46) finding that little is known about what constitutes adequate knowledge to teach with understanding in any discipline. Knowledge of computers - beyond a ‘certain minimum’ - may not of itself be a particularly important determinant of the frequency, type and effectiveness of computer use in teaching, but may impact on other factors which may affect computer use and teacher role.

**Pedagogical Content Knowledge**

In Chapter One, the concept of pedagogical content knowledge was presented, using Kagan’s (1992, p. 158) words, as “a unique interface of content and pedagogy, an understanding of how topics and skills can be organised and taught to pupils” and restructured content knowledge. It was suggested that it is necessary to rethink subject knowledge from a “pedagogy-with-computers” perspective (Albion, 1996). Olson (1988b, pp. 55-56) has drawn attention to the need to regard software as “ideaware”, where the central ideas of the software are used as ways of representing
content. Richards (1997) found that a particular difficulty for teachers was the problem of connecting basic computer skills and literacy with applied knowledge in different curricular and disciplinary areas. An ERIC search on pedagogical content knowledge revealed less than 100 articles, nearly all of which relate to studies of Mathematics and Science teaching, and none relating to teaching with computers. In general, little work seems to have been done on the influence of pedagogical content knowledge on the use of computers.

Knowledge of Routines

The importance of routines to teachers is well-established. Cuban (1993) has observed that

high school teachers, bound by a social organisation of instruction that includes two or three different subjects and seeing 150 to 200 students daily in five or more fifty-minute classes have created a durable, practical pedagogy that researchers have documented consistently. (p. 202)

Dwyer, Ringstaff and Sandholtz (1990) assert that

teachers are, by the nature of their work, pragmatists. They must survive the day; they must be ready for the next. Confronted by large numbers of computers or not, they arrive at their classrooms the very first day of their careers with a deeply-rooted belief about schooling that will help them weather the storms they face. (p. 4)

There is a very important link between the durable, practical pedagogy of a teacher and his/her practical theories of teaching (as described in Chapter One) which will be explored later in this chapter. Within the literature it is often unclear, however, whether the term “routine” is used to refer to those grand, holistic and often implicit forces which guide pedagogy, or whether it is referring to a definition which is limited to how the physical relationship between space and materials in a classroom are governed (Evertson, 1995, p. 215).
Emmer (1995) considers that routines are important aids to management because they provide recurrent, predictable patterns of behavior that simplify the students’ and the teachers’ task of making their way through the complexities of the behavioral environment. (p. 220)

It is hardly surprising, then, that issues such as how a teacher might distribute resources (such as books) to students in a class, whether moving rooms is a disturbance to teaching (perhaps due to the resources available in one room and not the other), or how a unit of work has been ‘traditionally’ taught might increase the complexities which teachers and students have to manage, and so act as a disincentive for computer use. Olson (1988b) notes that routines allow the business of the class to be done, but they also say something about who the teacher is, and about the significance of what is done ... Classroom routines are not what the computers will replace, they are what the computers must fit if they are to be useful to teachers. (pp. 89-90)

Teachers’ durable, practical pedagogy is incredibly pervasive, so a consideration of such pedagogy is a most important aspect of understanding the use which teachers make of computers. Those predictable patterns of behaviour which serve the basic functions of order and management in the classroom are powerful influences on how computers will be used, precisely because they allow teachers to go about their business with a certain degree of automation and predictability.

**Attitudes and Confidence**

Attitudes and confidence represent a group of related factors which may be influential on the extent and effectiveness of use of computers in teaching. There is a diverse range of research methods which have investigated the influence of factors such as self-confidence, level of comfort, attitudes
towards computers and anxiety toward teaching with computers, in an
359; Johnson, 1997; Marcinkiewicz, 1993/4; Marcinkiewicz & Regstad, 1996;
McCoy & Haggard, 1989; Tyler-Wood, Putney, & Cass, 1997). These studies
have consistently identified teacher confidence as an important
contributing factor to a teacher’s decision to use computers in his/her
teaching.

This finding is supported by studies into the perceived self-efficacy of
computer-using teachers. Perceived self-efficacy is defined as “individual’s
beliefs about their ability to perform particular actions or attain certain
goals” (Gorrell, 1990, p. 77), and is related to self-perception and self-
concept. Self-efficacy relates the choices people make to their aspirations,
their efforts and perseverance. Gibbs (1999) has commented that it is well
established in the research literature that the highly self-efficacious
teachers are the most likely to take on innovations and new approaches to
teaching. The relationship between perceived self-efficacy and computer
use has been increasingly studied (Albion, 1999b; Borchers, Shroyer, &
Enochs, 1992; Enochs, Riggs, & Ellis, 1993; Jacobsen, 1998; Olivier &
Shapiro, 1993), and these studies consistently report perceived self-efficacy
as a good predictor of computer attitudes and usage patterns. A related
finding is that of Marcinkiewicz (1993/4) who studied the relationship
between innovativeness (as a motivational construct related to a
willingness to change in reference to a specific situation) and levels of
computer use, and found that higher rating of innovativeness predicted
higher levels of computer use.

The literature reveals that confidence is related to a range of other factors:

**Knowledge of teaching methods.** A number of authors (McCoy &
Haggard, 1989; Richards, 1997) have shown that knowledge of methods of
teaching with computers can be an important influence on being
confident when using computers. There is a tendency in such literature to
assume that explicitly taught pedagogical knowledge is a necessary pre-
cursor to confident and effective teaching, a position which all but dismisses the possibility of self-taught computer-using teachers. The basic assertion that knowledge of pedagogy is a contributor to confidence remains uncontested.

**Access to the technology.** Tyler-Wood, Putney and Cass (1997) suggest that computer ownership or access in the workplace is a predictor of confidence. This, too, makes intuitive sense, and is consistent with Umbach’s (1997) contention that effective computer-using teachers need to be self-motivated users with unimpeded access to the technology. Downes (1993), however, indicates that the relationship between personal use and use of computers in the classroom is not straightforward, and that in fact use with children can precede personal use. As an indicator of computer use in teaching, the issue of access to the technology has not been sufficiently explored in the literature.

**Knowledge of the technology.** In a statistical study, Tyler-Wood, Putney and Cass (1997) found that knowledge was not a good predictor of confidence. Lynch (1999), in case study work, found that for many teachers their relative unfamiliarity with the technology (particularly when compared with students’ skill) caused them to feel threatened and inhibited, and this was evidenced in a lack of confidence. Olson, James and Lang (1999) found that teaching unfamiliar subject material and new approaches to teaching created role insecurities. Yildrim (2000) found that participation in an educational computing class improved confidence and reduced anxiety. Similar claims have been reported by Edwards (2000). As an indicator of computer use in teaching, the issue of knowledge of the technology has not been sufficiently explored in the literature.

**Classroom experience with computers.** A number of studies have found that personal confidence increased following classroom experience (Albion, 1996; Dunn & Ridgway, 1991; Hativa, 1995). This compares well with recommended strategies for developing self-efficacy beliefs in relation to computer use (Albion, 1999b) and is loosely related to
instrumental conditioning (Taylor, Sluckin, Davies, Reason, Thomson, & Colman, 1982, ch. 13). According to the principle of instrumental conditioning, when teachers have a positive experience, this acts as a reinforcement, which should promote continuation of that rewarded behaviour.

In summary, teacher confidence and a positive attitude towards the use of computers are important contributors to whether teachers will use computers in their teaching. These are probably more important than factors such as computer knowledge or skill (beyond a ‘certain minimum’).

**Gender**

Gender is a factor which scholars have considered as an influence on the extent and effectiveness of use of computers. A number of statistical studies have investigated the importance of gender in predicting effectiveness of computer use. McCoy and Haggard (1989) comment that earlier studies had eliminated gender as a factor, and found the same in their study. Becker (1994), however, found that gender had a bearing on other important factors: male teachers tended to have more advanced qualifications, and spent more time using computers. Becker concluded that despite cultural changes in recent years, female teachers still have more non-work-related obligations, which affects the amount of time spent using computers, and this in turn may have an effect on teachers’ preparedness to use computers.

Olivier and Shapiro (1993) have also made some interesting observations in relation to gender and self-efficacy studies. They suggest that males feel more in control when using a computer and are more efficacious in coping with adverse events than females. According to Olivier and Shapiro, self-efficacy theorists attribute these differences to the fact that girls are frequently taught compliance, negotiation, and non-risk taking behaviours. Certainly, Matthews’ (2000) own study, and others that he
cites, suggest that female teachers report lower confidence when using computers than do males.

I have found no support for a notion that gender of itself is a determinant of computer use by teachers. However, the issue of gender highlights a range of cultural influences related to a teacher’s present circumstances or personal biography which might be important in any particular teacher being confident to use computers in his/her teaching, and these may be revealed along gender lines.

Teaching Experience

The final personal factor to be considered as a influence on the extent and effectiveness of use of computers is teaching experience. McCoy and Haggard (1989), in the conclusion to their study of determinants of computer use by teachers, comment that,

contrary to our expectations, the results ... indicated that computers were used by more experienced teachers. This might be a reflection of the fact that experienced teachers typically use a larger variety of teaching activities, and that the computer is more easily added to their ‘repertoire’. Even though less experienced teachers have likely received more computer education training, they report less use of computers in teaching. (p. 7)

Matthews (2000) found that teachers with more years of experience report significantly lower levels of computer literacy, but higher levels of computer usage. Edwards (2000) believes that the idea that “new teachers are more likely to use school technology than veteran teachers” (p. 13) is a “popular myth” and does not stand up to investigation. There is support for this idea elsewhere in the literature. Becker (1994) found that the length of time a teacher had taught a subject tended to serve as a reliable indicator of whether that teacher would use computers in his/her teaching (though curiously, and unexplained, he found the reverse to be true for English teachers). Tyler-Wood, Putney and Cass (1997) found that
greater age tended to lead to greater confidence\textsuperscript{7}. Two reviews (Hativa, 1995; Meredyth et al., 1999) both point to studies which suggest that flexibility in adapting to new curriculum and pedagogy is a key factor in whether teachers will use computers in their teaching.

Moreover, the correspondence between increased experience and higher levels of computer use is completely consistent with constructivist views of teacher development. Huberman (1989, pp. 33-38) suggests that the empirical literature identifies the following phases in the career of a teacher: “survival and discovery”, “stabilisation”, “experimentation/activism”, “taking stock/self-doubts”, “serenity”, “conservatism” and “disengagement”. The formative process typically takes some years - Kagan (1992, p. 149) suggests around about two years, Calderhead (1987b, p. 7) suggests closer to five - and teachers reach a time when “intuition and knowledge begin to guide performance and a holistic recognition of similarities among contexts is acquired” (Kagan, 1992, p. 160). A consideration of the developmental process suggests that more experienced teachers will be more likely to include innovations in their teaching, as they have a sound basis from which to proceed, and are not troubled by the myriad of concerns which impact the teacher-information.

Bents and Howey (1981, p. 14) classify understandings of teacher development throughout the remainder of a career in terms of age theories (identifying concerns, problems and factors which are common to all or most adults at particular times in their lives) and stage theories (which focus on distinct differences in the structure of thinking at different points in development). Whilst it is reasonable to more generally identify greater experience with greater ability to innovate, intrinsic factors such as developmental level, together with personal factors such as marriage, birth and divorce (Measor, 1985) affect the ability

\textsuperscript{7} It is not clear from Tyler-Wood, Putney & Cass’s study whether greater chronological age should be uniformly interpreted as representing greater experience, but this seems to be the general thrust of the study.
to innovate. Furthermore, Huberman’s (1989; 1992; 1995) study of career trajectories suggests that teachers will be inclined towards a phase of experimentation in their teaching, as a later development of having first ‘stabilised’ in their work as a teacher. This is often after having taught for eight or more years. So, there are times at which mature teachers might be more naturally inclined to try out different innovative strategies, as long as they are not hampered by external personal or other intrinsic factors.

This concludes the discussion of the personal factors which may influence the effectiveness and extent of use of computers in teaching. Those considered - particular knowledge of computers, pedagogical content knowledge, knowledge of routines, attitudes and confidence and teacher experience - provide insights into the reasons for effectiveness and extent of use of computers in teaching which are widely reported. Whilst this discussion offers important insights, the literature is largely inconclusive, in that no single factor or group of factors can be identified as being a determinant of why many teachers use computers less than they might be expected to.

I now turn to a discussion of practical theories of teaching, which I find provides a helpful framework for understanding the issues of type, effectiveness and frequency of computer use.

**Practical Theories of Teaching**

Hodgson (1995, p. 28) considers that none of the factors considered so far in this review are as critical as those pertaining to the teacher’s capacity and ability to cope with this new pedagogical environment. As discussed earlier in this chapter, the importance of routines to teachers - of a durable, practical pedagogy - is well-established. Also well established, as discussed in Chapter One, is that classroom actions of teachers are guided by internal frames of reference which are deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences. There are powerful and deeply held frames of reference
which are behind the durable, practical pedagogy. From this perspective, viewing the teacher as a professional sense-making constructivist (refer to Chapter One, pp. 8-10), scholars have sought explanations for the failures of well-meant activities and products, enquiring why teachers do what they do with innovative ideas (Olson, 1988a) rather than offering only criticism of the teacher or the instigator of the innovation.

Miller and Olson (1994) contend that “... what teachers are trying to accomplish shapes what they do with what they find. When they find computers in a room they shape them to their purposes” (p. 137) and “the existence of innovative practice in the classroom has less to do with the advent of technology than it does with the teacher’s pre-existing conceptions of practice” (p. 123). Norton, McRobbie and Cooper (2000) found that teachers did not use computers in the teaching of Mathematics because it did not resonate well with pre-existing understandings of teaching and learning in that subject. This point is particularly well illustrated by Middleton (1999), who argues that existing pedagogical orientation determines use of technologies:

For teachers committed to student-centred pedagogies, what were known at the time as ‘audio visual aids’ could foster ‘relevance’. For these teachers, tape-recorders, video or movie cameras and projectors, and recorded music helped school knowledge ‘connect’ with students’ expressed ‘needs and interests’ at the appropriate ‘level of development’. The technology lent itself to group work in classroom environments designed to cater for diversity.

Others incorporated the new appliances into ‘top-down’ pedagogy. For example, the overhead projector is arguably the simplest ‘visual aid’ to operate. While some teachers allowed students to create their own transparencies and use the projector to display their own individual or group projects, others used it as a sort of ‘permanent blackboard’ and projected the same notes unchanged from year to year. (p. 18)
A change in pedagogy is not merely a matter of wrestling teachers from their long-held routines, it is a matter, as Ridgway and Passey (1991) consider, of a “change in world view” accompanied by a period of teaching which will be less certain than the old style, and the gains are uncertain. Teachers may well be loath to pay such a price for uncertain rewards … (p. 7)

Therefore, … it will be extremely difficult to capitalise on the potential of the computer as a teaching resource, and the major difficulty will be the teacher … (p. 7)

Change is not difficult because of an unwillingness to change or a lack of technical proficiency (which would cast the teacher in a rather negative light) but rather because of the durability of the internal frames of reference. The notions of constructivism and practical theories of teaching, therefore, offer an explanation of why change and innovation is difficult.

Wallace and Louden (1992, p. 512) consider that it is a “commonplace observation” to explain the judgements and decisions teachers make about their work in terms of their biography and experience, and that it has particular relevance in settings where teachers do not have a strong base of content or pedagogical knowledge. Wallace and Louden’s concern was with the teaching of Science in an elementary school setting, however it seems reasonable to assume that teaching with computers could be regarded as such a setting. Spender (1994), for instance, has argued that computer-using teachers have to forge a new educational theory and practice without the benefits of models, precedents or even guiding principles; that for the first time in centuries, teachers are being required to teach in a way that they have not been taught previously. Ridgway and Passey (1991) observe that if one accepts the view that actions derive from constructions about the world, then one faces the challenge that the majority of teachers do not have constructions which are well suited to appropriate educational uses of computers … teachers bring existing
In addition to providing an explanation of why innovation is difficult, constructivism also helps us understand what pedagogy occurs when a teacher teaches a subject which is outside his/her realm of experience. In Louden and Wallace’s (1990) study of teachers with no background in the content or pedagogy of Science yet were in the position of teaching Science, it was observed that pedagogy in an unfamiliar subject area was appropriated directly from the teaching of a discipline with which teachers were more familiar. For one of their teachers, Bill (an English teacher) they comment,

the goal and content were science, but the pedagogy was English … (p. 185)

and for another, Malcolm, a Craft teacher, they consider:

his Science lessons took the form with which he felt most comfortable. Like Bill’s drift towards English, Malcolm’s drift was towards Craft. (p. 186)

Similarly, Ms Jensen, in Miller and Olson’s (1994) study, taught thematic units and writing and composition in much the same way after the introduction of computers as she did before.

If pedagogy in an unfamiliar subject area can be appropriated directly from the teaching of a discipline with which teachers are more familiar, it is important to enquire what implications there might be for this. As Louden and Wallace (1990) explain:

Malcolm’s silent … lesson prevented students from making their own ideas explicit or generating alternative interpretive models. Similarly, Bill presented the experimental method as if it were linear and rational, and his stage-management of students’ observations prevented them from reconstructing their own understanding of scientific activity. (p. 187)
In this case, because pedagogy originated from a more familiar subject area, it actually did a disservice to the content being taught. In contrast, Whelan (1992) found that the nature of the subject area (Legal Studies) matched very well with teachers’ (lack of) experience:

the teacher’s lack of base for authoritarian knowledge transmission, their depth of teaching and life experience, and the offer of relevant knowledge to study by the syllabus in a discipline which mandates contestation … combined in a unique opportunity.

(Whelan, 1992, abstract)

It cannot be assumed that practical theories of teaching will necessarily do injustice to the teaching of content knowledge which is unfamiliar, however they will always hold implications for how the unfamiliar is both understood and taught.

It is widely accepted that classroom actions of teachers are guided by internal frames of reference which are deeply rooted in their values, beliefs and personal experiences, especially school-based ones, and are based on interpretations of those experiences (see Chapter One). The issue of adoption of computer use in teaching is fundamentally that of the durability of the practical theories of teaching (which I regard as a value-neutral concern, or perhaps even a strength of teaching), rather than an unwillingness to change or a lack of technical proficiency (which would cast the teacher in a rather negative light). A change in pedagogy is not merely a matter of wresting teachers from their long-held routines, it is a matter of a change in world view. Practical theories of teaching extend beyond an explanatory framework of the change that takes place (or does not take place) to an explanation of the origin of the pedagogy which is observed and the implications of unexamined origins to current pedagogy.

I now move to the sixth aspect of computers and classroom practice - teacher role.
TEACHER ROLE

As Hurly and Hlynka (1982) have commented, what the role of the teacher in a classroom infused with technology might be, and whether technology could induce changes in teacher’s role, behaviour and methods, have been concerns which pre-date the use of computers. Through arguments relating to the emergence of a new societal stage (Banathy, 1991; Jones, 1982; Petre & Harrington, 1996; Reigeluth, 1992) and the educational considerations which may be entailed, the issue of the role of the teacher in the technological teaching/learning environment continues to be much discussed.

The fundamental difficulty of discussing the role of the teacher in the technological classroom is that there is much exhortation, from a diverse range of positions, that change in role is desirable and that teaching with computers will help to achieve that. Indeed, some schools have invested heavily in technology in order to promote fundamental changes in philosophies and goals of the school and the pedagogy of their teachers (Daly, 1997; Grasso & Fallshaw, 1993). Such investments do not come from planned research and careful analysis and interpretation of the data, but instead tend to describe computer-based teaching practices and projects which have had the intention of encouraging teachers to change their pedagogy. Where change in role has in fact been documented, it is rarely clear to what extent it results from reactions to local change efforts, urges to change felt from a wider (educational) community, predispositions to teaching approaches for which one has not previously had the freedom or equipment to explore fully, or from the mere presence of computers in the classrooms. Furthermore, for purposes of comparison of this thesis with other similar projects, there are relatively few studies in the literature which do not impose an ideological position on participating teachers, and also use interpretive methods. The Apple Classrooms of Tomorrow (ACOT) project is one example, but schools in this project were provided with high levels of access to technology, much more so than has been the
case for the self-taught computer-using teachers investigated in this study (see Chapter One).

Teachers have long suspected that, should they use computers in their teaching, their use would herald changes in pedagogy, as is evidenced in Bliss, Chandra and Cox’s (1986) research, conducted when computer use in schools was in its relative infancy. There is no shortage of studies which document some change in teaching role, but there is a diversity in both terminology used and frameworks for analysis, and this makes the drawing of comparisons difficult. Some authors use terms such as “constructivist” and “active learning” to describe teachers who use non-traditional styles. Others draw a contrast between “student-centred” and “teacher-centred” classrooms, or between “instruction” and “construction”. Terms such as “constructivism” and “student-centred learning” present particular difficulties because, whilst they refer to particular philosophical positions, they have also been applied rather more loosely. For instance, one teacher may be described as “teacher-centred” on the basis that he or she does not use technology, and another teacher described as “student-centred” because he or she does. Another writer might comment that the computer-using teacher spends less time lecturing, and so those classrooms are described as more student-centred.

**Changes in Classroom Interaction Patterns**

In discussions which concern constructivist/student-centred approaches compared with transmissive/teacher-centred approaches, I believe that what is most frequently being drawn to our attention is what Goodson and Mangan (1995, p. 617) describe as changes in classroom interaction patterns, and what Hativa (1995, p. 361-2) describes as a move away from “frontal teaching”. It is important, therefore, to observe there are typically

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some differences in classroom interaction patterns in computer-based classrooms compared with other classrooms.

Whether or not there is something ‘special’ about the computer to promote such changes is far from clear. From my own experience, I can’t recall ever having observed any woodwork, metalwork, cookery, sewing or ceramics teachers directing procedures from the front of the room. Intuitively, it makes sense that teachers who consider their environment carefully are more likely to encourage particular classroom interaction patterns simply because students are working on somewhat individual projects with often expensive or sensitive pieces of equipment. It could well be that it is the typical response of the thoughtful teacher to the presence of equipment in the classroom, and the need for individual mastery of it, and the opportunities for teaching and learning which this classroom environment presents which are at the heart of the changes in interaction patterns - not the computer per se. This is an area of investigation to which I have found no references in the literature.

Goodson and Mangan (1995) found that when computers were introduced to the classrooms of different subjects, there were shifts in classroom interaction patterns, but not statistically significant, with much variation between teachers. Prior to computer use in these classrooms, they had also found considerable differences between subjects with respect to small-group work, teacher-centred approaches and teacher-student interaction. Goodson and Mangan therefore found that the classroom interaction patterns were more attributable to the pre-existing subject subculture than to the presence of computers in the classroom.

An extrapolation of this argument would suggest a ‘cultural’ difference between primary school classrooms and secondary school classrooms, as a few scholars have observed (McCoy & Haggard, 1989; Richards, 1997), which is then an influence on the way computers are used in those classrooms and the interaction patterns found therein. McCoy and Haggard (1989) found that
teaching level was a significant determinant of computer use, with the teachers being more likely to use computers. This is probably due to the elementary teachers’ perceived responsibility for students’ “whole” education. The high school teachers are more likely to have a narrow view of their responsibility, including only their particular content area.  

More recently, Richards (1997), in the Australian context, similarly observed that in respect to computer use:

the most notable difference was between the primary and secondary teachers. Those primary teachers using computers were able to operate in a much more flexible framework than the secondary teachers. Computer usage in secondary classrooms tended to be more compartmentalised and isolated, reflecting narrow rather than integrated curricular applications.

Changes in Teachers’ Philosophical Position

The results of several studies suggest that computer use can both promote a change in teaching approach (i.e. less frontal teaching) and also a change in philosophical position, perhaps towards what Becker and Ravitz (1999) and Riel and Becker (2000) call constructivist-compatible approaches. Grundy, Bigum, Evans and McKenzie (1987, p. 44) have reported several case studies where an increase in student control over that which is learned and how it is learned was observed. Newhouse (1998) found that, in a laptop computer program, only the teachers who aimed to increase student control regularly facilitated the use of the portable computers in their classrooms. Becker and Ravitz (1999) found that after continued exposure to computer use, teachers began to operate not as presenters of ready-made knowledge, but as facilitators of students’ learning. Goodson and Mangan (1995) found some shifts towards student-centred pedagogy, but whether or not this effect (small as it was) can be attributed to the use of computers is not clear.

In the large scale ACOT project (Sandholtz, Ringstaff, & Dwyer, 1997), researchers noted that during the first few years, the addition of
technology did not revolutionise classroom instruction. Although the sheer numbers of computers and associated equipment transformed the physical classroom environment, the student learning tasks remained substantially the same. Over several years, teachers began to question long-held beliefs about the purpose and nature of instruction, adopted new strategies for managing their high technology classrooms, and began to interact with students differently. Ringstaff, Sandholtz and Dwyer (1992) found that over time, instruction shifted from what they described as a ‘traditional’ model to a model of instruction heavily dependent on student collaboration and peer teaching. The relevancy of the ACOT project for the Australian environment has been called into question by Bishop (1996, p. 33) who has commented that “the changes brought about by that project in the US, in term of teacher acceptance and relevant use in classrooms, are largely taken for granted here”. Notwithstanding this consideration, the evaluation of the project (Sandholtz, Ringstaff, & Dwyer, 1997, pp. 8-10) documents the emergence of change after a long period of immersion.

What the explanation for this apparent belief change might be has been pondered by a number of scholars. Becker and Ravitz (1999) have suggested technology-induced belief change, facilitating conditions or spurious correlation, and found that a technology-induced belief change was the best explanation. Becker (1994) has suggested that it may be reasonably explained by being the result of learning how to maximise the benefits of computers. That the apparent change reflects long-standing teaching practices or predispositions has been suggested by Becker (1994) and Goodson and Mangan (1995). Goodson and Mangan also comment that a move towards a more student-centred model was already favoured within the education system they studied, so an apparent change could in fact be attributed to teachers’ adopting the ‘official’ approach. Russell (1992) and Bishop (1994) have noted that “student-centred approaches” - such as group work, problem solving, discovery learning and peer tutoring - are very much a part of the recommended approaches to teaching in the Australian environment. Thus, apparent shifts in teacher
philosophical position can be interpreted as teachers finding that computers are a suitable vehicle for expressing what has been espoused anyway.

The evidence is, therefore, growing that the use of computers in teaching can promote a change in the teachers’ philosophical position. Given that Ray (1991), for instance, has illustrated that computers can be used to support all kinds of educational purposes, it seems rash to suggest that such change is necessarily in the direction of constructivist-compatible teaching approaches. There is also much lack of clarity as to whether the changes which are documented in the literature are ‘real’ or ‘apparent’ changes, and what the fundamental causes for such change might be.

**Changes in Teachers’ Role**

Bishop (1994, p. 38) has made a useful distinction between the fundamental teaching style of a teacher and his/her role in the classroom. She has observed that a teacher may not change his/her fundamental teaching style, but with the introduction of computers, teachers find that their role in the classroom and classroom organisation have changed.

It is one thing to observe changes in classroom interaction patterns, another to suggest that such changes might be accompanied by changes in philosophical position, and completely different again for the teacher to discern exactly what his/her role should be, among the changed interaction patterns. Richards (1997), for instance, found that even teachers disposed towards a student-centred model were worried that the role of the teacher [in classrooms where computers were being used] would simply become one of a mere ‘facilitator’ - that is, a facilitator of the computers (the very role they felt the least confident to take on) rather than of student learning per se. (p. 6)

I have earlier referred to studies which found that teaching unfamiliar subject material and new approaches to teaching created role insecurities, and that teachers may choose a role so as to have close control of discourse
when teaching unfamiliar content. As Sandholtz, Ringstaff and Dwyer (1990, p. 8) found, teacher change when computers are used is not unidirectional, and teachers may initially adopt a more teacher-centred approach.

Goodson and Mangan’s (1995) work on subject subcultures has identified that the introduction of computers sets off a range of culture clashes between antecedent subject cultures and the cultures of computing, manifested in the teacher initially perceiving a sharp dichotomy between co-opting the computer to fit into what is already being done in the classroom, or becoming technical trainer. Goodson and Mangan found that this sharp dichotomy may soften overtime, as cultural interplay and negotiation proceeds. They also noticed that this cultural clash is strong where subject cultures are dominated by external factors, such as tertiary entrance requirements, and in such cases computer use may not be encouraged. Newhouse (1998) has reported similar issues of classroom culture in his Australian case study.

Change in teacher role is so closely tied to changes in the philosophical and political environment that it is almost impossible to observe such change in isolation. There is growing evidence that technology can induce changes in teacher’s role, behaviour and methods. Whilst some changes to classroom interaction patterns follow the introduction of computers, when compared with the differences between individual classrooms or subjects with respect to small-group work, teacher-centred approach and student-teacher interaction, the degree of change experienced when computers are used is probably over-rated. However, teachers continue to struggle with resolving for themselves an appropriate and rewarding role in this changed and changing environment.

**SUMMARY**

I have found a large body of literature on computers in education, and yet little of it is in the more permanent form of bound texts and references to
guide the practitioner or researcher and there are few definitive studies expressly documenting and interpreting the pedagogy. The literature on computers and pedagogy has been reviewed by considering: (1) why teachers use computers, (2) where computers are used in the curriculum, (3) the software products in use and the modes in which a computer can be used, (4) the difficulties and concerns with computer use which are commonly reported by teachers, (5) factors affecting the type, effectiveness and frequency of computer use in teaching, and (6) changes to the teachers’ role when computers are used.

Furthermore, from review of the factors affecting the type, effectiveness and frequency of computer use in teaching, it can be said that the following are important considerations when striving for successful use of computers by self-taught computer-using teachers: the work environment, technical factors and personal factors (including knowledge of computers, pedagogical content knowledge, routines, attitudes and confidence, and practical theories of teaching) were identified as impacting on the extent to which teachers use computers.

**RESEARCH QUESTION**

In Chapter One, it was suggested that what is special about self-taught computer-using teachers is that, firstly, they are new to using computers, and secondly, by virtue of being self-taught, their knowledge about computing and related pedagogy is likely to be ad-hoc, incomplete, possibly inaccurate and its development is at the teacher’s own initiative. The issue at stake is one of content knowledge; whether it is reasonable to assume the do-it-yourself position that teachers “… are more active than passive, more ready to learn than resistant, [and] more wise and knowledgeable than deficient” (Clark, 1992, pp. 76-77) and are virtually infinitely able to adapt to new teaching situations, or whether there are other issues of knowledge which need to be attended to.
Certainly, the conception of teacher knowledge, presented in Chapter One, as including content knowledge, pedagogical content knowledge and practical theories of teaching would suggest that the relationship between knowledge and pedagogy is more complex than might be implied by this simple dichotomy. Arguments for the importance of a wide variety of factors on knowledge and pedagogy have been reviewed in this chapter. The question which is investigated in this study is: when teachers begin to use computers in their teaching, is it sufficient to assume that they are active, wise, and knowledgeable professionals, capable of making meaning and developing pedagogy and to simply leave them alone to get on with their work? This question is explored in the particular context of the pedagogy of three teachers at Outeast College.

From this, the importance of content knowledge, pedagogical content knowledge and practical theories of teaching to the pedagogy of self-taught computer-using teachers is discerned, and a consideration of whether do-it-yourself is a suitable form of professional development, and what might be done to improve the professional development of self-taught computer-using teachers follows.

In the next chapter, methodology for this investigation as a collective case study is discussed, and in Chapter Four, the context of Outeast College is described.

Chapters Five, Six and Seven are the case studies of the individual teachers. In these, a portrait of their pedagogy is presented, and this is interpreted to provide an understanding of the relationship between teachers’ knowledge and pedagogy. The case studies are presented in broadly the same form, but with slight differences between chapters so that the individual stories are best told.
CHAPTER 3 - METHODOLOGY

INTRODUCTION

In general terms, the design of this study can be described as an interpretive case study situated in the ethnographic tradition of educational research. The purpose of this chapter is to discuss the epistemological and ontological understandings on which this study is based, together with the particulars of the study design. This chapter begins with a discussion of the case study method.

STUDY METHOD

The choice of study method arises out of a consideration of the research question - whether it is sufficient to assume that self-taught computer-using teachers are active, wise, knowledgeable professionals, capable of making meaning and developing pedagogy and to simply leave them alone to get on with their work. This question implies a two-tiered enquiry: to firstly apply what Eisenhart (1988, p. 100) calls the general ethnographic question - “why is … teaching and learning occurring in this way in this setting?” - to the classroom work of self-taught computer-using teachers and secondly to evaluate those findings through the lens of the adequacy of the knowledge and professional development which occurs. To investigate the research question, therefore, requires a study design which lends itself simultaneously to ethnography and evaluation. The particular method chosen is that of the case study.

In this study, the term “case study” is used in the sense discussed by Stake (1994). The case is, as Stake (p. 236) and Huberman and Miles (1994, p. 440) note, “a phenomenon of some sort occurring in a bounded context … [a] unit of analysis”. In this study, the case is that of a particular self-taught computer-using teacher, teaching a particular class in a computer
laboratory. Such a case orientation treats each case as unique and special, founded in a belief that the idiosyncratic and the particular are legitimate in themselves and are important to portray (Stake, 1994, p. 238; Walker, 1980, p. 33).

It will be clear to the reader from the outset, however, that this study is not of a single case; it is a work built around the separate case studies of three teachers. Using Stake’s (1994, p. 237) terminology, it is a collective case study, a term which refers to “an instrumental study extended to several cases”. He describes the instrumental case study as being where

a particular case is examined to provide insight into an issue or refinement of theory. The case is of secondary interest; it plays a supporting role, facilitating our understanding of something else. The case is often looked at in depth, its contexts scrutinised, its ordinary activities detailed, but because this helps us pursue the external interest. (p. 237)

In this study, the “external interest” is teachers’ pedagogy, understood to be “the function, work or art of a teacher” (see Chapter One). Stake also notes that in a collective case study, “individual cases … may or may not be known in advance to manifest the common characteristic” (Stake, 1994, p. 237), an issue which is discussed in reference to the selection of participants, later in this chapter.

Lancy (1993, p. 140) considers that a case study is the method of choice for studying innovations for which no clear single set of outcomes has been pre-established, as is the case in this study of the relationship between teachers’ pedagogy and knowledge. In such studies, understanding and documenting the innovation is valued, aimed at helping decision makers determine whether the innovation is what they want, and this is the core work of case study approaches to educational evaluation (Davis, 1980, pp. 26-29).

Furthermore, case study method invites the researcher to see beyond apparent samenesses in teaching practice (as is mentioned in the Preface and discussed in the analysis chapters) in search of implications for how
pedagogy is construed. That is, to look inside what Erickson (1992) calls the “‘black boxes’ of ordinary life”. Indeed, Erickson comments that one of the main purposes of ethnography in educational research is to reveal what is inside the ‘black boxes’ of ordinary life in educational settings by identifying and documenting the processes by which educational outcomes are produced. Those processes consist of the routine actions and sensemaking of participants in educational settings, which, because they are habitual and local, may go unnoticed by practitioners and researchers alike. (p. 202)

It is for these reasons that this study has been designed as an ethnographic case study. I now proceed to present the epistemological and ontological understandings on which this study is based, and then move to describe the particular study design.

**FUNDAMENTAL UNDERSTANDINGS**

In this section, I consider the interests, values and beliefs that are inherent in this and the assumptions made about reality. Fundamentally, the central interest of this work is that of understanding, and it is thus associated with the interpretive paradigm of educational research (Candy, 1989; Lather, 1992). This paradigm assumes multiple realities and is focussed on discovering the meanings and beliefs underlying the actions of oneself or others. Interpretivism contrasts with a positivist approach which contends that only sensorially apprehended experience forms the basis of valid knowledge, which can only be advanced through observation and experiment. It also contrasts with a critical approach which concentrates on that which is problematic among multiple realities, seeking to uncover constraints and power relationships in the belief that doing so will lead to liberation and emancipation. Furthermore, I concur with Elbaz (1983, pp. 12-13) that the interpretive approach regards teachers as autonomous agents who hold and use knowledge (consistent with the constructivist understanding of knowledge discussed in Chapter One), and presents a teacher from a perspective that can reflect that teacher’s own experience of his/her role and work. In contrast, a positivist approach
would view pedagogy from the perspective of things which are ‘done to’ a teacher, and as Elbaz notes, critical analyses often cast the teacher in a passive role.

Although the study has been broadly situated within the interpretive tradition, there is sufficient diversity among the perspectives of researchers who call their work “interpretive” or “case study” to warrant being specific about the beliefs, values and techniques that guide this particular study. Howe and Eisenhart (1990) state that articulating the specific beliefs and values is essential for justifying the design of the study and analysis undertaken, and that these have a direct bearing on the nature of the inquiry, the study design, data analysis, and issues of trustworthiness.

Following Lankshear et al. (1997a), I have adopted the approach of presenting the beliefs and values by describing a number of inter-related themes, which are presented as follows, and which I see as being consistent with the constructivist perspective articulated in Chapter One.

**Ethnographic perspective.** Ethnographers are committed to an appreciation that social reality is constructed culturally and individually (Bresler, 1996, p. 133), an understanding that daily life is often invisible to us because of its familiarity and also because of contradictions which we may not want to face (Erickson, 1986, p. 121). To the ethnographer, such a social reality involves explicit interpretation of the meanings and functions of human actions (Atkinson & Hammersley, 1994, p. 248). Spindler and Spindler (1992) and Taft (1997) stress that ethnography is not merely a technique, but rather a particular style of enquiry. This style is reflected in a discussion of the following inter-related themes: naturalistic enquiry, holistic perspective, interpretivist perspective, subjectivity, participant observation, inductive analysis and phenomenology.

**Naturalistic enquiry.** I understand this as meaning that the site is studied without manipulation of its natural setting (Lincoln & Guba, 1985, p. 189).
A review of the literature reveals few studies into computer use which are naturalistic in terms of the ideological position imposed on participating teachers (that is, simply letting them continue with their work as they will), and in terms of the methods used for data collection (examples include Bliss, Chandra, & Cox, 1986; Goodson & Mangan, 1995; Hickey, 1993; MacArthur & Malouf, 1991; Olson, 1989b; Schofield, 1995; Wright, 1987). My understanding of naturalistic enquiry does not extend to Lincoln and Guba’s assumption that the researcher does not impose a priori categories on the results of the study; in fact, I explicitly include inductive analysis (see later in this chapter). Furthermore, this study is not naturalistic in the sense of allowing the questions to arise from the data; I have collected data in order to discern answers to previously-established research questions.

**Holistic perspective.** I understand this as meaning that teaching and classroom life are highly complex, and cannot be reduced to simple variables, thus rendering causal explanation, control and prediction impossible (Bresler, 1996, p. 133). Therefore, the whole situation is studied, rather than single or multiple variables (Walker, 1980). This is not an attempt to study or report everything that might be found in an observational study, but to take the whole context into account (Spindler & Spindler, 1992, p. 71).

**Subjectivity.** I understand this as referring to two related concepts. Firstly, a subjective perspective is a rejection of the positivist notion of being able to derive a single and objective view of a situation, and places a focus on discovering the meanings and beliefs underlying the actions of others. Secondly, the concept of subjectivity clarifies how the researcher and his/her points of view and partialities are situated in relation to naturalistic inquiry. Naturalistic inquiry is limited by the impossibility of any sense of total researcher objectivity, because ethnography and related work depends on the researcher’s active and personal involvement in the data collection and analysis (Eisenhart, 1988, p. 109). Researchers are always situated within social reality and carry with them their knowledge,
values and influences (Bresler, 1996, p. 133), and I seek to acknowledge my perspectives and influences.

**Participant observation.** I use this term to reflect an appreciation that a thorough understanding cannot be arrived at simply through the views and insights of the study participants, but requires the researcher’s active and personal involvement in the data collection and analysis (Eisenhart, 1988, p. 105).

**Inductive analysis.** I use this term to identify a commitment to using research questions to guide the analysis rather than to constrict findings (Huberman & Miles, 1994, p. 440; Morse, 1994, p. 221).

**Phenomenology.** I use this term in a general sense to place emphasis on the way that humans interact with empirical objects and events to which they give meanings (Holstein & Gubrium, 1994; Wiseman, 1993, p. 130). This study documents something of individual psychological processes, in contrast with an ethnomethodological orientation which would be concerned with social processes (Wiseman, 1993, p. 133).

In the above paragraphs, I have located the study within the interpretive tradition and articulated the particular beliefs and values on which it is based. I now proceed to discuss the particular design of this study. This is followed by data analysis, and a discussion of the generalisability of the findings of case study work.

**STUDY DESIGN**

*Access to the Site and Selection of Participants*

Outeast College, described in detail in Chapter Four, was the site for this study. It is the school where at the time of the data collection for this study I was employed as Head of Information Technology. The reasons for
selection of this site were two-fold. Firstly, the outcome of this study would be directly relevant to my work at the College. Secondly, the daily demands of teaching meant that it would be impractical to conduct regular observations at another site over many months.

Access to the site and to particular classrooms was negotiated in several stages. Firstly, I obtained the Principal’s endorsement for the study. On the basis that such a program would ultimately benefit both the teachers involved and the school, and that there would be little or no disruption to classes, the study proposal was embraced enthusiastically by him. With the Principal’s support, approval for the study from the University Ethics Committee was sought and subsequently granted. The ethical parameters within which the study was conducted included: specific agreement to participate in the study obtained from the participating teachers, parents of students in participating classes, and the school Principal (as a non-government school, permission from other educational authorities was not required); total confidentiality of names and places (hence the use of pseudonyms throughout this thesis); the guarantee that the videotape of lessons would only be viewed by the researcher; and the understanding that results from the study would be communicated in a thesis, journal articles and conference papers.

During a staff meeting at the very start of the 1996 school year, the research project was explained, and volunteers called for. It was explained to staff that participants would need to make a commitment to the regular use of computers in their teaching in at least one class, and it was hoped to attract staff who had already established this as a professional goal for themselves. Five volunteers came forward. Three of these teachers participated fully in the study throughout the school year; Geoff, Arlene and Howard are introduced and discussed in Chapters Five, Six and Seven. The two others withdrew early in the study - one due to illness, and the other due to additional professional demands related to a promotion within the school.
The continuation of Geoff, Arlene and Howard in the study was serendipitous. The classes with whom they would be using computers were classes with which I would not usually have much contact, and therefore the use of computing would not be significantly influenced by myself. The classes they had chosen would also ensure a participation of each major division of the school (Junior School, Middle School and Senior School, as described in Chapter Four), and this was important to ensure continuing support from the College (such were the internal College politics). These classes or teachers were not thought of as being in some way representative of these Schools, and there is no evidence to suggest that these teachers thought of themselves in this way.

Geoff, Arlene and Howard were teachers whose friendship and collegiality in the school I have valued, but I would not ordinarily have had more than a passing relationship with them on a day-to-day basis. All three had longer histories in the school than myself, and each of us had particular responsibilities (I co-ordinated Information Technology, Howard had responsibility for overseas students, Arlene was a House co-ordinator at the time of the study, and Geoff managed all sport and physical education programs for the Junior School), and our paths crossed regularly in formal meetings, and in the day-to-day exercise of our responsibilities. To the best of my knowledge, there was mutual respect for our various capacities and endeavours. There was no reason to suspect that any issues of authority or power would prevent an effective relationship within the context of the study. Over the years, our contact with each other was sufficient for me to be reasonably confident that a trusting, honest and open relationship could be established. Therefore, these teachers seemed excellent participants in the study at the time, and in hindsight, there is nothing which has arisen from the research which would suggest differently. Drever (1995) has commented that

something that is seldom mentioned is that interviewing is often an intensive and rewarding social experience! Often you will meet people years later, and they will remember that you interviewed them. (p. 9)
It is my conviction that participation in this study has helped to strengthen my friendship with Arlene, Geoff and Howard at a personal and collegial level.

Geoff, Arlene and Howard identified one class each to work with in a computer environment during the year. Geoff chose a Year Three class, Arlene a Year Seven English class, and Howard a Year Eleven English as a Second Language (ESL) class. Each selected class would spend one session per week in a computer laboratory (either a single period of 45 minutes or a double period of 90 minutes, depending on the work program for the class each week). The particular class selected, and documented in Chapters Five, Six and Seven, represents the major exposure that each teacher had in teaching with computers during that year.

The classes involved in the study selected, it was then necessary to seek permission from the parents of the students in the classrooms. The information distributed to parents inviting student participation stressed that: many teachers find working with computers an uncomfortable and unfamiliar experience; Outeast College encourages its teachers to take opportunities to improve their practice; the school approved of the study; the participating teachers had volunteered to participate in a program of teacher improvement; and nothing in particular would be expected of students except to be enquiring learners as in normal classes.

**Duration of the Study**

The data were collected over the second, third and fourth terms of the school year (May to November). The duration of the study was guided by Spindler & Spindler’s (1992, pp. 64-65) recommendations for ethnographic studies. They note that significant discoveries can be made in two weeks or less, but the validity of ethnographic observation is based on observation in situ that lasts long enough to permit the ethnographer to see things happen not once, but repeatedly. They also recommend that for adequate study of a single class room or significant segment of a single
class room, the duration should be for at least three months with observation for a significant portion of the element being observed. Thus, whilst the actual element of each class’ life (computer use) is rather a small component of the full experience that each class and teacher share together, the data collected traces the development of that element for as much of the school year as was accessible, and exceeds Spindler and Spindler’s minimum requirement.

**Data Collection**

Drawing on Eisenhart’s (1988) and Lancy’s (1993, ch. 1) discussion of data collection methods used in ethnographic and case study work, four sources of data were used in this study:

- videotapes of the teachers and classes in the computer laboratory (weekly observations over many months)
- interviews with each of the teachers
- videotapes of the same teachers and same classes studying the same subject, but in the ‘regular’ classroom
- field notes and comments kept in my teaching journal

In this section of the discussion, I consider how each of these was used in this study, including a discussion of exactly what data were collected, how they were recorded and why they were collected.

**Participant Observation through Videorecording**

Participant observation represents the very essence of case study work. Bogdan (1973) described it as

... a research approach in which the major activity is characterised by a prolonged period of contact with subjects in the place in which they normally spend their time. During the encounters, data, in the form of field notes, are unobtrusively obtained and systematically collected. (p. 303)
The purpose of participant observation is to come to know the situation being studied through nearly continuous interaction with the participants (Shimahara, 1990). As Spindler and Spindler (1992, p. 66) comment, “there is no ... substitute for the alert individual observer, with all senses working at top efficiency”. Notwithstanding the integral relationship between participant observation and the case study research design, the particular merits of this technique available to the ethnographer is bolstered by two observations about teacher self-report in interview situations. Firstly, Halkes (1986) noted that “some researchers reported to have been struck by the struggle teachers sometimes have with the verbalisation and communication of the subjective meaning of the concepts to the researchers. This may even result in the teachers’ dissatisfaction with the apparent meaning s/he has conveyed”. Secondly, Wubbels, Brekelmans and Hooymayers (1992) have identified a tendency for teachers’ ideals to distort their self-report of interpersonal behaviour in the classroom, and the least effective teachers, as perceived by their students, are more likely to show the greatest distortion.

A major disadvantage of participant observation is that the observations made may be idiosyncratic to the observer and mediated through his/her tacit knowledge limitations, eccentricities and biases. Such observations may therefore not be matched by the interpretation of other observers (Lancy, 1993; Spindler & Spindler, 1992; Taft, 1997). However, there are five particular advantages:

- it does not rely on teachers’ talk, but allows effective collection of data related to teachers’ actions (Cohen & Manion, 1989, p. 125);
- the researcher is able to discern on-going behaviour (Cohen & Manion, 1989, p. 125);
- the researcher can develop an informal and intimate relationship with those being observed (Cohen & Manion, 1989, p. 125);
- it is not a reactive method of data gathering - methods which rely on participant reactions to prompts by the researcher can in fact
bias the very data that is being studied (Cohen & Manion, 1989, p. 125); and

- only the human observer can be sufficiently alert to divergences and subtleties that may prove to be more important than the data produced by predetermined categories of observation (Spindler & Spindler, 1992).

In this study, a variation of the technique of participant observation was employed - that of the video recording of classroom activity. Mousley (1998) has commented that the use of video in place of direct participant observation in interpretive research is well established, particularly in the mathematics and sciences, such as in the Third International Mathematics and Science Study (Stigler, Gonzales, Kawanka, Knoll, & Serrano, 1999). Erickson (1986, pp. 144-145) notes that the use of video recording is sometimes called microethnography, a term which Shimahara (1990, p. 86) uses to refer to participant observation which occurs as scheduled visitations. This study is microethnographic in both senses. It can be argued that microethnography constitutes a style of research in its own right, because it does not directly incorporate the ‘human instrument’ as the primary means of data gathering, as in the case with ethnographic work.

Five disadvantages of microethnography compared with direct participant observation can be identified:

- Participation is not available as a means of learning (Erickson, 1986, p. 145).
- The observer in situ will often pick up what the camera or recorder leave out (Lancy, 1993, p. 14; Spindler & Spindler, 1992, p. 66).
- Video recording raises sampling problems in the selection of the data and limitations of accuracy due to bias and lack of opportunity, as well as tactical and ethical considerations in making the observations (Taft, 1997). As Erickson (1992) comments
Making any film or videotape involves sampling decisions, of which the most obvious are when to turn the camera on and off and where to point it. Any audiovisual record is an incomplete document of what actually happened, even though a continuously shot film or tape is a more complete record than the participant observer's field notes. Decisions about what to record and how to record it, then, are not neutral. They are research decisions that should be informed by the overall conduct of participant observation in the study. (p. 207)

- Contextual information of the site is beyond the frame of recording, and therefore the researcher would need to gather this data separately (Erickson, 1986, p. 145).
- Repeated and detailed observation may mean that highly salient data may be overlooked because it becomes too familiar or afforded undue weight (Erickson, 1986, pp. 144-145; Spindler & Spindler, 1992 p. 66; Taft, 1997, p. 73).

Despite these disadvantages of microethnography, Erickson (1986, p. 145) suggests that the advantages of it are such that, when combined with an alternative method of data gathering, it constitutes a perfectly suitable qualitative technique. Four general advantages can be identified:

- Video recording allows for recorded instances to be revisited at leisure countless times, allowing for a much more thorough and accurate description than can be provided through field notes (Erickson, 1986, pp. 144-145; Spindler & Spindler, 1992 p. 66).
- Video recording offers a perspective which allows for the study of events which are rare or fleeting in duration, particularly when the shape and character of such events unfolds moment by moment, or when one wants to be able to identify subtle nuances of meaning that occur in speech and nonverbal action (Erickson, 1992 p. 204-5).
- Video recording has the potential to reduce the natural tendency of the investigator to leap to conclusions in response to
observations that might confirm a theory being induced from the data. Using videotape recording, the researcher has the opportunity for deliberation, and can hold back from drawing early conclusions for which there may be little data, or which may be contra-indicated (Erickson, 1986, pp. 144-145).

- Video recording can reduce the dependence of the observer on frequently occurring events as the best sources of data. A rare event can be studied quite thoroughly through repeated viewing (Erickson, 1986, pp. 144-145).

In addition to these general advantages, there were features specific to the local context of Outeast College which made this technique the preferred data collection method:

- Woods (1990, p. 102) has noted that “most case study ethnographies seem to be marked, not by relaxed and systematic data gatherings, but by … a frustrating sense that the really important action is happening elsewhere”. Whilst videotaping certainly brings some distance between the researcher and the participants, it does make possible a more impartial, ‘clear headed’ and focussed viewing of the situation, compared with the distraction of daily life and responsibilities in the workplace. Cohen and Manion (1989) also note that one of the concerns with case studies is “how do we know that the observer does not lose his perspective and become blind to the peculiarities that he is supposed to be observing?” (p. 125). The videotaping provided a way for me to distance myself from the setting, and achieve a broader sense of perspective.

- The degree to which I should participate in the classroom setting, and my commitment to naturalistic enquiry was another consideration. The research took place at the school where I taught, and was perceived to be the ‘computer expert’. Prior experience had shown me that the moment I walked into a computer laboratory, students would ask me questions and
teachers would tend to defer to me for expertise. It was important for me to minimise my direct involvement with the classroom to effectively observe self-taught computer-using teachers as they go about teaching with computers. It was frequently my role within the school to enter classes to provide some technical assistance, and to work with teachers on curriculum development. Howard, Arlene and Geoff appreciated my desire to restrain myself from doing these things, which would directly influence their pedagogy and ‘interfere’ with their classes.

- The pragmatic necessity of gaining access to the various classroom settings was an important consideration. As a practising full-time teacher, it was not possible for me to be routinely available to directly observe classes beyond my classroom or its immediate environment.

Through the use of video recording for data collection, I would describe my role in the study, using Junker’s (1960) terminology, as a “professional loiterer” - a non-participant engaged only in observation, but whose role and participation in the study was publicly known at the outset.

Recording began in the first week of May (early in Term Two) and continued throughout the school year. Recordings were made during the same period each week, for every week that it was feasible. It was not feasible to make recordings on some weeks if the teacher was absent from school, if I was absent from school so the equipment could not be set up, or if the class was involved in some other activity (for example, a sports day or preparation for examinations). Thirteen classes were videorecorded for Geoff, nine for Howard and thirteen for Arlene. These represent a comprehensive record of the work of each teacher with his/her chosen class for the school year of the study, a total of approximately ten hours of videotape for each teacher.

On several occasions, each teacher and his/her class was recorded in a ‘regular’ classroom - two such classes for Geoff, three for Arlene and two
for Howard were videorecorded during the year. The time and location of these classes was by mutual agreement between each teacher and myself. The purpose of this was to enable some comparison of each teacher’s action in a regular setting and a computer laboratory.

Making videorecordings of the classes necessitated that I, as researcher, set up the videocamera in a suitable location prior to the commencement of each class. I would then press the record button a few moments before the class commenced, and disappear from view as quickly as possible, to attend to other duties. The recording was set to run until it automatically stopped at the end of the tape.

The videorecording was initially made onto a microcassette. In the few days immediately following the particular episode, these were watched by myself whilst they were transferred onto longer duration ‘standard’ 90 minute VHS videocassettes. This meant that classes were available for viewing sequentially at a later time, without changing tape, and without the videorecorder being present as a playback device. At this stage in the analysis, the notes which I made were only sufficient to alert me to issues which would be worth discussing in future interviews. The VHS videocassettes became the permanent record of the activity in each classroom.

**In-depth Interviews**

In-depth semi-structured interviews are the second major data-gathering technique in case study and ethnographic work (Bogdan, 1973, p. 304; Eisenhart, 1988, p. 105). They are the principal means of learning about participants’ subjective views (Eisenhart, 1988, p. 105), and whereas participant observation allows for in-depth portrayal of the here-and-now, the interview permits the respondent to move back and forth in time - to reconstruct the past, interpret the present and predict the future (Lincoln & Guba, 1985, p. 273). They help to inform the researcher about activities
beyond his/her immediate experience, such as historical events or events occurring in other places (Eisenhart, 1988, p. 105).

Drever (1995, p. 13) notes that the semi-structured interview is characterised by being a formal, ‘on the record’ encounter on an agreed subject; being structured by main questions set by the interviewer; using prompts and probes to fill in the structure, encouraging broad coverage, exploring answers in depth; and being a situation where the interviewee has a fair degree of freedom with regard to what to talk about, how much to say, how to express it.

Disadvantages of interviewing include the time that it takes to prepare for and conduct each interview, that non-verbal information and its contextual meaning is lost (body language, facial expression). Tone of voice and inflection are retained in the tape recording, but are lost in a subsequent transcription; data gathering is invariably related to data reduction. Particular concerns related to interviewing as a method are: that the interviewee may offer what the interviewer wants to hear, that the teacher may find difficulty in expressing subjective meaning, and may provide distorted accounts of interpersonal behaviour (as discussed previously). The use of multiple data gathering techniques and revisiting issues that arise in interviews should highlight such anomalies. It is also possible that interviewees may have a demonstrably incorrect recollection of facts or events, or try to distort an interpretation of the past or present. Presenting actual examples of teaching in the form of the videos can assist with establishing accuracy. All the same, these are part-and-parcel of dealing with subjective realities.

The questions for interviews in this case study were developed to explore the participant’s frame of reference, which was not presumed to be the same as the researcher’s (Drever, 1995, p. 15). Marland, Kennedy, Forlin and Sturman (1997) recommend that the disclosure of practical theories of teaching can be facilitated by asking open-ended questions, listening to what is said, using a recursive style, reflecting terminology used by
participants, encouraging elaboration and seeking clarification and exemplification of the material presented. The interview questions, detailed in Appendix Two, were devised around these principles. The tone of each interview was that of a conversation between people who share similar interests rather than a formal interview. My aims were to establish a rapport, develop intimacy and to probe deeply (Bogdan, 1973, p. 304).

Video replay was used to promote discussion, to learn something of participants’ subjective views of particular classroom events. This usually took the form of the tape being played and either myself or the participant pausing the tape and discussing features which interested us. Whilst this strategy bears some similarity to stimulated recall methodology (King & Tuckwell, 1983; Meade & McMeniman, 1992), it was used not to attempt to access the interactive thought processes of teachers through visual stimuli, but rather because teachers often find it easiest to begin talking about the explicit (what they do), and then allow the flow of ideas to move to the implicit aspects (Marland et al., 1997). This technique was used as part of an overall interviewing strategy to reveal something of the participant’s subjective view of what was going on in the classroom.

Interviewing began in the last week of March (late in Term One) and continued throughout the school year. In total, there were five interviews with Geoff, six interviews with Howard and four interviews with Arlene. This represents a total of approximately 20 hours of recorded conversation. The difference in the number of interviews with each participant reflects the difficulties of scheduling times to sit down together. I had a tentative plan with each participant to interview them on a monthly basis, but because of the busyness of the lives of teachers at Outeast College (see Chapter Five) various interview times were cancelled or transferred. Despite this, the interview which took place were fairly evenly distributed over the year, and provide a systematic record of each teacher’s perceptions of teaching with computers over the course of a year.
The first interview with each participant was the longest, and related to obtaining some details of each participant’s teaching history, a broad overview of his/her perspectives, and building trusting relationships with each one (Germain, 1986, p. 153). The questions which were included in this discussion are detailed in Appendix Two.

Whilst the focus of the first interview was contextual, the focus of the second and subsequent interviews was that of computer use and pedagogy. These were designed to allow me to ask questions of the data that led to more focused observations in the search for patterns or themes, and included the viewing of a recent lesson. Our conversations ranged over a wide variety of topics including: a description of the lesson and its aims; particular pedagogical practices employed; the positive and negative features of the lesson; the teacher’s confidence with computers; the physical arrangement of the classroom, and its implication on teaching and learning; and teacher lesson planning. The particular prompts for discussion in these interviews are given in Appendix Two.

The interviews were tape recorded, so conducting the interviews required me to set up both a cassette recorder and a video recorder and television in a suitable location. An unoccupied classroom or office was used for each of the interviews.

The hours of recorded conversation were transcribed from tape directly onto a word processor file, and I subsequently listened to the tapes a second and third time to check the transcripts, and many minor changes and corrections, also including notes relating to tone of voice and inflection.

**Researcher Introspection**

Researcher introspection involves the researcher him/herself reflecting on the research activities and its contexts, and is a source of data for the study in its own right (Eisenhart, 1988, p. 106). The ethnographer regularly
records the kinds of things that are happening to him/her to account for sources of emergent interpretations, insights, feelings, and the reactive effects that occur as the work proceeds. In recording these reflections, it is necessary that the views of participant and researcher remain distinct (Eisenhart, 1988, p. 107).

For this purpose, I kept field notes and notes made in my own teaching program. It was particularly important to keep field notes relating to any occurrences within the class or school at the time of each videorecording. (One particular occurrence was a time when the teacher of the Year Eleven ESL class not usually taught by Howard was on extended leave, and Howard was working with effectively a class of double its regular size for several lessons.)

**Trustworthiness**

Concepts such as reliability, validity, generalisability, replicability and triangulation have traditionally been important considerations in the discussion of data collection in educational research. A number of writers (Eisenhart & Howe, 1992; Kvale, 1995; Lincoln & Guba, 1985) have observed that these concepts arise from the quantitative tradition, and are grounded in understandings of knowledge that are not part of the interpretive paradigm. Lincoln & Guba (1985, p. 290), however, have developed the concept of “trustworthiness” with respect to quantitative research. They consider that

> the basic issue in regard to trustworthiness is simple: how can an inquirer persuade his or her audiences ... that the findings are worth paying attention to, worth taking account of? What arguments can be mounted, what criteria invoked, what questions asked that would be persuasive on this issue? (p. 290)

Trustworthiness can be established by attending to issues of credibility, transparency, verification and generalisation (Huberman & Miles, 1994, p.
The discussion of the study design concludes by addressing the first three of these in turn, and generalisation is discussed at the close of this chapter.

**Credibility**

Lancy (1993, p. 23) emphasises that “the overriding issue ... is to provide sufficient information for the reader to judge the author’s credibility as a research instrument and his/her astuteness as an analyst of social science”. Strategies for establishing credibility suggested by Lancy (1993) and Taft (1997) are to:

- describe both the evidence on which conclusions are based, and any efforts to test for disconfirming the tentative conclusions; avoid generalisations such as “many teachers” and “for the most part”, as the issue of disconfirmation is not clear;
- present the process of data analysis transparently, so that laypersons involved in the area to which the theory applies will be able to understand the derivation of categories among the data;
- immerse oneself long enough in the field to see things happen not once, but repeatedly, and provide ample opportunities for cross-checks to identify patterns and reconcile inconsistencies;
- communicate effectively to the audience, making especially transparent the process of gathering data and drawing conclusions;
- write the report in a way that can be readily understood by laypersons using a style that eschews variables and obtuse constructs that only a specialist can be expected to understand; and
- deliberately present data and findings in the words of the participants, not the researcher; use illustrative verbatim quotes from field notes, records of classroom interaction and interviews.

These guidelines have been followed in the conduct and presentation of this study.
Transparency

Huberman and Miles (1994, p. 438) consider that transparency of method is important to: ensure that the reader will feel confident of, and can verify, reported conclusions; allow the possibility of secondary analysis of the data; allow the possibility of replication of the study; and make any instance of fraud or misconduct more trackable. Huberman and Miles, together with Eisenhart (1988, p. 108) and Sultana (1991, p. 60) recommend describing the following as fully as possible:

- choice and use of the settings and people in the study;
- entry into the field;
- social conditions under which the study took place;
- role and status of the researcher in the study;
- researchers’ expectations and pre-suppositions;
- the data gathering techniques;
- theoretical or analytic constructs used to guide data collection or analysis;
- data collection and analysis procedures used;
- process of analysis as explicitly as possible; and
- surprises that were encountered.

Writing a report which strives towards transparency of method is partly what is meant by “thick description”. Thick description also includes the presentation of fulsome descriptions in field notes and verbatim quotes, and according to Olson (1989a), also includes deliberate acts of reflection and interpretation by the researcher. The detail of aspects of this methodology chapter and of the case studies (Chapters Five, Six and Seven) reflect my commitment to principles of transparency and thick description.
**Verification**

Verification entails addressing the most common or most insidious biases that can steal into the process of drawing conclusions (Huberman & Miles, 1994). The term most often associated with such issues is that of triangulation, or procedures by which multiple sources are used to obtain evidence on the same phenomenon (Taft, 1997, p. 73). Huberman & Miles have argued that sources can be inconsistent or conflicting, rather than converging, and thus new ways of thinking about data resolution need to be considered. They then argue that reducing the impact of common and insidious biases is not so much a question of using multiple sources (although this may play a part), but a way of doing research. The principle recommendations for this style of research are:

- Use of multiple methods for data analysis.
- A long period of exposure. Spindler & Spindler (1992, p. 64) have observed that “the validity of ethnographic observation is based on observation in situ that lasts long enough to permit the ethnographer to see things happen not once, but repeatedly”. Taft (1997, p.73) and Huberman & Miles (1994) have similarly noted that this allows for multiple opportunities for cross-checks and double checks of data.

The study has been designed to fit these guidelines. It is worth noting that, consistent with Elbaz (1983, p. 161), extensive triangulation between interview and observation was not conducted because it was felt to be looking at knowledge in a fragmented way, as comprised of discrete elements of understanding reflected in discrete episodes of behaviour. A holistic approach to understanding the truths being revealed was preferred.

I now move to a discussion of the analysis of the data collected.
A key consideration in the data analysis of case study research is that of the etic or emic perspective of the research. In general terms, “etic” refers to an outsider’s perspective and “emic” refers to the insider’s perspective (Lancy, 1993, p. 30). Harris (1979, p. 32) stresses that the etic/emic distinction is not that of subjectivity/Objectivity, commenting that objectivity is the epistemological status that distinguishes between the community of observers from the communities that are observed. Subjectivity has already been identified as a tenet of the present research. Harris notes that

Emic operations have as their hallmark the elevation of the native informant to the status of ultimate judge of the adequacy of the observer’s descriptions and analyses. The test of the adequacy of the emic analyses is their ability to generate statements the native accepts as real, meaningful, or appropriate. In carrying out research in the emic mode, the observer attempts to acquire a knowledge of the categories and rules one must know in order to think and act as a native.

Etic operations have as their hallmark the elevation of observers to the status of judges of the categories and concepts used in descriptions and analyses. The test of the adequacy of etic accounts is simply their ability to generate scientifically productive theories about the causes of sociocultural differences and similarities. Rather than employ concepts that are necessarily real, meaningful and appropriate from the native point of view, the observer is free to use alien categories and rules derived from the data language of science. Frequently, etic operations involve the measurement and juxtaposition of activities and events that native informants may find inappropriate or meaningless.

(p. 32)

In a broad sense, then, the etic perspective is an outside, external or generalised understanding that spans various cultures in which the
researcher is free to interpret observations in terms of an a priori theory, whereas the emic perspective is a native understanding particular to a specific culture.

The approach I have taken in this study is what Lancy (1993, p. 30) calls an investigative perspective, which is informed by both etic and emic knowledge. The interview questions were designed to have the participating teachers provide emic descriptions of the situations in which they were involved, whereas my own field notes and notes arising from microethnography were designed to provide an etic perspective. The analysis is exclusively an etic one, as it is couched in terms of a conceptual framework (detailed below) which was derived by myself, and not by the participants.

In the data analysis phase of this study, I have taken what Lancy (1993, pp. 142-143) describes as a realist stance, being neither bound to a pre-determined theoretical framework, nor concerned with grounded theory. This stance is one where the researcher is mindful of problems, relationships and theory, but not as preconceived ideas (aiming to prove or disprove a hypothesis) nor as a way of predetermining what is observed and elicited from informants. The researcher is more interested in discovery than verification, and works with a preparedness to formulate, test and (if necessary) discard a series of ‘hunches’; his/her work is inspired by and intuitive understanding and recognition of the unfolding events that may defy initial articulation.

**Phases of Data Exploration and Analysis**

Initial analysis of the videorecording proceeded according to Erickson’s (1982) recommendations to produce a commentary on each class. As an indicator for the degree of details of these notes, I used Cohen and Manion’s (1989, p. 127) recommendations that “the notes should be full enough to summon up for one again, months later, a reasonably vivid
picture of any described event”, and that there should be several single-spaced typed pages for every hour of observation.

Once the interview data and the observations from the videorecording were in textual form, the analysis proceeded by grouping the data according to emergent categories. The extraction of categories from the data was not spontaneous, but occurred through a deliberate mental process (Germain, 1986, p. 157-158). This study is related to established theory and research through what Eisenhart (1991) has called a “conceptual framework”, which provided the starting point for this deliberate process.

According to Eisenhart (1991), a conceptual framework is one which is not based on formal logic or accumulated experience. Rather, it is an argument based on different points of view and culminating in a series of reasons for adopting some ... ideas or concepts ... and not others. The adopted ideas or concepts serve as guides [to the research project]: to collecting data in a particular way, and/or to ways in which the data ... will be analysed and explained (p. 10).

It is an argument that the concepts chosen for investigation or interpretation, and any anticipated relationships among them, will be appropriate and useful, given the research problem under investigation (Eisenhart, 1991, p. 11; Huberman & Miles, 1994, p. 440). The theoretical framework was derived from the literature review presented in Chapter Two and Elbaz’s (1983) notion of the content of practical knowledge. The conceptual framework is expressed in the following initial categorisation:

- Day-to-day life as a teacher
- Difficulties and concerns
- Features of the technology
- Knowledge of self
- Knowledge of the teaching milieu
- Knowledge of content
- Knowledge of computers
• Knowledge of curriculum development
• Knowledge of teaching
• Pedagogy
• Classroom Interaction Patterns

This categorisation, however, did not restrict the ways in which the data could be understood (Clarke, 1997).

The first case study to be worked through was that of Geoff, and a “bottom up” approach to categorisation (Eisenhart, 1988, pp. 107-8) was applied. This consisted of: defining the units of material that are meaningful to myself, as guided by the conceptual framework; comparing these to other units; grouping like units into categories; and positing relationships between them. Using this process, the notes from the videorecordings and the interview data were considered concurrently. Many new categories emerged from the data, and a detailed categorisation of all the data available on Geoff ensued. These categories are presented in Table 4. The analysis and coding of the transcripts was completed partly by using printouts of the transcripts, and partly by conducting investigations of the text at the computer screen. The software product NUD•IST (Richards, Richards, McGalliard, & Sharrock, 1992) was used to search the data, and ultimately all the categories were transferred into NUD•IST to allow ease of extraction of text relating to each theme.

The process of continuing to re-work the data continued as I extracted the data from NUD•IST and began to write the story of how Geoff used computers in his teaching and why. I found that many of the categories which had been initially established were too thinly populated to be useful, and after much working of the data and reconsulting transcripts, I arrived at the following structure for the discussion of Geoff:

Background
The Teacher in the Organisation
Pedagogy

Features of Teaching and Learning in the Classroom
The next stage in the data analysis was the exploration of the data concerning Howard and Arlene. The transcript data for both of these participants was categorised using the tentative structure used for the analysis of the discussion of Geoff. These data on Howard and Arlene were then worked through a second time to identify other ways in which it could be categorised, and this lead to the expanded categorisation presented in Table 4. From this process, the structure initially developed for Geoff was shown to be a good representation of the data of each of the participants, and was confirmed as the basic framework in which each of the case study chapters (Chapters Five, Six and Seven) would be organised. Using a common framework for presenting the data provides a basis for inter-case comparison.

**GENERALISATIONS AND INTER-CASE THEORISING**

Sultana (1991) has commented that

> qualitative research … at best can claim to provide people involved in similar circumstances with material which could be of some use to them in sharpening their own perceptions and procedures, rather than to produce “universal truths”

(p. 61)

Spindler and Spindler (1992 p. 71) consider that ethnographic research should be conducted in a way that it is not narrowly focussed on the immediate situation, but sheds light on a wider context, and facilitates an understanding of something beyond the cases (Stake, 1994, p. 237). Indeed, the diversity among the participants in this study (teachers of different year levels, subject areas and with heterogeneous backgrounds) has led to a better understanding of the issues associated with the early use of
computers by self-taught computer-using teachers, and the relationship between knowledge and pedagogy more generally. This is discussed in Chapter Eight.

An important consideration to be made, therefore, is who is in a position to make the generalisation. Lancy (1993, p. 165) claims that long-term immersion in the field gives credence to the researcher’s claim to speak for similar groups or situations. This, according to Taft (1997, p. 74), makes it possible for the researcher to make generalisations to the extent to which he/she is ‘multicultural’ with respect to the object of study, and can mediate between one group and others. Taft is careful to note that no such generalisation should be considered final, only a working hypothesis for further studies. It is hoped that some readers of this work will find that the case studies resonate with their own experience.

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Table 4 - Categories Used in the Second and Third Phases of Data Exploration

<table>
<thead>
<tr>
<th>Teaching Life</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busy and Fragmented</td>
<td>Personal History</td>
</tr>
<tr>
<td>Time Management</td>
<td>Teaching History</td>
</tr>
<tr>
<td>Likes Teaching</td>
<td>Innovation</td>
</tr>
<tr>
<td>Likes Diversity</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>Likes a Challenge</td>
<td>Skill Focus</td>
</tr>
<tr>
<td>Being in the Midst of Change</td>
<td>Life Experience</td>
</tr>
<tr>
<td>Opportunities to be Oneself</td>
<td>Local Culture and Opportunities</td>
</tr>
<tr>
<td>Isolation</td>
<td>Encourage Enjoyment</td>
</tr>
<tr>
<td>Professional Support</td>
<td>Homogeneous Rather than Individual Treatment</td>
</tr>
<tr>
<td>Stress</td>
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<thead>
<tr>
<th>Knowledge</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milieu</td>
<td>Link to PE Methods</td>
</tr>
<tr>
<td>Self</td>
<td>Link with Values</td>
</tr>
<tr>
<td>Teaching</td>
<td>Planning</td>
</tr>
<tr>
<td>Content</td>
<td>Adaptability</td>
</tr>
<tr>
<td>Of Organisation</td>
<td>Bravado</td>
</tr>
<tr>
<td>Of Wider Context and Development</td>
<td>Link to Content Knowledge</td>
</tr>
<tr>
<td>Collegial Interaction</td>
<td>Frustration</td>
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<tr>
<th>Seeking to Improve Practice</th>
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<tbody>
<tr>
<td>In the Organisational Circumstances</td>
<td>What is Pleasing</td>
</tr>
<tr>
<td>Training</td>
<td></td>
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<tr>
<td>Learning through Observation</td>
<td>Room Layout</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Lesson Description</td>
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<tr>
<td>Reflection</td>
<td>Integrated Use of Computers</td>
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<tr>
<th>Student Life</th>
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<tbody>
<tr>
<td>Recognition of Student Abilities</td>
<td>Value of not Using Computers</td>
</tr>
<tr>
<td>Inability to Recognise Student Skills</td>
<td>Solving Problems</td>
</tr>
<tr>
<td>Important to Belong</td>
<td>Teacher’s Role</td>
</tr>
<tr>
<td>Important to Experience Success</td>
<td>Computers</td>
</tr>
<tr>
<td>Important to Feel Supported and Encouraged</td>
<td>As Experiential</td>
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<th>Particular approaches</th>
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<tr>
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<td>Planning</td>
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<tr>
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<td>Computers</td>
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<th>Table 4 - Categories Used in the Second and Third Phases of Data Exploration</th>
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<td>Training</td>
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<tr>
<td>Particular approaches</td>
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</table>
Stake (1978) and Lancy (1993) place the onus on the reader for generalisation. They suggest that case studies may be in harmony with the reader’s experience and thus a natural basis for generalisation. Lancy (p. 165) notes that “this is comparable to the [legal profession] where the applicability of a particular precedent case must be argued in each subsequent case. The reader must decide whether the findings apply or not”. It is important that the study be described in detail (as per the recommendations for transparency of method earlier in this chapter) to allow potential audiences to determine whether the context they are interested in is sufficiently similar. In this study, the conceptual framework provides a basis for inter-case theorising, which is discussed in a separate chapter (Chapter Eight), and the learnings were aggregated and compared only after the presentation of each of the cases.

**SUMMARY**

I have described this study as a collective case of three self-taught computer-using teachers, undertaken due to an interest in each teacher’s pedagogy within a computer laboratory environment. The particular purpose of this chapter has been to present the epistemological and ontological understandings on which this study is based, and to describe the particular research methods and study design employed.

In the next Chapter, I proceed to describe Outeast College, the school at which this study was based, including the computer resources and related curriculum programs, and my role in the school as it pertains to this study. In Chapters Five, Six and Seven, I present the results of the analysis described above - the case studies of Geoff, Howard and Arlene.
CHAPTER 4 - THE CONTEXT OF THE STUDY

In this chapter, I describe the school at which this study was located, the computer resources used by the participants in the study, and I discuss my role in the study. It is in this chapter that I honour many of the tenets of trustworthiness, as described in Chapter Three: acknowledging my perspectives, influences, role and status, together with a portrayal of the local conditions and circumstances in which this study took place.

THE SCHOOL

The study site, Outeast College, is a private, co-educational school in the outer suburbs of Melbourne, Australia, providing education for students from Pre-Preparatory until the end of their secondary education (Year Twelve). There is no sense in which Outeast College is thought to be representative of schools in terms of the computing resources available, their placement and distribution among the classrooms of the school or the staff response to their use; nor are the teachers who have participated in the study (Howard, Arlene and Geoff) thought to be representative of teachers at Outeast College or of teachers in general.

Outeast College was administratively organised into three divisions, each known as a School: Junior School (Pre-Preparatory to Year Four), Middle School (Years Five to Eight) and Senior School (Years Nine to Twelve). Junior School was relatively self-contained in a building of its own, whereas Middle and Senior Schools shared classrooms and facilities. During the year in which the data for this study was collected, school census information indicated that there were approximately 520 students in total studying at Outeast College. Class lists from the same year showed that Junior School classes were typically the smallest, ranging from ten students to up to twenty-five in each class. The school timetable from that year also showed that there was one class group at each year level in the Junior School. In the Middle School, there was one class group at each of
Years Five and Six, and two class groups at Years Seven and Eight. In the Senior school, there were three class groups at each level. Senior school is different from the others in that class lists showed that up to 40% of students were full fee paying overseas students, there being approximately 30 such students in Year Eleven alone.

### COMPUTER RESOURCES AND PRIORITIES

At Outeast College, Information Technology (IT) had traditionally been taught as a subject in its own right. There were two fully qualified and experienced computing specialist teachers in the school; one taught Years Prep to Six (at these levels, IT was a compulsory study), and the other taught at Years Ten, Eleven and Twelve (at these levels, IT was an elective study). There had traditionally been no IT used by students in Years Seven, Eight or Nine. In addition to being the senior IT teacher, one of my roles in the school was to instigate computer use at these year levels (as described in the chapter on Arlene).

One year before this study was conducted there had been a major upgrade of the hardware and software available in the school. This added further impetus to something which had been strongly encouraged by myself and the Principal over the previous two years, the integrated use of computers in all subject areas. Indeed, by the year in which this study was conducted, there was a modest number of enthusiastic teachers wanting to explore the use of the up-to-date computer facilities, and able to do so because the upgrade had included a new laboratory which made it possible for classes to have access to a computer laboratory through a booking system; the booking records show that nearly 100% of requests were accommodated.

Olson (2000) has commented that the aggregation of computer resources into laboratories makes a powerful comment on a school’s aims and objectives with respect to computer use. He has stated that
one way of looking at computer labs is to see them as a brute necessity reflecting the difficulty of readily assimilating computers in the sufficient numbers needed for [computer aided learning] physically into the classroom. Another way to look at them is to see how they are associated with the move in education to stress generic mental skills instead of traditional subject based objectives … [the lab is] a place to do highly prescribed things in a rather routine fashion. (pp. 2-3)

Whilst Olson considers that the aggregation of computers into laboratories potentially indicates particular philosophies of learning, Bigum (1987a) has documented that many teachers and schools cite the nebulous reason of “having to respond to what is out there” when presenting reasons for having computing in the school and the organisation of facilities. Hooley and Wooding (1996), too, have commented that “it is a characteristic of school computing in Australia that the philosophical ideas underpinning its direction are unclear” (p. 71). Through my work and observation at the school, I have found the Outeast College’s reasons for having computers, and rationale for their location throughout the school, was unclear and driven by “brute necessity”. Discussions with teachers and administrators at the time highlighted a sense of complying with the inevitable and meeting externally determined expectations, such as those noted in Bigum’s study: the unarticulated demands of parents; continuing the work of feeder schools; perceived requirements for the future of employment of their students; and maintaining a competitive edge with other schools. In addition, an interview with the Deputy Principal of the time was particularly revealing. He observed that the major reason for the School Board (the ultimate governing body) agreeing to continue to fund computing facilities was to have the school maintain a competitive edge on other neighbouring schools whose use of computers in teaching were known to be expanding.

It was in this policy environment, which was simultaneously driven by both fiscal concerns and priorities which were uncertain and evolving, that a curriculum and teacher development environment evolved into
that which the three participants in this study (Geoff, Howard and Arlene) worked, and I now proceed to describe these.

**THE CURRICULUM ENVIRONMENT**

At Outeast College, the official stance was that the integrated use of computers was encouraged in all subject areas, but it would be more accurate to say that the Principal and Deputy Principal exhorted teachers to use computers in their teaching whenever they felt they could. There was no explicit statement of a policy, nor were particular incentives offered to encourage teachers to adopt an integrated approach. My understanding of the integrated use of computers at Outeast College was encouragement for teachers and students to appreciate computers as an important learning resource - a useful tool in all their studies - a view which is consistent with Bigum (1985) and Allitt (1985). At Outeast College, the integrated use of computers did not mean treating computers as an object of study, nor did it imply that teachers would be faithful implementors of an already developed curriculum or that they would be aligned with a particular philosophical approach which computers could be seen as advancing (such as constructionism or enquiry learning). Rather, they were participants in an evolutionary and adaptive change in which the various modes of computer use - support, exploration, control, tutorial, resource, link modes (ACS/ACCE, 1994/1995) - could be explored.

The integrated use of computers at Outeast College was predominantly by self-taught computer-using teachers. The expansion of the physical resources had been so rapid that it was not possible to arrange for thorough training in the technology or the pedagogy of computer use for all staff prior to the wide scale availability of computers for teaching in the year prior to the present study. Professional development programs were,

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9 Victorian authors, whose work, in my opinion, reflects an understanding of computers in education commonly held throughout Victoria to the present day.

10 This document is contemporaneous with the data gathering phases of the present study.
of course, planned, but there was no prima facie reason to prevent enthusiastic colleagues taking advantage of the facilities ahead of attending any specific training programs themselves.

It was in this environment that Arlene, Geoff, and Howard came to my notice as enthusiastic colleagues eager to engage in a process of evolutionary and adaptive change, and explore the integrated use of computers in their respective subject areas. I was naturally pleased when, into the following year, they volunteered to be participants in the present study. The classes with which Geoff, Arlene and Howard chose to work were from the Junior, Middle and Senior Schools respectively, and their pedagogy would be influenced to some extent by the practices of teaching with computers which had developed in these Schools in the years previous. It is these practices which I discuss in the following paragraphs.

**Computer Use in Years Pre-Preparatory to Six**

The use of computers at these levels had previously been taught as a separate subject by a specialist teacher for one or two periods per week for each class group. In the year prior to the study being conducted, there was a determined effort on the part of the two IT-specialist teachers in the school (the Junior School specialist and myself) to encourage a move towards integrated use of computers in all classes, rather than an exclusively extraction program. This was to be facilitated, in part, by the availability of a small bank of laptop computers which could be moved from classroom to classroom (rather than classes needing to move to a computer laboratory for use of computers); as well as by a change in role of the computing staff who would work more closely with, and develop the skills of, the classroom teachers. This was the setting of Geoff’s work as a specialist IT teacher with the Year Three class.
**Computer Use in Years Seven and Eight**

Of all the teaching programs in the school, it was the subject of English at Years Seven and Eight which had been most influenced by the integrated use of computers. Three years before this study commenced, my teaching allotment included team teaching with the Year Seven and Eight English teachers for one period a week for each class (two classes at year level). The program which evolved at that time was a direct antecedent of the class program for Arlene’s Year Seven English class in the present study (refer to Chapter Seven).

A number of self-taught computer-using teachers from subject areas such as English, Geography, History and Science found the opportunity to use computers in their teaching. The availability of a second laboratory made it possible for them to book their classes into a laboratory on a needs basis.

**Computer Use in Years Ten to Twelve**

At these year levels, IT was taught as an elective subject, but a number of self-taught computer-using teachers from a range of subject areas found the opportunity to use computers in their teaching. However, the heavy internal assessment (Year Eleven) and external assessment (Year Twelve) demand at these senior levels meant that teachers were obliged to ensure that the subject ‘was taught’, leaving less time for using innovations such as the computer (Newhouse, 1998, has similar findings). The English faculty was one of the exceptions to this, routinely encouraging students to use computers to improve the efficiency of composition and editing, and improving the presentation of work. All English classes would be booked into a laboratory regularly for this purpose. Howard used computers more regularly than his colleagues in his teaching of English as a Second Language (ESL) to Year Eleven and Twelve overseas students.
THE PHYSICAL RESOURCES

At the time of the present study, the computer facilities at Outeast College consisted of three laboratories and two banks of laptop computers. A detailed description of the laboratories together with an overview of the software available and the operating procedures for the systems is found in Appendix One.

Junior School

The laboratory in the Junior School (known as the Junior School Technology Room) consisted of 13 Apple Macintosh LC 475 desktop computers and two colour printers. Also available from this room were 12 laptop computers (Macintosh Powerbook). These laptops were used as a mobile bank of computers which could be moved to various classrooms, and also to supplement the number of desktop computers in the Technology Room so that there was full class set of 25 machines available when necessary (Geoff’s small Year Three Class, for instance, used only the desktop computers). All specialist computer classes were conducted in this room.

Senior and Middle Schools

The computer facility for Senior and Middle Schools consisted of two technically equivalent laboratories which ran Microsoft Windows 3.1 as an operating system and a bank of laptop computers. The room known as Computer Room 2 was the room designated for the integrated use of computers, and teachers throughout the school could book times for their classes to use this room. This was the room in which Howard’s and Arlene’s classes were conducted. Available from the library were 27 laptop computers (NEC Versa series) which were configured to be technically equivalent to the desktop computers in the laboratories. These were used by classes when they visited the library, but, more often, were borrowed on
an individual basis by students who had a particular need to use a laptop computer in a regular classroom.

Computer Room 2 consisted of 28 IBM-compatible computers, a mixture of 486- and 386-class machines. They were equipped with colour monitors, mice, and 3.5” disk drives. The computers in Computer Room 2, and the room adjacent to it, were interconnected as a Local Area Network (LAN), and managed through a common Novell Netware fileserver\(^1\). During the second half of the year of the present study, a LAN-based connection to the Internet was also established\(^2\), but since this represented the very genesis of Internet usage in the school it did not generally feature in the pedagogy of the participants in this study\(^3\), except for a group of lessons taught by Arlene.

The decision to allocate one of the laboratories to the integrated use of computers was a deliberate one. Hativa (1995, p. 361) and Lynch (1999) have both drawn attention to many teachers feeling uncomfortable about working in a laboratory because it is perceived as the ‘territory’ of a technically-savvy sub-group of staff and dominated by their rules, routines, expectations and mores, as described in Chapter Two.

In addition to the physical resources, Outeast College employed a part-time computer technician who, in addition to minor technical repairs, was system administrator of the computer networks (described below). In the times during the week when this person was not on site, technical support, system administration, repairs and maintenance were the

\(^{11}\) A system very similar to the one at Outeast College has been described by Morelli (1996).

\(^{12}\) That is, it was technically possible for all computers in the two rooms to access the Internet simultaneously through a single link. Technical details of an Internet connection very similar to the one at Outeast College have been described by Hilbig (1996).

\(^{13}\) Deregulation of the Internet in Australia had only come about in the year before this study commenced (Clarke, 1999), so its availability in schools, homes and business was quite limited compared with what the reader of this study might be accustomed to. It is my opinion that teachers were only beginning to explore the educational possibilities and that there was little commonly-held wisdom of how it could be used in education.
responsibility of the Junior School IT teacher and myself. My role in the
school, at various times during my working day, included being
technician and system administrator, and I now proceed to describe in
greater detail my role in the school and in this study.

MY ROLE IN THE SCHOOL AND IN THE STUDY

Throughout the course of the study my role in the school was that of Head
of Information Technology. My brief included overseeing the
introduction of the integrated use of computers in all subjects and classes
in the school, working with the professional development co-ordinator in
identifying technical and pedagogical training needs of staff, and
conducting some of the required training. I was conscious that many staff
would have a sense of wanting to be accountable to me in terms of the
integrated use of computers in their teaching; on a day-to-day basis, I was
often asked questions such as “do you think I should do this unit of
work?” or “I did this with my class today - I hope it’s all right with you”.
At various times over these three years, I fulfilled the role of system
administrator, technician, team-teacher, and curriculum ideas person. As
I went about my daily work, the problems of my presentation of myself as
a computer-using teacher to my colleagues was frequently present in my
mind. I took heed of Jacobsen (1998) and Watson (1993) who found that
the enthusiastic character of a computer-using teacher which makes
computer use seem easy appears to inhibit colleagues and disguise the
extensive learning which is required. In designing the present study, and
whilst collecting the data, my role in the study was a concern to me, and I
reflected on it constantly. The issues that I reflected on are discussed in the
following paragraphs.

Outeast College - in response to a do-it-yourself environment - sought to
encourage (as I have already noted, in quite small ways) those teachers
who wanted to take advantage of the newly available computer resources;
that is, to encourage the staff to be self-taught and computer-using. This
The study itself provided one means of providing this encouragement. I spoke at several staff meetings, inviting and enthusing my colleagues to use computers regularly in their teaching over the course of a whole year, and hoping that several would also allow me to interview them and videotape their work. At least eight took up this challenge seriously, five were willing to be participants in my study, but only three were able to be followed through for the whole year (for reasons of illness and change of professional duties).

As teachers took up the challenge of using computers in their teaching, my intention was to always value them as constructivist learners, capable of developing their own teaching/learning programs. However, in the absence of sample programs or curriculum documentation, I felt a sense of having let them down. Yet, I was also aware, even as Head of Information Technology, of the limitations of my moral authority to make such designations. Grundy, Bigum, Evans and McKenzie (1987) have used a geographic metaphor to explain the difficulty which I experienced:

> The geography of the knowledge terrains of teaching, learning and curriculum are sufficiently well known by most teachers that they are able to draw crude maps. Of course, there are many ‘official’ maps, usually produced by researchers, which may bear some resemblance to the terrain as the teacher sees it but more often than not reflect some broader geographic principle which is valued by the researcher ... The history of educational computing has been such that for the most part teachers have been given maps drawn by people whose main credentials are that they began exploring first.

(p. 58, my emphasis)

For myself, I could claim a solid grounding in the discipline of computer science and a deep consideration of the integration of computer use in the senior secondary curriculum which I taught. However, I could not make any special claim to have knowledge about the relationships between computer science and other subject areas, only that I had been exploring them for some years (in the form of having thought and read about possibilities, with practical experience limited to the team teaching arrangement which had operated at Outeast College, as described in the
“Year Seven Program” section of Chapter Seven). I took the view that it would have been highly presumptuous of me to work in a way that could imply that I had ‘the answers’.

Further countering my misgivings was a need to recognise that many of the staff at Outeast College, including Howard, Arlene and Geoff, had trained and worked as teachers throughout a period of history during which school based curriculum development was part of their normal work life, and they were used to developing their own goals, programs and practices. I wanted to acknowledge their professional capability to be in control of this aspect of their work life, and to work through the issues of the relationship between their respective subject areas and ‘doing computing’. Furthermore, curriculum theorists have pointed to local knowledge and experience being important for curriculum development (Marsh & Stafford, 1984, ch. 5), thus I needed to acknowledge that each of the participating teachers had taught at Outeast College for more years than I, and that Howard, in particular, has worked longer in the teaching profession than I.

The computer-using teachers at Outeast College were participants in an evolutionary and adaptive change, developing their own programs of study and pedagogies of computer use. Through this study, I have documented the pedagogy which emerged; I have not been concerned with comparing it to idealised expectations and programs. It is in attempting that venture, given my various roles and responsibilities, that I have had cause to constantly reflect upon my role in the study.

As noted in Chapter Three, at the outset I chose to be, as much as possible, a “professional loiterer” (Junker, 1960) who would refrain from acting in ways which would affect the activity being studied and with a research role known to all participants from the start. I was certainly not seeking a means to influence or evaluate the pedagogy of Geoff, Arlene or Howard, or to pass judgement on them as professionals. Mindful of the classroom dynamics to which both Hativa (1995, p. 361) and Lynch (1999) have drawn
attention - that teachers may feel uncomfortable about working in a
laboratory because it is perceived as the territory of a technically-savvy sub-
group of staff and dominated by their rules, routines, expectations and
mores. I felt that it was necessary for me to withdraw as much as possible
from the functioning of the class and the planning of the teacher to allow
their own rule, routines, expectations and mores to develop. I chose to
discreetly distance myself from these colleagues and the classes involved
in the study. The classes they chose to work with for the purposes of this
study were ones which I did not teach and would ordinarily have had
little to do with. I did not team-teach with these colleagues during the
year of the study, nor did I offer them any curriculum or technical support
above what my normal collaboration would be. I documented the
minimum collaboration that I had with these collegeaues in my diary or
field notes as it arose.

I chose an etic rather than an emic perspective for this study (see Chapter
Three). That is, I adopted an outside, external or generalised perspective
in which I have been free to interpret observations in terms of a priori
theory. As a computer-using teacher myself, I believe that my capacity to
grasp an insider perspective would have been distorted by my knowledge.

**CONCLUSION**

In this chapter, I have described the study site, Outeast College, including
its administrative structure, the student population, the policy and
curriculum environment in which the present study took place, and the
computer facilities. I have reinforced that which has been alluded to in
earlier chapters - the use of computers in teaching at Outeast College as an
evolutionary and adaptive change which honours teachers as
knowledgeable professionals and constructivist learners. I have also
described my role in the school and in the study.
In conclusion, I note that Outeast College is not especially strong on the factors which Becker (1994) discusses as important components of a work environment which are most likely to lead to computer use: network of computer-using teachers, organised support (staff development activities, full-time co-ordinator of computing), and smaller class sizes. Within these constraints, and despite an unclear philosophical position, computer use by non-specialist teachers has been urged, and has been taken up by a number of staff. This study arises from my continuing, genuine and etic interest in the emergent pedagogy of these teachers who have been left to construct for themselves a pedagogy of computer use.

In the next three chapters, I describe the teachers who participated in the study and discuss their pedagogy.
CHAPTER 5 - GEOFF

As described in Chapters One and Two, this study seeks to understand, from the perspective of the relationship between knowledge and pedagogy; why teaching and learning occur in a particular way in a particular setting. In this chapter, Geoff is studied: I consider both the teaching and learning I have observed by providing a rich descriptive account of Geoff’s pedagogy and teaching circumstances, and also interpret the data to provide an understanding of the relationship between teachers’ knowledge and pedagogy. Both aspects of the discussion are interwoven in order that Geoff’s story might be best told.

The range of data presented in this and the following two chapters, and indeed the style of writing, are deliberately chosen to emphasise the trustworthiness of this study - that is, to persuade the reader that the findings are worth taking account of (Lincoln & Guba, 1985, p. 290). As described in Chapter Three, I have deliberately sought to present data in such a way as to adequately describe the particular context of Geoff’s work, avoid generalisations, demonstrate that I have observed patterns emerge, avoid obtuse constructs, use words of the participant, and to indicate that I have engaged in deliberate acts of reflection and interpretation. In short, I have aimed for what Olson (1989b) describes as a thick description.

The data on Geoff is presented in the following five substantive sections of this chapter. The first two sections concern Geoff’s particular context, considering firstly his background and his experience with computers, and secondly describing his organisational circumstances. In the third section, I describe the features of Geoff’s pedagogy which I have observed, and it is in this section that I discuss the use which Geoff makes of computers in his teaching. Fourthly, I consider Geoff’s personal attributes - his knowledge, practical theories of teaching and beliefs associated with teaching with computers. It is in this fourth section that I consider the
impact and implications of familiar pedagogical patterns on Geoff’s teaching with computers.

BACKGROUND

Geoff is a male teacher at the school. He is a foundation staff member, starting his teaching career at the school 14 years earlier, and he has taught there continuously since that time. When I first met him, he was a teacher of Physical Education (PE), but as he explained during our first interview,

...when I first started I was a classroom teacher - Grade Three - and then after three years I taught in the secondary school - PE and Maths and in the junior school I taught PE and sport as well at the same time - that was about two years worth and then the last seven or eight years primarily PE and Sport in the Junior School ...

(Geoff, Interview 1)

Geoff told me about his teaching load in the year in which the research was conducted:

[I do] everything! This year’s a bit of a mish-mash in that you’re sort of being spread out - from teaching two-year-old playgroup right up to Year Eight volleyball and computers and library and all sorts of things in between ...

(Geoff, Interview 1)

The majority of Geoff’s teaching load was in the areas of PE and Sport, but he began the year as a specialist computer teacher for several classes in the Junior School. It was in his role as a specialist computer teacher for Year Three that Geoff participated in this study. As a specialist computer teacher, he worked with a whole class group of students in a computer

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14 Throughout this study, I refer to Geoff as a “specialist computer teacher”, but as the data in this chapter shows, in terms of his diversity of duties and his practical theories of teaching, Geoff is very much a generalist. The use of the term “specialist” in Geoff’s case derives from the class which he taught. That is, as discussed later in this chapter, the Year Three class came out of their regular classroom for designated computer lessons with a teacher who was not their regular class teacher, and it was part of Geoff’s duties to teach these specialist lessons.
laboratory, and the year in which this study took place was the first year in which Geoff had worked as a computer specialist. I elaborate on Geoff’s role as a specialist throughout this chapter.

In introducing Geoff, I want to clearly describe his professional experience with computers, indeed to present him as a self-taught computer-using teacher. This is what I do in the following section, and following that I move to a more comprehensive description of Geoff’s teaching circumstances, portraying the context of the organisational milieu and the collegial relations which directly impact on his role as computer specialist for Year Three.

**Self-Taught and Computer-Using**

During our interviews, Geoff related when he had started learning about computers. His first contact with computers had been many years before (in the late 1980s or very early 1990s), when the only computers in the school were some Apple ][e and GS computers in the Junior School, and before the school had employed a computer specialist. Geoff and three colleagues (whom he described as “the three of us rookie teachers”) decided to spend a few hours after school one night to “play around” on the computers. One of his colleagues knew a little more than the others (after all, they had to know how to turn on the computer and insert a boot disk), but together over a period of months, they “got on it and played”.

Geoff described this ‘play’ as “logical play” and “discovery”. I asked him what he had found most helpful when learning about computers in those early times, and he replied that learning with others was a major contributor, as they could help one another out. He said he found it helpful “not getting stuck”; it gave him the confidence to try something else. Geoff told me that he learnt the hard way - he “lost a lot of work”, but was always working out good questions to ask. I have always found him to be the sort of person, who, if he thought you could help him out with a question, would have no hesitation in approaching you in the staff
room or corridor for “one quick question”. Compared with self-discovery and seeking help from friends, Geoff infrequently used other means of learning about computing; he claimed to have never referred to a book, manual or magazine, and only rarely did he use the in-built help system. He found the Macintosh computers very helpful, describing them as “easy to use”, “more intuitive” and “user friendly”. He particularly appreciated the symbolic representation of operations (using icons), and the lack of restriction on file names (compared with the “8.3 filename” restrictions of DOS).

Despite his enthusiasm for computers, he did not have one at home. Rather, he would borrow one from school as necessary. This involved carrying a monitor, screen, keyboard, mouse, system unit and cables out of the Junior School computer laboratory down a flight of stairs across the playground into the car park. I had seen him do it often enough, and it was testament to his enthusiasm for using computers.

Geoff described himself as an enthusiastic user of computers, and the range of tasks he has used them for bears this out. He uses computers for all administrative tasks relating to the organisation of sport and camps, and even noted that “I tried to invent things that I could use computers for”. Geoff used a computer to prepare all letters to parents for camps and sporting activities. He claimed to have set up the first computerised database of students in the school (which I have no reason to doubt, but I never saw any evidence of it). This was an AppleWorks (ie Apple II[e/GS]) database which would sort students by age, gender, house, year level, and name to assist with the allocation of students to sporting teams. Geoff had also explored the use of spreadsheets. He used them simply as a grid, to help him prepare timetables and present other tabulated information, but he was conscious that this was not considered to be a ‘proper’ way of using a spreadsheet. He remarked several times that ‘others’ (by which I understood that he meant the Junior School specialist computer teacher) had commented to him, somewhat sarcastically, that “that’s a novel way of using a spreadsheet”. He was fundamentally interested in discovery
and being pragmatic in his use of any tool which could make his work life more efficient, rather than doing things ‘the right way’. In our second interview, he commented that “… perhaps people discover new ways … and it’s discovery, that’s what it is all about”.

Geoff believed that his skill level was sufficient for the tasks he wanted to undertake, but by no means sophisticated, and throughout the year, Geoff consistently expressed concern about his skill level, a point which will be discussed later. Despite this, during the year in which this study was conducted Geoff did not attend any course on computing or how to use computers in his teaching. Of the three teachers in the study, Geoff is probably the most self-taught (if only because of his penchant for discovery), and is certainly computer-using. All three teachers in this study use computers extensively in their work, but, over a year, Geoff probably used a larger range of applications than either Howard or Arlene.

I have broadly discussed Geoff’s background and presented him as self-taught with respect to computer use. Geoff is also self-taught in respect of pedagogy of computer use, a matter which is further considered in the following section in which Geoff’s teaching circumstances are presented.

THE TEACHER IN THE ORGANISATION

In this section, I consider the organisation milieu in which Geoff worked, his role as a specialist teacher, relationships with key colleagues and features of his professional world.

Organisational Milieu

As I have referred to my notes and teaching journal, there is no doubt that the organisational milieu of Outeast College had been subject to great change, ferment and uncertainty in the year in which the study took place. In each of our interviews, with nearly every question I asked, Geoff would
somehow bring the conversation around to organisational changes. As I illustrate in the paragraphs which follow, he was clearly disquieted, and changes weighed on his mind. Because Geoff’s role as specialist computing teacher meant considerable interaction with other staff (particularly the class teacher and another computing specialist, as I discuss shortly), the changes probably impacted on him more than they did on Howard and Arlene. Discussions with Howard and Arlene showed that they were also affected by the changes, and I address these in Chapters Six and Seven, however Geoff was the most outspoken of the three participants in this study, and also gave the clearest description of what the changes were. It is partly for this reason that I have chosen to present the study of Geoff first.

Another reason for presenting the organisational changes in some detail here is because in my working through the data on Geoff, I have become convinced that there are important parallels between how he has adapted to being a computer teacher and how he has worked with the various changes and constraints which he has faced since he started his teaching career at Outeast College. That discussion is presented later in this chapter in the discussion of Geoff’s problem solving ability.

As Geoff and I discussed, a number of years of uncertainty in the school’s direction had culminated in the appointment of a new principal in the second half of the year prior to this study taking place. From that point on, we both observed many changes in organisational procedures, structures and collegial relationships. As Geoff and I shared in our first interview, we were both of the opinion that this climate had resulted in many staff feeling uncertain of their place within the ‘pecking order’ of the organisational hierarchy. More tangibly, my teaching diary from planning meetings of the previous year indicated three changes: the increase in the number of teaching hours of each member of staff; the implementation of a whole-school timetable from Pre-prep to Year Twelve; and the accompanying process of equalising teaching loads so that any staff who had previously taught in a relatively narrow range of year levels and
subject areas now were required to teach a much more diverse range of classes.

Geoff’s concerns related to increased teaching load, teaching loads which meant that teachers taught a greater variety of classes, inequitable treatment between Senior and Junior schools, apparent under-valuing of abilities and commitments of staff to school life, and the apparent placing of financial concerns ahead of educational ones. I would stress that I have not validated the facts of what Geoff said, but these are relatively unimportant compared with the tone of what he had to say. He was not happy because he believed that the administration was implementing policies and outcomes which did not resonate well with his values. It was Geoff’s belief that he was not alone in his views, and my notes of the time support the notion that Geoff was indeed not a lone voice who was critical of the school in this way.

Whilst Geoff might have taken exception to the range of policies and practices in place, he also acknowledged that he had seen many changes in Outeast College over the years. Indeed, he took a fairly philosophical approach to them, commenting,

… that’s sort of what has made the place interesting - seeing it grow - and I don’t know - change for the good, and for the bad - they’re things you come to deal with and as I’ve been growing - I suppose I’ve learnt to sort of analyse which ones are good and bad in my own mind anyway, and try to do something about them on the way.  

(Geoff, Interview 1)

How Geoff works with change and the organisational constraints around him is very important to understanding Geoff as a specialist computer teacher. I discuss Geoff’s modus operandi of being flexible and solving problems later in the chapter, and the sense in which he stated that he is a “product of the school”.

Geoff’s classroom practice, however, was apparently not affected by these changes. In the light of the above discussion, it would be tempting to think of Geoff as being negative and down-trodden and conveying this in
his conduct in the classroom. In total contrast, I always observed him to be positive, encouraging and enjoying his work with students. In that sense, he was able to isolate the classroom from the broader organisational issues and his passionate feelings about them.

Geoff’s professional world was shaped by this broader milieu: how he came to be teaching Year Three computing, the colleagues with whom he needed to work closely, and the busyness of his teaching days and his diverse teaching load were all products of the function of the organisation. It is these which I describe in the following sections.

**Geoff’s Unique Role as Specialist Computer Teacher**

I have described Geoff as specialist computer teacher for the Year Three class, and in this section I describe more fully what this role involved.

The study of computing in the Junior School of Outeast College had traditionally been treated as an extraction program. This meant that the only significant use of computers for a given class would be for one or two periods per week with a specialist teacher. In the year during which the study was conducted, there was a strong move towards integrated use of computers in all classes in addition to a continuing extraction program. This was to be facilitated by two key factors: the availability of a small bank of laptop computers which could be moved from classroom to classroom, to facilitate more ready access to computers; and a change in emphasis in the role of the computing staff to work more closely with the classroom teachers and develop their skills.

Whilst Geoff was an enthusiastic user of computers, it was only a consequence of the school timetable which gave him the opportunity to take on this role of a computer specialist. The reason for this was that one of our colleagues was employed (and had been for several years) specifically to teach specialist computing classes in the Junior School; as it happened, in the year under discussion, it was not possible to schedule all
these classes on days and times when she was available. Geoff was keen to take up the opportunity to be a computer specialist for several classes when the possibility was presented to him. I have come to think of Geoff’s purpose for taking up the challenge of teaching with computers - using the terminology of Olson (1988b, p. 30) - as “expressive”. Olson has used this to describe a purpose which is directed to the formation of an impression of oneself in the eyes of others, and I believe that Geoff’s purpose was at least in part concerned was demonstrating that he was ‘more than’ a PE teacher - that he sought to demonstrate to the school and himself that he had developed valuable skills and knowledge, and that he was confident and capable.

Timetable changes early in the year meant that whilst Geoff started the year with several computing classes, he ultimately only took the Year Three class for one period per week as a computing teacher. Moreover, our specialist colleague also took the Year Three class for a second computer lesson each week. Thus for Geoff, learning to be a computing specialist was as much a matter of negotiating a tripartite working relationship between himself, the long-standing and acknowledged specialist, and the Year Three classroom teacher as to what he should teach and how he should teach it. The change in emphasis of the role of the computing specialist from one of genuine speciality to one which included support and co-operation was not in fact defined in any greater detail. It was simply expected that the computer teachers would work in such a way as to encourage and support the use of computers by the classroom teachers. Geoff’s learning to be a computing specialist was not a matter of assimilating a pattern of working which had been prescribed, but that of creating a suitable pattern of working in this tripartite arrangement. Geoff was most certainly self-taught in this role and in the conclusion to this chapter, I will discuss Geoff’s formulation (or lack of formulation) of this role.
Relationship with the Class Teacher

Despite valuing the classroom teacher’s initiative, Geoff consistently revealed some basic disquiet with the professional relationship between the two of them, particularly that the control of the learning process resided with the classroom teacher. He commented at length that

the good thing about that is that they have work … to do … the problem with that is that either the work is the same for three or four weeks or four or five weeks or whatever unless they do some of the work in their own room or they come in and use the computer lab in their own time. … So then, when they come in, you know, they really just have to work, to get onto it and to interrupt them, to teach them something is a lot harder especially when I don’t have them in - I don’t mind having a project sort of lesson but if they had another lesson that was like a skills lesson that they could practise all the skills … [What I do now] become[s] like a typing lesson in a sense. You know, we are just fixing up certain little problems along the way. But as soon as you start teaching them, you’re taking away computer time or typing time away from the students and that’s sort of what holds them back the most. So their teacher is using the lesson well but I think they are still shying away from taking the laptops to their room, or using the lab or whatever …

(Geoff, Interview 3)

Geoff valued doing what he could to promote and extend the integrated use of computers, and to that extent he was pleased that the control of the lesson resided with the classroom teacher. And yet he found that this drove him into a role which he did not find fulfilling and has disadvantages in terms of developing students’ skills with computers.

I would contend that there was clearly an interest and willingness on the part of both Geoff and the classroom teacher to co-operate. There was, however, no evidence that the two of them actually engaged in any long-term or detailed planning at all. This led to some of Geoff’s discontent with his role as computer specialist. There is also the implication that Geoff’s aims for the year and for individual classes cannot be considered
without reference to the work and class objectives established by the class teacher, and I consider Geoff’s aims later in this chapter.

**Relationship with the Computing Specialist**

Throughout the interviews, Geoff clearly stated that he saw our Junior School computing colleague as “Head of the Junior School Computers”, and in that respect Geoff would have liked to be able to refer to her for key curriculum decisions, technical support and leadership. Geoff often found her hard to work with, but clearly saw that it was important to continue to get on well with her. He had developed a range of ways of ensuring the relationship was as fruitful as possible.

Geoff saw a real need to plan and co-ordinate, and the fact that both Geoff and our colleague were working with the Year Three class with computers emphasised the importance of this, as he explained in our second interview:

> or will I be given ... [a] ... niche to teach in? Because I know ... [our colleague] ... does Microworlds and whatever but it seems that she is starting to creep into Clarisworks so it looks like those two programs are exhausted and we are only half way through the year. So are we going to become creative with those two programs for the rest of the year? Or is our job to teach different programs that the teachers can teach in their classrooms? They’re the decisions or the answers that I need. And all of a sudden “Right. This term Geoff you are teaching this program and ...you are teaching this. This is going to help the teachers in their classroom. Off you go and if the teachers have any work that they want to do on the computers well you have got to stop where you are up to and use Clarisworks or Microworlds or whatever things that you are going to use”. Fair enough, ... we do that and when we have got nothing to do then we go back on to the programs you know that we are teaching. I don’t know. To me that probably makes the most sense. It would really be good if decisions were made as to what we are doing.

*(Geoff, Interview 2)*
Geoff would have appreciated a variety of support from our specialist colleague. Geoff’s frustrations (which I discuss in more detail later) included there being no rigorously upheld policy on the location and care of student disks, inability to locate new print cartridges when necessary and difficulties with printers. Our colleague, as the main user of the computer laboratory, was certainly the person who could have assisted Geoff with these things. As the more experienced of the two computing teachers of Year Three, one might have expected her to take a more leading role in planning and co-ordinating Year Three’s use of computers. I am sure, too, that Geoff would have appreciated having someone close by with whom he could discuss his teaching or even learn from on informal bases. She did not support Geoff in any of these areas, and a case could be made for Geoff’s success as a computing specialist being stymied by the lack of a truly effective relationship between the two of them.

However, interpersonal relationships of themselves are not the only factor. Organisational circumstances were an important constraint as well. During our interviews, Geoff had told me that their timetables were such that he was rarely able to meet with either the classroom teacher or the computer specialist. I was able to verify this by referring to the school timetable. It could be argued, that if something is important enough, then you make the time, and there is no evidence that any one of the three of them went out of their way to make the relationship work. Combined with the organisational circumstances which made it almost impossible to schedule meetings, workloads which were higher than in previous years were a further disincentive.

Just as I found that Geoff was able to isolate the classroom from the broader organisational issues and his passionate feelings about them, so it was that he always spoke of the computer specialist and the classroom teacher in a friendly and convivial way when he was speaking with students. In that sense, his relationship with both of these colleagues did not affect his classroom practice, but the issue of the responsibility for curriculum development and lesson planning, discussed above, was a
very important influence on his pedagogy. It is this which the discussion on
the relationship between Geoff and our specialist colleague highlights.

This concludes the presentation of Geoff’s professional world as I have come to understand it as I have worked alongside Geoff, and interviewered and observed him. I have described the organisational milieu, particular features of Geoff’s professional practice, his relationship with key colleagues and his unique role as computer specialist. I now proceed to a discussion of Geoff’s pedagogy.

**GEOFF’S PEDAGOGY**

*Features of Geoff’s Professional World*

Geoff’s work as a computer teacher to Year Three was defined in large measure by his relationships with colleagues as discussed above, but his work life was also framed by a number of other features: busy and fragmented, isolated and needing to manage time and preparation effectively.

I have earlier referred to Geoff’s diverse teaching role but, more than this I believe that Geoff’s work life was fundamentally busy and fragmented. He was always seen around the school, rushing from one job to another. He was the sort of teacher who would be teaching a group of students ball skills on the quadrangle whilst repainting the court lines for the afternoon’s basketball competition, and probably making plans for the following week’s swimming sports at the same time! Geoff’s very survival as a teacher and his way of doing many things at once was testament to his good planning and time management. I have not known him to be unprepared for any task which he was to undertake, but I have known him to work very hard and often for long hours.
Geoff found that his professional world was very isolated, and he made particular reference to his lack of knowledge of broad educational initiatives and programs. In our third interview, Geoff spoke of feeling “like an island … even in PE”, a sentiment which applied to the local situation as much as it did to the regional or state context. Geoff was frustrated at the (lack of) planning and oversight of the Year Three computing program, feeling that he had been left to his own devices, as discussed above. He was also frustrated that there were few opportunities for him to observe other teachers at work as a means of improving his own practice, as I discuss in a later section.

**Preparation and Planning**

One particular feature of Geoff’s pedagogy was that he did not plan lessons, at least in any explicit form. I asked him if he had any written-down lesson plans, and he replied,

> No none. None written down. Because of the structure of things - like I’ll come in and go to do spreadsheets which I would have done last lesson - I knew where I was up to, I had certain things I want to get out in my head - and I’ll come in and they’ve done perhaps magic squares with [the other computing teacher] and they are half way through that and I have to make a decision - “Do I go on or she’s taken them on past where I was going to teach them, perhaps it is better to continue on where [the other IT teacher] left off” so it is just a waste of time. And then today I may have had a certain concept that I was going to teach or whatever and the teacher comes out - “Oh I have lots of work for them to do today that I want them to do on the computer”, so I get thrown around from lesson to lesson. It’s just the thrill of what is going to happen next and not what I am going to teach next at the moment. *(Geoff, Interview 2)*

In part, Geoff’s lack of lesson planning stemmed from his need to fit in with the class’ work. It can also be partly attributed to the busyness of his job but, importantly, it can also be attributed to detailed curriculum and lesson planning never being a feature of his pedagogy.
In our second interview, Geoff reflected on his very early years of teaching at Outeast College, commenting,

... there was no discussion, and there was no committees, or no syllabuses, or no work programmes or no anything ... and I thought that was normal, so you know, it makes it really hard for me to say that I’ve lived in a normal world [of teaching].

(Geoff, Interview 2)

Working on a moment-by-moment basis was a well entrenched aspect of his teaching practice, a theme which I discuss in more detail later in this chapter. Whilst Geoff did not plan explicitly or in advance, it is important to note that each lesson he conscientiously and spontaneously created a lesson which fulfilled the classroom teachers’ aims as he understood them.

Geoff’s use of demonstrations during his lessons reflect his planning. These were conducted at an ‘ordinary’ computer which would be later used by one of the students - a Macintosh LC II with an 11” monitor. There was no zoom facility, special computer with a large screen or other equipment to assist with teacher demonstrations. In order to conduct a demonstration, Geoff had to sit side-on to the computer and the class, work the mouse and the keyboard in a back-handed fashion and glimpse the screen from side-on. Only the students sitting closest to Geoff would have really been able to see any detail of what was being demonstrated. Admittedly, there was no alternative facility in the school which Geoff could have used for a large screen demonstration, but he could have, for instance, produced screen captures (similar to the ones used in Appendix One) and from that produced photocopies or used an overhead projector. Geoff persisted with his use of demonstrations, apparently unaware of the difficulties or without the desire to investigate other possibilities, or planning strategy which would be more effective. Throughout the year, he persisted in working ‘on the spur of the moment’.

In the preceding sections, I have discussed the important background factors which influenced Geoff’s pedagogy: his relationship with key colleagues, the nature of his professional world. I now move to an
account of the particular classroom practices which I observed in Geoff’s classroom. Geoff’s teaching with computers took place in the Junior School Computer Room which was equipped with 14 computers. A floor plan and technical account of the facilities which Geoff used in his teaching with computers are presented in Appendix One.

**Features of Teaching and Learning in Geoff’s Classroom**

Observing Geoff’s work with the class over the course of a year, I have no doubt that Geoff likes children. When Geoff talked about what pleased him in his lessons he referred to features such as including everyone, being fair to all students, helping students solve problems and seeing improvements in students’ work. I would describe Geoff as very even-tempered, organised and in control, orderly and encouraging. His manner would warm the heart of the least able student in the class as much as the most able.

There was a sense of formality about Geoff’s teaching and how he and the students worked together. When working as a class group, students were expected to remain in their places and speak only after having raised their hands. When working individually at the computers, they were expected to raise their hands and wait patiently for Geoff, although he allowed them to leave their seats and come up to him to politely ask for assistance. On several occasions, I observed the formal greeting or dismissal: “Good morning boys and girls” - “Good morning Mr … “. Entry and exit to the computer room was often by students processing in two parallel lines. Whilst all of these features spoke to me of formality (more so than was present in either Howard or Arlene’s classes), it also spoke to me of classroom order. At the start of some lessons, the room would look untidy, and some computers would be on and some would be off, but Geoff always ensured that room was tidied at the end of each lesson with computers turned off, often leaving the room more neatly presented and
orderly than he had found it. Geoff’s busy, fragmented and often disorderly professional life never showed in his lessons.

There was a seating plan for the class - each student was assigned a particular computer at which to work. As Geoff explained,

... they all [go] to the same computers for my [Year] Three lessons ... Otherwise we have troubles every week unless ...it’s really good and they go to the one computer and [we] don’t have any hassles. At the same time, you can keep turkeys away from good workers, or two turkeys together, once you’ve set your patterns and then it’s easier to concentrate and get on with your work. I find there are three or four boys who want to be together all the time so ... once I realised that, I had set computers all the time.

(Geoff, Interview 2)

As far as I could tell, once the seating plan had been adopted there was little change in it for the whole year, although Geoff did allow a few students to sit in other places in some lessons. This seating plan also spoke to me of Geoff’s sense of classroom order.

Each student was equipped with a disk and the computers in the laboratory were configured so that work could only be saved onto a floppy disk (as described in Appendix One). Each disk was to have the student’s name on it, and the collection of disks were to be kept together as a class set in the laboratory. So that students could work on computers in their classroom, it was necessary for the disks to leave the laboratory at various times. An all-too-frequent occurrence, and significant frustration for Geoff, was students being unable to find their work on a disk, or the disk itself.

Geoff’s lessons were quite highly structured. The students would enter the room under his direction in an orderly manner. There would then a plenary session which usually consisted of the students sitting on the floor and Geoff sitting on a chair in front of them and briefing on the tasks to be completed and, in many lessons, providing a demonstration of the computer skills to be used. During our fourth interview, Geoff referred to this time as a “mission talk”. After this plenary session, students would
move to a time of individual work at the computers, and during this time which occupied the majority of each lesson, Geoff would move among the students assisting them. In the following two sections, I discuss Geoff’s instructional approach during the plenary sessions and the times of individual work.

**Instructional Approach during Plenary Activities**

During plenary activities, I never saw Geoff vary from a transmissive instructional style. Whilst he solicited feedback from students and asked questions of the class during this time, any opportunities for question-and-answer would typically last for only one minute, compared with a length of the introductory plenary session of between two and fifteen minutes. 

I believe that Geoff’s transmissive approach is compatible with his belief, as he expressed it to me on several occasions, that it is the teachers’ duty to provide correct information at all times. It also parallels findings such as that by Olson, James and Lang (1999) and Carlsen (1992) who found that teaching unfamiliar subject material creates role insecurities and teachers behave so as to have close control of discourse when teaching unfamiliar content. But the transmissive approach was a well-entrenched component of his PE pedagogy, as he explained:

…computers is probably a little bit different [to teaching PE] because they can go off and discover within the boundaries, the limits, that you set - but then with PE I’m probably more of a ‘teller’ because 30 kids all doing shot-put at the one time, you can’t let them go and discover how to do shotput [sic] a different way, you know. And the time constraints as well - so really you have set things that you need to be done by a certain time; that’s if you want to [really] achieve something.

*(Geoff, Interview 1)*

**Individual Work**

The majority of time for each lesson in total was spent in individual work. During these periods of time, Geoff moved systematically around the
room, quietly observing what each student was doing. The help which Geoff gave to students during times of individual work took several forms. Geoff spoke with students about their work away from the computers. Geoff provided what I call ‘quick assistance’ to individual students: offering a word of encouragement or suggestion, or responding to a question which only takes a matter of seconds. Most of the assistance he gave took one minute or more, and I observed him speak with three or four students throughout each lesson, offering encouragement or advice as the student was working. On a handful of occasions throughout the year Geoff took the opportunity to speak on a particular matter with a group of students seated close together, but for the most part his interaction with students was on an individual basis.

Geoff’s body language indicated that he was prepared to intervene quite strongly in a students’ working to provide assistance. Up to three times each lesson Geoff chose to stand or kneel behind a student as he or she worked, talking the student through the way to perform a particular operation or a strategy for designing, completing or improving work. At times, he took control of the mouse or keyboard to demonstrate a technique or rectify a problem. I believe that Geoff’s actions were well judged, allowing the student the opportunity to learn, not presenting himself as having superior knowledge, and yet providing necessary assistance. His actions throughout all the lessons in which I observed him also indicated that Geoff was ‘hands on’, engaged with the students and certainly not afraid of the technology.

My abiding impression of Geoff’s work during the lesson is that he was busy. There was always something for him to do or a student who needed assistance. He interacted with at least five different students per lesson for several minutes and spoke with and encouraged all the others at least in passing. Only once in the year did I see Geoff bring any work of his own into the room and try to do some, and he succeeded in doing this for no more than five minutes. Geoff responded as a need arose, and in that sense was student-centred, but as a result, there were several students to
whom Geoff gave less individual attention over the year (because they did not ask for any assistance), something of which he was apparently unaware.

Whilst the basic structure of Geoff’s lessons was that of individual work buttressed by plenary activities, the times of individual work were punctuated by one or more activities. Over the course of the study, I observed Geoff using several different types of such: demonstration of a student’s work or a new concept, a variation of the demonstration where Geoff would make suggestions of how to improve the work, what he called “tips and tricks” and leading the class in simple arm, neck and leg exercises. These diversions from times of work lasted between two and six minutes each. I wondered what was the reason for Geoff using plenary sessions during the time of individual work. There was the obvious need to introduce something new or review a concept, but he told me that his major reason was to break up the time of individual work into smaller blocks which more reflected a students’ concentration span. Ergonomics, problem solving, learning from one another and critiquing one’s work did not feature in his explanation for his approach. Like the use of demonstrations, I see this tactic to break up long spells of concentration by injecting some interest and diversity as an important link to Geoff’s PE teaching which is discussed in the next section.

Having read and re-read the data describing Geoff’s lessons, I have several impressions of them. The first is that the time of individual work was indeed *individual*. Students did not work together on tasks, but very much by themselves with Geoff assisting them. A student would ask the person sitting next to him or her for assistance, and Geoff never showed any inclination to stop this, but the final result was individually thought-through and produced pieces of work. It is suggested by Packer and Winne (1995) that the layout and form of the classroom impacts on teaching practice and even reflects values and models of teaching and learning. Indeed, I believe that the layout of the classroom (refer to Appendix One) implied an individuality in learning and was an implicit influence on
how Geoff’s classes were conducted, and resonated with Geoff’s emphasis of achieving individual outcomes which is discussed later in this chapter.

**Consistency of Teaching Practice**

As I reviewed my notes on Geoff’s lessons with Year Three, I was struck by the consistency of Geoff’s lesson outline. Figure 1 shows the changes and type of classroom activity for each of the lessons I observed. From this figure, the considerable consistency in the format of Geoff’s lessons can be discerned. There are two major elements: a time for students to work individually, and a time for the class to be together in an activity, discussion or instruction guided by Geoff. Geoff readily confessed (as previously discussed) that he never consciously planned any computer lesson in any detail and never had any written lesson plan, so I found the consistency among computer lessons and between computer and PE lessons remarkable. I asked Geoff about this in our final interview: he replied that he got the pattern from teaching PE, teaching a few things at a time because young students need patterns and routines, and that he believed that this pattern was well entrenched in his mind. The very basis of his class organisation and routine was constant and sustained his practice. This practice was appropriated from his PE teaching and incorporated into his teaching with computers.
In this section, I discuss issues relating to the software packages which I saw Geoff use, and the modes in which Geoff used computers, and to briefly compare this use with the relevant literature (referring to Chapter Four).

In fact, during the year in which I observed Geoff, I saw him use only two software packages, Clarisworks and Microworlds. Clarisworks consists of several components, including word processing, drawing, spreadsheets, and databases, but I observed Geoff use only the first two of these. Using the ACS/ACCE (1994/1995) classification (see Chapter Four), I observed Geoff work only in the support mode, where the computer is used to enhance the presentation of work. The only lesson in which Geoff used Microworlds was also the only one in which I saw him venture into using

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**Software in Use; Modes of Computer Use**

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**Figure 1: Changes in Classroom Activity in Geoff’s Class**
computers in the Exploration/Control mode, but this was teacher-directed. I observed no use by Geoff of computers in tutorial, resource or link modes. Consistent with the use in a support mode, the reasons for using the computer were to give students an opportunity to improve their computer skills, and to improve the quality of the work.

The support mode is often linked to the use of computer as a productivity tool to improve the efficiency of the production of items of work. This is not really a feature of Geoff’s thinking; in fact, on a number of occasions he said that he thought that students could produce work (for instance, a front page for a project) faster and with fewer difficulties (e.g. lost disks and trouble printing) and with greater variety and creativity in design using manual techniques. Geoff was content to be exposing the students to some more computer skills and doing what he could to fit in with the class teacher’s requirements.

This use of Clarisworks as a dominant tool is consistent with Shear’s (1995) findings (see also Chapter Four) relating to computer use in Victorian primary schools. But the use of the computer in support mode is contrary to Hativa’s (1995) finding that at primary levels students’ use of computers in predominantly self-exploratory. It is not clear on what basis the schools and teachers in Hativa’s study were being presented with computer use. If, for instance, they were using a small number of computers based in a classroom on a rota system, then self-exploratory work might be expected to dominate. I believe that Geoff’s aim to have students learn certain skills is an orientation which might lend itself more easily to use of the computer in the support mode.

My subjective evaluation of the software used and the modes of use is that I have found Geoff’s work to be competent but uninspiring. I have come to think of his classroom practice as being competent in the general sense. For instance, the class did not riot, there was no damage done, students were purposefully engaged in tasks which either improved skill or enhanced their other studies, and Geoff made no major errors when
working with or talking about the technology. In a sense, his flexibility in teaching and his willingness to attempt teaching with computers is inspiring, but realistically, the students did little more than word process work for their class teacher under Geoff’s supervision week after week. Geoff seemed to lack initiative, ideas or inspiration about other ways of using computers that he might try, of different types of software (even though only a limited selection was available, as described in Appendix One), or of how the routine might be given some new or exciting presentation. This chapter is in many ways a celebration of Geoff’s competence - an analysis portraying why it is that a self-taught computer-using teacher can in fact be so competent. Nonetheless it is opportune to note here the residual sameness of the classroom activity and the lack of breadth of software types and modes of use to which the students were being exposed.

This concludes the discussion of the features of Geoff’s pedagogy. I now move to a discussion of Geoff’s personal attributes, his practical theories of teaching which are expressed in pedagogy just described.

PERSONAL ATTRIBUTES

In this section, I discuss Geoff’s personal attributes which impinge upon his pedagogy: knowledge of computers, pedagogical content knowledge, and practical theories of teaching.

Knowledge of Computers

During our discussions, Geoff made a number of statements which clarified for me the extent of his knowledge of software and computer systems which he generally considered was limited.
Throughout our interviews, Geoff repeatedly referred to concerns about software, and what he would be teaching during the course of the year. For instance, during our second interview he commented:

> If I have exhausted Clarisworks I am going to need something else to do and that’s where the curriculum comes in and I don’t know if there is anything else ... Do I have to become creative using Clarisworks for three years? It looks like ... [this] program [is] exhausted and we are only half way through the year ...  

(Geoff, Interview 2)

Whilst there may be some truth in this, I think it also reflects how much Geoff knew of the software and its possibilities. There is a particular difficulty for teachers, as Richards (1997) has noted, of connecting basic computer skills and literacy with applied knowledge in different curricular and disciplinary areas. After a year of talking and working with Geoff quite closely, I believe that his knowledge of both areas was not well developed.

In relation to his knowledge of computer systems, Geoff made the following comments during our interviews:

> There’s a lot of holes - terminology, I had a problem today and I didn’t know how to solve it. I don’t know where the manual is to solve it, I’ll go and ask [someone], or I’ll find another way of solving the problem. It may not be the quickest and the right solution so ... I think I had one of them today. I don’t know how I solved it. But you get by.  

(Geoff, Interview 2)

> I don’t know all the terms. That was one area - I still call the bottom part underneath the monitor the computer so that it’s a disk drive of all that’s incorporated in it - I don’t know if it is a disk drive or a computer - I don’t know is it both?  

(Geoff, Interview 2)

Comments of this type would not be made by a person who had a thorough knowledge of computer systems, terminology and hardware/software operations.

Further support for this view of Geoff’s understanding of computer systems is found in his responses when I had asked him about any
frustrations he had during particular lessons. At these times, he drew attention to his lack of knowledge:

Well, I tried last week to fix the Chooser\(^\text{15} \) sort of things. Like - see the first two there? Then I went to the third one. The first two I got working then I did the same whatever you like to call them constraints or variables, set them up the same and it didn’t work. (Geoff, Interview 4)

My experience, as the person who would often have to fix these problems, was that very simple changes to the Chooser and checking of connections would resolve the problem.

**Pedagogical Content Knowledge**

Olson (1988b) has noted that

… software is, at the heart, “ideaware”, and the more the “idea” of the software is transparent to the teacher, the more likely the challenge to “ideas” in everyday practice can be discerned by the teacher … (pp. 56-56)

Geoff’s ideas of what to do with the software were limited as evidenced in his claiming that the entire value of Clarisworks would be exhausted by half way through the year - and I believe this is a direct indicator of his basic computer skills and literacy and how they may be applied and integrated within courses of student, which is pedagogical content knowledge. The very limited range of modes in which Geoff used the computer with Year Three I think is further indication of his level of knowledge.

I now turn to a discussion of Geoff’s practical theories of teaching, including his fundamental values, disposition to problem solving and being flexible, and also the nature of the class work which occurred.

\(^{15}\) The Chooser is software within the Macintosh operating system, the purpose of which is to select the printer to be used.
Practical Theories of Teaching

In this section, I interpret Geoff’s practice in terms of the assertion that classroom actions of teachers are guided by internal frames of reference which are deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences (Marland, 1995). I call these frames of reference ‘practical theories of teaching’ because they have the characteristics of a theory - considerable explanatory and predictive power for the teacher concerned (Marland, 1994, p. 187) - and because they are directly related to Geoff’s practical action as a teacher. I have come to understand Geoff’s teaching practice as being organised around the following: participation for all students and an atmosphere of belonging and achievement; a belief that learning should be enjoyable; an endeavour to value students as knowledgeable participants and to create opportunities for experiential learning; working for positive and affirming relationships with students, and an ability to problem-solve, modify, innovate and ad-lib. I now proceed to discuss these in greater detail.

I consistently heard from Geoff that his teaching was pitched at encouraging participation for all, belonging and achievement:

… the things I do - the way I’ve set things up for people is that everyone can belong, and participate and have a go no matter what their abilities are … (Geoff, Interview 1)

Within the ambit of participation, belonging and achievement, there are a number attitudes which Geoff highly valued. Geoff frequently expressed a belief that learning should be enjoyable, for example”

…so I’ve just got to provide the foundation that they enjoy sport and are prepared to have a go and they’re not feeling bullied or stirred or whatever. So … that’s probably how I see my job … (Geoff, Interview 1)

Geoff endeavoured to seriously value students’ prior experience, as he explained at the second interview:

I’m at the moment finding out how much they can handle, what their … trying to assess what experience they have had. Some students have had experience at
home, some have had only ...up to grade one ... seeing we start teaching on the Apples at grade two, at least I’ve got a starting point at grade two.  

(Geoff, Interview 2)

And Geoff also valued students as **knowledgeable participants**:

The best thing now is that the teacher is not afraid to take the laptops in the classroom. So if it is not what she wants she can modify and change [what we have done in the computer lesson] and direct. The children will have a lot of answers and say, “No, this is the way it’s done”.

(Geoff, Interview 2)

Geoff believed that **good learning experiences were often experiential**. A number of times in our interviews, Geoff commented that to learn about computers he had played around with computers himself and experimented along the way. Geoff appreciated that teaching computing offered him more scope for allowing students to experiment than did PE teaching:

But then computers is probably a little bit different because they can go off and discover within the boundaries, the limits, that you set ...because 30 kids all doing shotput [sic] at the one time, you can’t let them go and discover how to do shotput [sic] a different way, you know ...

(Geoff, Interview 1)

In accord with this, Geoff was generally happy to allow students to experiment and did not try to maintain too much control over student progress:

The biggest problem, I think, with any of them - they like to play with the Tool Bar a little bit too much and the biggest lesson they are going to learn is, through experience, to type first and then to play the Tool Bar afterwards - change it, modify it, to suit the page.

(Geoff, Interview 2)

On a number of occasions, I asked Geoff what pleased him about a computer lesson. Geoff consistently referred to participation for all,
belonging, and that he valued **positive and affirming relationships with students.** For instance, at our second interview he noted:

> I was quite pleased really at the start you know how I included everyone. Just the teaching sort of things, I was quite pleased with generally how that all went.  
>
> *Geoff, Interview 2*

It is important to note that when discussing what pleased him, Geoff consistently drew attention to his relationships with students and their intellectual and social development; he did not ever refer to the technology.

One hypothesis, therefore, is that the relationships with students mattered more to him than the technology. An alternative hypothesis is that he experienced so many difficulties with the technology (see the discussion on his frustrations below) that he was never pleased with the technology, and that relationships with students gave him something positive to talk about, regardless of how central they were to his beliefs about teaching. There may well be some truth in this second hypothesis, but Geoff’s talk of relationships, participation, belonging and achievement is very consistent over the year and spans his teaching in all the disciplines and classes which we discussed is evidence for the first hypothesis. That is, the teaching context (be it PE, computing, library or some other task) serves as a vehicle for Geoff’s teaching to express those things which he values most.

The practical theories of teaching, as just described, relate to Geoff’s pedagogy in general, but one particular manifestation of that is how he goes about teaching unfamiliar content in unfamiliar circumstances. In our first interview, we discussed how he approached the teaching of unfamiliar material, and Geoff drew on his experience of taking a library lesson. This had many parallels to his teaching of computers, as he was a self-taught library teacher and the library lesson was the same proportion of his teaching load as was his work with Year Three on computers. Geoff commented,
It’s been a tough task for me that because I really only teach one lesson a week - two lessons a week - so I don’t know - you go in there with your own flavour and I relate it to reading stories at home with my own children, you know, so I practise reading better when I read to the children - I know that after reading to my own children for so long, I’ve worked out ways of keeping their interest there, and I ask them a lot of questions and I make sure the books relate to them, so I just take that into the classroom. To become a better librarian I need to be in-serviced and I need … you know ...and it’s the same I’d say with probably anything new I’ve had to take on I can only do it from my own experiences and the best I can - and then unless I get training or syllabus or there’s some guidelines or whatever [it’s quite challenging].

(Geoff, Interview 1)

Whilst there is the sense of feeling professionally deficient or unprepared, Geoff draws on experience both as a teacher and in his life beyond the classroom; the importance of maintaining fundamental values informs his practice.

Geoff’s values also give insight into his confidence in the computer classroom. His lack of knowledge in a number of areas (software, computer systems and general professional issues) gives rise to a sense of insecurity and lack of confidence, but there is an over-riding sense in which he is fundamentally very confident. This is indicated by interpreting those things which he values through the perspective of perceived self-efficacy, which is defined as “individual’s beliefs about their ability to perform particular actions or attain certain goals” (Gorrell, 1990, p. 77) and is related to self-perception and self-concept. Self-efficacy relates the choices people make to their aspirations, their efforts and perseverance. Gibbs (1999) has commented that it is well established in the research literature that highly self-efficacious teachers are the ones who are most likely to take on innovations and new approaches to teaching. Studies which have considered the relationship between perceived self-efficacy and computer use (Olivier & Shapiro, 1993) consistently report that perceived self-efficacy is a good predictor of computer attitudes and usage patterns. From my observation of his classes and his interviews, I would describe Geoff as very highly self-efficacious and exceptionally
innovative. Interestingly, Gibbs (1999) has noted that other research has suggested that self-efficacious teachers are likely to describe their class settings in terms of warm, interpersonal relationships, and emphasising academic endeavours. This reflects Geoff’s fundamental values as a teacher.

I now turn to a discussion of Geoff as a problem-solver and innovator, a factor which I find to have very powerful explanatory and predictive power in relation to Geoff’s practical action.

’Problem Solving’ as Fundamental to Geoff’s Pedagogy

Throughout our interviews, Geoff described himself using a number of ways which I found interesting: bravado, problem-solver, modifier, innovator and ad-libber. He acknowledged that there were many deficiencies in his knowledge and, therefore, that he experienced problems which he did not know how to solve. When asked how he tackled such situations, he replied, on separate occasions:

[I’m] just a smart Alec. I try the very best I can. I play, I try and look at the words, I read, I try and create the answer myself and then 99%, every now and then I don’t, but then I solve the problem … (Geoff, Interview 2)

Geoff viewed problem solving as an important skill in which to immerse his students, as he explained at our second interview:

…[it] … worked with it centred but when they printed it wasn’t centred so we had to look in the format section, document format, to check it. Then when we set it all up using the same distances from left and right it didn’t produce the same result on two different printers which … that threw me straight away. So then we worked out well, this printer is either throwing a bit of paper at the start or something like that and we then just altered it to that printer. So that was another skill in itself so you know, one or two mistakes or not mistakes but problems
sort of … that’s another lesson in itself. So the guys seemed to cope with it really …  
(Geoff, Interview 2)

Geoff summarised his approach to working with computers:

… even if I can’t solve the problem correctly I’ll work out a way they can still continue to work …  
(Geoff, Interview 2)

However, Geoff was still conscious that his ways of solving problems might be inefficient, incomplete or erroneous. There was a touch of sarcasm in his voice when he told me “and people say, ‘Perhaps you should have done it this way’, or ‘that’s a novel way of using a spreadsheet!’”. At another time in our interview, he quite clearly stated “I don’t know if that’s the right way to solve things but that’s the way I think”.

Geoff’s problem-solving skills were integral to, and a general feature of, his work life at Outeast College. To underline this, which I believe is absolutely fundamental to understand Geoff’s use of computers, I quote his description of how he modified and innovated in four arenas of his professional life. In reference to his work as a teacher of PE, Geoff reflected,

It’s been … difficult … we’ve always had the problem with resources … to me … the maintenance men and … [other colleagues] … we became innovators, and we worked ways around things, by looking after budgets and labelling and a whole lot of different things like that - instilling ways of looking after equipment, we’ve been able to buy more and more and more and being able to, then provide en-masse, you know, lots of work in the PE side of things and that’s been great because, because, where you’ve been deficient in say buildings and whatever and grounds, we’ve been able to catch up in other ways - say, we worked around that way and perhaps that’s structured the type of teacher I am as well. When we have a gym and things like that well I’m going to have to change - to having everything and then you’ve got no excuses with grounds.  
(Geoff, Interview 1)
In his work with other PE teachers in neighbouring schools, implementing his beliefs of fairness and inclusively, Geoff commented,

"I would say I would be one of the leading modifiers, I would say nearly in Victoria. I've got the whole district to change all their rules to modify - to look after 90% of the students - where all the rules are written for people who go on to the State championships and Australian championships, which doesn't cater for the majority of kids in the thing ... I've got school sports, which are modified now, even so the [smaller] schools are competing on equal terms where the big schools don't dominate all the time."

(Geoff, Interview 1)

And more particularly, on a lesson-by-lesson basis, Geoff commented that innovation and ad-libbing were a necessary and essential part of his teaching repertoire:

"See, with PE you're a perpetual 'ad-libber' ...if it's windy, or it's raining - or you go out and you've got a lesson planned, and the Year 12's are on the courts - you've got to change and adapt, so you're a perpetual innovator and making things work - depending how the kids are - silly or crazy they come out. [You see, like] PrePrep last period of the day - you're never going to be able to get anything out of them, so you've got - the minute you try - you're just beating your head up against a brick wall - and you give up so, you've got to change, so - I don't know, perhaps I'm an adaptor.

... probably the really good teachers get to plan what sort of person they're going to be, before the start of the lesson - it sort of comes out in me by feeling the vibes of what the students are like, how I am, and what the weather's like and what we're learning and whatever, so I have to adapt to the lesson, very quickly, so perhaps I've got a lot of hats!"

(Geoff, Interview 1)

Particularly important in the following quote is that the ability to ad-lib is not tied to content:

"Come and teach ... Year Eleven computers. I'm not afraid to get up in front of anyone. I'm not afraid to say
“I don’t know”. I’d rather learn from the children if I don’t know. There’s always some way we can learn - I’ve always felt I’m capable at anything, and [every]thing. Perhaps I’m not, but it’s good to have that sort of bravado anyway - you know, to come in and say “Hey, I can do it” - I’m not really frightened of it and if I am I’ll admit it and they can teach me and if I can’t catch up real quick and take them the next level well then - well I’ve never had that, but perhaps - I’m sure - Year Eleven Computers would probably run rings around me - I don’t know.

But that’s the philosophy I’ve had in really anything - but perhaps if I went higher up and, you know, I’d taken them to my maximum amount of knowledge that I had - and then someone had taken them further then I would be deficient, but then I even see deficiencies in the senior PE, so I don’t really feel frightened to take anything in there.

(Geoff, Interview 1)

Having heard Geoff consistently describe his work life in the preceding terms I do not find it at all surprising that Geoff takes that same problem-solving, bravado, adaptive and creative approach to his work with the Year Three class and computers. Indeed, it was the basis of his lesson-by-lesson planning and survival. Not only did he rarely plan any lesson in detail, in an effort to ‘fit it to the moment’, he did so in order to be flexible in his interaction with the class teacher. This suggests to me a teacher who is confident in his teaching.

Geoff’s flexibility and adaptability are also reflected in how he coped with the many changes which he had seen in the school. He presented a philosophical and long-term view of the changes at Outeast College, indicating that they offered him the opportunity to become more flexible, a better Jack-of-all-trades:

… I think it really comes down to the person’s flexibility and their willingness to say “Hey, it doesn’t matter” and go home and forget about it …

(Geoff, Interview 1)

Particularly revealing was the comment which Geoff made:
I’m a product of this school and all the principles and the systems that’ve evolved, and that we began with and looking out at other schools - I feel I’ve fallen behind with the world anyway …  

(Geoff, Interview 1)

The very essence of what it is like for Geoff to be a teacher is very strongly associated with how Outeast College has shaped him as a teacher. He is a flexible teacher because the demands of the school have shaped him that way.

**Achievement of Outcomes**

I have come to think of Geoff as outcome-orientated and goal directed in his work. In our first interview, he explained his approach to teaching, as applied to both PE and computing:

… the main thing is you have the skills that you want to achieve within the lesson - and then you want to use them in a practical sense - and then at the same time if you can get them to enjoy it at the same time well then that helps the learning …  

(Geoff, Interview 1)

In that interview, it became clear that Geoff had developed the pattern of students doing both PE and sport - PE was the training in basic skills which could be used in the playing of sport. For Geoff, it was a requisite of playing sport that each student could perform a skill to a certain level. Indeed, his efforts to foster participation in sport was in part built around creating a skills-based PE program to ensure that all students learnt the necessary skills so that participation in sport was not denied to them. Geoff was used to thinking in terms of a ‘skill’ versus ‘application’ dichotomy, and his talk about his computing frequently reflected this. For instance, he saw his role, in part, as assisting students to develop certain skills so that they could take them back to the classroom to use. His approach to the computing lessons was to help students to ‘produce’ the work products as stipulated by the classroom teacher.
When he spoke about students’ work with computers, Geoff invariably used the verb “do”. For instance:

They have their text books and their work there and they used it to do a project I suppose.  
(Geoff, Interview 2)

And the same kind of language is used when he talks of his own work in the classroom:

I probably had to do a lot of the work that the class teacher should have done in the classroom.  
(Geoff, Interview 2)

This observation is important because I never heard Geoff describe the students’ or his own work using alternative verbs such as “thinking”, “learning” or “creating” which could be appropriate in some instances. I believe that the language which came to mind reflected his general disposition towards being goal-directed. To make this assertion, I draw on the thesis articulated by Munby (1987, p. 380) that the speech used by teachers when they talk about their work represents something to them, and that if a particular form of language is used persistently, then a case for representing a construction of reality through them becomes more compelling. Within a ‘doing’ or ‘production’ mindset, the students were in the room to produce certain pieces of work, not to think, create, imagine or explore. This is congruent with Geoff’s general orientation towards being outcome orientated.

The very basis of Geoff’s class organisation and routines parallels his PE lessons, as described earlier. A goal-directed and outcomes-orientated approach is also highly appropriate for many aspects of PE teaching. Indeed, I would argue that almost every aspect of Geoff’s teaching with computers has been appropriated from his PE teaching. In other words, the subject subculture of PE teaching is an extremely powerful influence on Geoff’s pedagogy in the computer laboratory. At quite a deep level, he is a PE teacher who is teaching computing.

Furthermore, I believe that this orientation towards ‘production’ emphasises the importance of the one-to-one relationship between a
computer and student as described earlier, because this is the way in which production would most efficiently occur. The subtle influence of the arrangement of the classroom is not at odds with Geoff’s fundamental goal-orientated disposition.

This concludes the discussion of the factors which are explanatory and predictive in respect to Geoff’s practical theories of teaching. I have found that Geoff’s pedagogy with computers is strongly based on pre-existing practices. I now move on to discuss the difficulties and concerns of teaching with computers as experienced by Geoff, a self-taught computer-using teacher.

**DIFFICULTIES AND CONCERNS WITH COMPUTER USE**

In this fifth substantial section of this chapter, I discuss difficulties and concerns which Geoff faced in teaching with computers, relating this to the literature review presented in Chapter Two of concerns typically identified by teachers.

The need to **disrupt teaching and classroom routines** can be a considerable detractor from using computers in teaching. As a specialist teacher, Geoff was not affected by this issue; indeed within limits, it in fact suited his disposition towards being a Jack-of-all-trades. Geoff was highly reliant on work set by the classroom teacher in order to formulate his lessons, and in the sense that work was invariably set by the classroom teacher for Geoff to follow, this did not represent a point of fragility. However, I have earlier stressed that the **co-ordination and planning** between Geoff, the computer specialist and the classroom teacher should have occurred, and the sense in which this did not occur was a point of fragility. As Geoff commented,

... with computers, my concern is not, not knowing, not knowing what to teach next term. Not having really a [Year] Three syllabus or anything like that to have a look at…

*Geoff, Interview 1*
A specific instance of fragility here is that because Geoff’s teaching was directly reliant on the work set by the classroom teacher, there was little variation in the tasks set (mainly word processing and presentation tasks), and consequently Geoff’s use of different software types was very much narrower than it might have been.

As described in Chapter Two, there are numbers of studies in the literature which report that computer use in teaching lessens time available and \textbf{down-grades the salience of content}. From Geoff’s point of view, as a specialist teacher, he did not have an option of using or not using the computers and so these issues did not effect his pedagogy. However, from the point of view of the class teacher, she was able to have students use the computers to complete work under Geoff’s guidance, and therefore partly distance herself from the responsibility of using the computers with Year Three. Whilst Geoff told me that computers were used in the Year Three classroom, he always implied that they could be used more. The issue of computer use intruded on other (more highly) valued content or teaching/learning activities. Geoff himself was not affected, but it was still an important influence in the setting of which he was a part.

Newhouse (1998), for instance, has drawn attention to \textbf{haphazard development of skills} as a point of fragility, and Geoff was concerned about students’ skill development on the computers. In fact, he commented that the work being set by the classroom teacher did not allow him to spend time teaching what he thought of as fundamental skills. As a PE teacher, Geoff thought in terms of skills, and he was concerned over the lack of planning and co-ordination relating to how students’ skill with computers would be developed. According to Geoff, the class teacher was not developing the skills, but equally he felt that he was unable to plan to teach these effectively.

\textbf{Suitability of hardware or software} has been identified in the literature as a point of fragility. There is no evidence that the software which Geoff was using (Clarisworks) was age-inappropriate or that it was unsuitable for the
tasks, nor was there any evidence that the computer hardware was not appropriate for the tasks. I have previously noted Geoff’s immature pedagogical content knowledge and his limited capacity to treat software as ideaware for teaching and learning activities: the sentiment that Geoff repeated on many occasions that he would run out of things to do with the software. This was a very important point of fragility.

Class management issues in a computer laboratory have been identified as a point of fragility in the literature. This does not seem to have been an issue for Geoff at all. The shape of the lessons were very similar to his PE teaching, and because he valued students as knowledgeable participants, I did not observe any occasion when he felt that his competence and authority were threatened. Lynch (1999) in particular found that, when working in a computer laboratory which was the province of specialist computer teachers, that teachers were perceived (by themselves and their students) to be subject to the rules, routines, expectations and knowledge of someone else. Whilst the computer laboratory in which Geoff taught was very much the province of our Junior-school computer-specialist colleague, I have found no evidence to suggest that the perceived ownership of the physical space and the social dynamics to which competing senses of ownership might give rise affected Geoff’s teaching in any way.

Technical problems were widely cited in the literature as points of fragility, and this is particularly true in Geoff’s case. One example of the difficulties was when Geoff had spent over seven minutes trying (in vain) to correct problems with the printers. He commented,

Still had trouble with the computers. A lot of them aren’t connected properly to the printers so when they go to print it’s Chooser settings that aren’t right or the lead settings … aren’t set properly. And I usually go through the Choosers but if I still can’t get it to work I haven’t time to check the leads.  

(Geoff, Interview 4)

As discussed earlier, I think there is a high correlation between technical problems as points of fragility and Geoff’s knowledge of computers. But
this is a very important point of fragility because Geoff didn’t find a way to work around the problem. In fact, printer difficulties led, on at least two occasions, to the lesson almost completely breaking down.

Geoff identified **lack of knowledge** as an important point of fragility. During our second interview when I asked what things had frustrated him, Geoff replied,

> Low points? Probably not being there to answer questions, I suppose. That’s probably the main thing. Not knowing the answer ...  

*(Geoff, Interview 2)*

Geoff’s case illustrates the importance of **resourcing** as a point of fragility. It could be argued that the provision of more technical support staff might have resolved the previous problem, but more importantly it was the resourcing which would need to be provided to enable Geoff, the Jack-of-all-trades, to do his job effectively. As he commented:

> ...I don’t mind doing all the different things, it doesn’t worry me, because it’s perhaps good for me - but you need extra time to do a whole lot of new things well - and if you’re not given that - and if the support’s not there and you’re left to run high and dry - you know - and you’re still expected to perhaps do what your job was last year, and then take on an extra twelve lessons in other areas - you can’t do anything well - I don’t think - well perhaps you can, but I’m finding it a bit tough at the moment.  

*(Geoff, Interview 1)*

Teachers need to be appropriately resourced in terms of their teaching loads and the physical equipment available to them.

**Lack of control over the facilities**, was a particular point of frustration for Geoff. At different times, he had reason to comment on such things as the changing furniture (varying number of type of chairs and tables in the room), the availability and location of basic necessities such as print cartridges. Management of student disks was a major difficulty. Because of the way the computers were set up, students could not work without a
disk, and also losing work which had previously been started was a problem. Geoff commented about

... losing someone’s disk. I tried to solve the disk problem. I think the disks should be housed in their classrooms because then the teachers [are] encouraged to use them in their classrooms and they are with them all the way. And then if they lose them the classroom teachers lose them. To be left here on the shelves anyone can take them, if there’s no-one in the room for a long time - unless they are locked away. And I think it is probably better to be locked away in their own room than up here. That means losing someone’s work - there’s a lot of work done for nine weeks - you know - is a bit of a problem.

(Geoff, Interview 2)

As I have come to understand it, the difficulties that Geoff was experiencing in this regard were not those of trying to fit into someone else’s rules and practices (those of the computing specialist). Rather, the difficulties arose because no-one was taking responsibility for the management of the resources. I observed no problem of a major kind in terms of resource management: the room was always reasonably neat, few computers suffered technical problems throughout the year and the facilities were always available when Geoff needed them. The difficulties being experienced were at a closer level of detail (issues of disks and printers). Even so, they constitute a point of fragility because a satisfactory lesson could not proceed without a solution (or interim resolution) to these difficulties.

This concludes the fifth major section of this chapter, the discussion on the difficulties, frustrations and points of fragility experienced by Geoff in his teaching with computers. Of the various frustrations and difficulties suggested by the literature and experienced by Geoff, I believe that the following constituted points of fragility: planning and co-ordination of content, limited technical knowledge and pedagogical content knowledge (software as ideaware), technical difficulties, resourcing and lack of control over facilities management.
I have earlier stated that unique to the role Geoff found himself in, learning to be a computing specialist was a matter of negotiating a tripartite working relationship between himself, the acknowledged specialist and the classroom teacher. In doing so, Geoff needed to create a way of working as a computing specialist, as his role would be a new one and he could not simply assimilate a pattern of working which had been prescribed or which had been worked through by someone else previously. In this section of this chapter concerning the pedagogy of Geoff, a self-taught computer-using teacher, I address the issues concerning the formulation of the role of computer specialist.

In discussing his role as computing specialist, Geoff commented at length that

the good thing about that is that they have work and ... to do ... the problem with that is though that either the work is the same for three or four weeks or four or five weeks or whatever unless they do some of the work in their own room or they come in and use the computer lab in their own time ... So then, when they come in, you know, they really just have to work, to get onto it and to interrupt them, to teach them something is a lot harder especially when I don't have them in - I don't mind having a project sort of lesson but if they had another lesson that was like a skills lesson that they could practise all the skills that they need and then they could ... do all the skills in their class room and perhaps come for, you know ... become[s] like a typing lesson in a sense. You know, we are just fixing up certain little problems along the way. But as soon as you start teaching them, you're taking away computer time or typing time away from the students and that's sort of what holds them back the most. So their teacher is using the lesson well but I think they are still shying away from taking the laptops to their room, or using the lab or whatever ...

(Geoff, Interview 3)
In other words, Geoff values doing what he can to promote and extend the integrated use of computers, and to that extent he is pleased that the control of the lesson resides with the classroom teacher. And yet he finds that this drives him into a role which he does not find fulfilling and has disadvantages in terms of developing students’ skills with computers. He would prefer to be proactive and actually be teaching the students some specific content or skills, but finds himself “fixing up little problems”.

Geoff’s conclusion was that in an environment which encouraged the integrated use of computers, the role of the computing specialist would clearly have to be different to what had been, as he commented,

If [students are going] to use laptops in the classroom a lot more and the teachers aren’t doing it and now they are starting to, well, that is going to change my job quite a lot.  

(Geoff, Interview 2)

Importantly, the role would have to be carefully constructed to ensure that the specialist remained a ‘real’ teacher with some responsibilities and control over content, as Geoff explained:

[Assisting the classroom teacher is] ... not going to be very good for me because ... it ... is just one form of teaching. So then I’m complementing the teacher who’s teaching the work, like to do a program or whatever and I’m also helping the classroom teacher. So I’m an assistant in a sense.  

(Geoff, Interview 2)

Geoff was insightful at giving advice such as this, but what is striking is that in the study of Geoff, I have found a litany of caveats and suggestions such as these, but no evidence that any action was taken by Geoff or anyone else to actively create a suitable role for him. The conclusion that I have drawn is that no-one was prepared to take responsibility for Geoff and his role or to give leadership in how it might play out in practice. There are a few factors which might explain why this might be: busyness, the somewhat strained and unhelpful relationship between Geoff and the computing specialist, and a lack of knowledge or inspiring ideas.
Throughout the year, Geoff is also caught in a tension - on one hand valuing the teaching of computer skills, on the other not wanting to be “the assistant” that this might imply. This is entirely compatible with Richards’ (1997) findings that such concerns are very much at the heart of teachers choosing to use (or not choosing to use) computers in their classroom practice. However, Goodson and Mangan (1995) found that this ‘hard’ dichotomy may, however, soften overtime, as cultural interplay and negotiation proceeds. There is no evidence that, over the course of a year, Geoff’s role changed, that he became any more reconciled to the nature of the dichotomy, or that new ways of working emerged which in some way ameliorated these concerns.

I have described Geoff’s pedagogy in relation to his use of only software packages as competent but uninspiring. I feel the same about the evolution of his role. Geoff managed to teach the allotment he was given but there was very little development of his performance in this role or in the structure and conduct of his classes. It was, I believe, a case of opportunities being lost. Geoff commented in our third interview:

> [if] I had four period lessons in a row … you could do something about fixing computers or setting up or spacing, getting the chairs right, you could work out where you were going to sit people and how you are going to do things. You could try things, you could ask questions but when you come in for one lesson you don’t really feel like it - it’s just like taking an extra. You get what I mean? You really … your heart … your heart’s there, but unless you’ve got more time you don’t have a chance to better yourself, I find.  

*(Geoff, Interview 3)*

I am inclined to think that social and political realities of his job made it difficult, but fundamentally, his heart was just not in it, and he really did, as he told me at one time, aim to simply survive the year. One is unlikely to go out of one’s way to grow if one is aiming to merely survive.
Geoff’s Aims for Teaching

A consideration of Geoff’s aims for teaching has been deliberately left to the end of this chapter. If we rely on Geoff’s explicitly articulated aims for teaching, then we have a portrayal of Geoff who makes little advanced plans for teaching and who told me that his major aim was to survive the year. According to a view of evaluation which measures success by the extent to which explicitly defined behavioural objectives have been achieved - that is, a Tylerist view (Davis, 1980, p. 24) - Geoff’s work suffered from an almost total lack of direction and would constitute a story of failure.

However, if we attend to Geoff’s implicit aims and goals which imbue his teaching it is not a story of failure. It was certainly his aim to support the classroom teacher. He also told me that it was his aim to have students use the computers for the whole lesson. Geoff was keenly aware that his lessons represent a substantial percentage of the time which his students spent using a computer in any given week, and he was committed to maximising that opportunity. Each lesson, Geoff conscientiously and spontaneously created a lesson which unfailingly fulfilled the classroom teachers’ aims as he understood them, and endeavoured to minimise the amount of teacher talk and maximise student work. The patterns of classroom action presented in Figure 1 indicate that he was largely successful in that.

Moreover, Geoff’s fundamental values and practical theories of teaching are consistently revealed in his teaching practice: participation for all, belonging and achievement, learning as being enjoyable, valuing students for their prior experience and as knowledgeable participants, and the importance of experiential learning. Geoff’s problem-solving strategies can be thought of as a model for students of how they might tackle unfamiliar and vexing difficulties as they work with computers. I do not think of Geoff as someone who is aimless in his teaching with computers.
(although he seemed to think of himself in this way), but it has taken the bulk of this chapter to present sufficient evidence to support this assertion.

**Conclusion**

In this chapter, I have presented a descriptive account of the unique perspective of Geoff as a self-taught computer-using teacher. I have considered Geoff’s particular background, experience with computers and the context of his teaching; Geoff’s pedagogy teaching with computers; and the factors which limit and promote his use of computers.

I now turn to the case studies of Howard and Arlene respectively.
CHAPTER 6 - HOWARD

In this chapter, I present a case study of Howard and seek to understand, from the perspective of the relationship between knowledge and pedagogy, why teaching and learning occur in the particular way they do in his classes. As for the preceding chapter concerning Geoff, this involves considering both what teaching and learning I have observed by providing a rich descriptive account of Howard’s pedagogy and teaching circumstances, and also interpretation of the data to provide an understanding of the relationship between teachers’ knowledge and pedagogy. Both aspects of the discussion are interwoven in order that Howard’s story might be best told.

This chapter is presented using the same organisation as in the previous chapter on Geoff, in five substantive sections: Howard’s particular context, his organisational circumstances, the features of Howard’s pedagogy, Howard’s personal attributes and the factors which limit or promote his use of computers. In the third section the use which Howard makes of computers in his teaching is discussed, and in the fourth section I consider the impact and implications of familiar pedagogical patterns on Howard’s teaching with computers.

BACKGROUND

Howard is a male teacher at Outeast College, and had taught there for just over eight years, having completed his teacher education course approximately 18 years earlier. Howard’s teaching career, as he told me during our first interview, is marked by being an English teacher during an era when there have been infrequent vacancies for English teachers. His initial appointment at Outeast College was to teach English and SOSE (Studies of Society and the Environment), but more importantly to work with overseas students. The first full year that he taught at the school was also the first year in which the school offered places to 120 overseas
students, and Howard was appointed to the role of International Student Co-ordinator (ISC).

Howard was ISC and a teacher of English as a Second Language (ESL) when I first met him, and it was as a teacher of Year Eleven ESL in which he participated in the present study. In our first interview, Howard outlined his career trajectory. He had moved directly from school to university, and much of his teacher education experience had been in a school with a great many migrant students. During his university studies, Howard had a church-based position as a worker for human rights and justice. Following teacher education, Howard told me that he had spent about six months as an itinerant teacher taking any job he could find before taking a permanent position in Singapore. Howard explained,

Four years, teaching in a secondary school ... Christian Brothers. Year[s] Seven to Ten as a regular teacher. Permanent job. Teaching English, Geography, Bible Study, PE.

... I came back here and did a bit of post-graduate study ... looking at Singapore literature in English ... and I was also doing quite a bit of emergency teaching during some of that time, again I did three months full time at ... [a particular school] in the small ESL department. With a very good teacher ... [she became] sort of my mentor in terms of ESL teaching. And then I was back there on and off at different times ... [and then] I was offered a job here.

(Howard, Interview 1)

In introducing Howard, I next present my understanding of him as a self-taught computer-using teacher.

Self-Taught and Computer-Using

By his own admission, Howard’s handwriting was a problem (personally, I have found it almost illegible). Because of this, Howard had used a typewriter for many years, and would use a typewriter to prepare almost
all written correspondence: notices to staff, school reports, letters, memoranda, and personal correspondence. During our first interview Howard told me that during his university studies, he had prepared a 25,000 word thesis using a typewriter, and typed it twice (for the draft and final copy respectively). Despite his personal reliance on the typewriter, Howard was not a touch-typist, but he described himself as an accurate and reasonably efficient two or three finger operator.

Howard’s first introduction to computers was two years prior to the present study. Therefore, of the three teachers in this study, Howard had been using computers for the least number of years. At that time, he and his family had recently purchased a computer for home use, and he was keen to learn how to use it, and so Howard was one of the small group of staff who attended the short computer course which I conducted that year. This course was an introduction to Microsoft Word for novices - four two-hour sessions to ensure that participants could type, save, layout and print a document. Howard told me that his initial learning about computers came from this course, talking with me (at school) and his wife (at home), reference to the online help system, and a fair amount of trial and error. I found Howard to be an enthusiastic learner, and we frequently had discussions regarding what courses, if any, he should enrol in. During the year in which the present study took place, the only course related computing or how to use computers in teaching that Howard attended was an external short course offered by a subject association on ‘Advanced Microsoft Word’, which was run over several evenings.

Howard told me that he found that he had picked up most of the basics of computer use through trial-and-error as he dealt with immediate problems as he went about using computers. He has continued to seek assistance from other users when necessary, and continues to make use of the online help system, but he has never made much use of manuals. Howard’s knowledge of how to use computers in teaching was, as he described it, completely “on the job”. As noted above, Howard had attended two short courses where he continued to learn computer skills,
and so he is not so completely self-taught in the same sense as Geoff. I asked Howard whether he thought it was accurate to describe him as “self-taught” and “computer using”, and he thought that it was. Certainly, none of the courses which he attended addressed issues of pedagogy; his attendance at these courses was at his own instigation, and so he was very much in control of his own learning process; furthermore, he has continued to learn much from trial-and-error, conversations with colleagues (including his wife, whom he described as a proficient computer user) and his systematic use of the help systems incorporated within the computer programs which he used.

I asked Howard why he made the transition from typewriter to computer. He said that the initial motivation was that it was “fashionable” to have a computer and to be using it both personally and in class; he felt that to continue to use a typewriter was a rather old-fashioned way of working. Howard had, in fact, used computers in his teaching for similar reasons in the year prior to the present study being conducted, though his use was not as regular or as systematic. In the terms used by Olson (1988b, p. 30) there is an “expressive purpose” for Howard’s use of computers (that is, a purpose which is directed to the formation of an impression of oneself in the eyes of others). There are also “instrumental purposes” (Olson, 1988b, p. 30) for Howard’s use of computer (that is, a purpose which is motivated by necessity). By using computers, Howard quickly discovered that it offered many advantages to ESL teaching: the ability to do such things as change the format of text, delete and replace text, and save for future reference. (A more detailed discussion of Howard’s beliefs of the advantages and disadvantages of computer use in ESL classes is presented in a later section of this chapter).

The range of software which I have known Howard to use was quite limited. Word processing was his staple, and it was his main form of written communication, replacing his former use of the typewriter. During the year of the present study, Howard told me several times that he was starting to get interested in desktop publishing, in an effort to
improve the layout and presentation of some of his written
communication. Howard was also one of a number of staff who were
starting to be interested in learning about Internet and electronic mail and
their pedagogical applications, but this was at the very early stages of
Internet availability in the school (refer to Appendix One). Whilst he
expressed interest in these technologies, Howard made no use of them in
class and found time for only limited personal investigation of them
during the course of the year. I did not observe him to make any use for
any other software types, including spreadsheets or databases. In contrast
with Geoff, who invented ways to use software (and therefore probably
used software in inefficient ways or ways not intended by the designer),
Howard was very keen to learn how to use a piece of software properly.
Within these constraints, Howard was an ardent experimenter. However,
it meant that if he wanted, for instance, to layout a table he would assume
there would be ways to do it in Word and would ask someone, and in so
doing slowly developed a sound understanding of capabilities and
principles of the software. In a similar situation, Geoff would have tended
to use a spreadsheet and not spend the time learning about tables in Word.
Howard’s use of software was unsophisticated, but he was aiming to be, as
he told me, a “good student” and thorough in his learning.

Howard believed that his skill level was sufficient for the tasks that he
wanted to take, but he was not confident of his own abilities, a point
which I elaborate on in a later section. Howard had used computers in his
teaching during the year before the present study, but compared with Geoff
and Arlene, Howard is probably the least experienced with computers. He
is also the one whose interest in exploring the applications for computer
use in his teaching had evolved most quickly.

I have broadly discussed Howard’s background and presented him as self-
taught with respect to pedagogy of computer use, and substantially self-
taught in respect to computer use. I believe that there were well-founded
expressive and instrumental reasons for him wanting to use computers in
his teaching. I now move to discuss organisational aspects of Outeast College which impacted on Howard’s teaching with computers.

THE TEACHER IN THE ORGANISATION

Whereas Geoff spoke at length in our interviews about his place in the organisation and the incumbent difficulties with which he had to work, Howard did not mention the organisational milieu at all during our interviews. That did not mean that he was not unaware or unaffected by the recent organisational changes in the school which Geoff had identified: uncertainty relating to the organisational hierarchy; the increase in the number of teaching hours; the implementation of a whole-school timetable; and the process of equalising teaching loads. I had noted in my journal that Howard had once remarked that his teaching load had increased every year since he had started at Outeast College. Howard worked long hours, often being one of the last members of staff on the school property, and he told me that he was feeling increasing pressure related to being effective in both the role of ISC and as a teacher.

There are three aspects of the organisation within Outeast College which particularly had a bearing on Howard’s pedagogy: Howard’s role as ISC, team teaching, and access to the computer rooms. These are discussed in the following three sections.

Howard as International Student Co-ordinator

In his role as ISC, Howard worked with students who had arrived from overseas to study at Outeast College and helped them adjust to living and studying in Australia. In the year in which this study was conducted, there were only 40 new overseas students, predominantly in Year Eleven, and class lists showed they accounted for approximately 50% of the cohort in Years Eleven and Twelve. Numbers of overseas students varied considerably from year to year, and most of them were from Asian
countries. Howard had a good background for this role: a long-standing empathy for students who had newly arrived in Australia, strong social-justice convictions, several years’ experience teaching students whose native language was not English, and, as Howard himself explained:

I have a fair understanding of where students are in terms of their English. I am able to use words and expressions they understand and have, I believe, a fair knowledge of their cultural and mental landscape. I also know something of the educational practice with which most of them are familiar and comfortable and the steps necessary to move them into more active roles as students.

(Howard, Interview 1)

Team Teaching

One particular aspect of Howard’s situation at Outeast College was his liking for team teaching. Howard’s Year Eleven ESL class consisted of 15 students, but there was a second ESL class, also small, running at the same times in the timetable, and taught by Angie. These two classes were timetabled at the same time precisely because Howard and Angie worked closely together and indeed team-taught on many occasions. Angie, in fact, had volunteered to take part in the present study, but had to withdraw due to illness. A consequence of Angie being ill was that, for several weeks at a time, Howard taught both groups as a combined class - a number of Howard’s classes which I had observed in the computer rooms were in fact combined classes16. A consequence of Howard’s preference for team-teaching was an increased workload for the times during which Angie was away.

16 Many of Angie’s students were in fact videoed whilst in the combined class conducted by Howard. This did not present any ethical difficulty for this study because Angie had agreed to participate in the study and permission had been obtained from the students in her Year Eleven ESL class and their parents/guardians to participate.
Access to Computer Rooms by Senior Students

The booking arrangements for the computer laboratory are an important consideration in Howard’s teaching life, and the frustrations he encountered. The issue here was not with Howard’s having found difficulty with securing computer room bookings whenever he needed them, but the school policy relating to the use of the laboratories by senior students. All students in Year Twelve had scheduled study lessons, and during these times they could use their study area, the library or, if available, a computer room. In practice, students were not allowed in a computer room without supervision, so if a class was in progress, and if it was convenient with the teacher, one or more Year Twelve students might be allowed to work privately on an otherwise-unused computer. This arrangement was signposted at each of the rooms, and it was clearly displayed that such use was at the discretion of the teacher. Such was the demand for computers at Outeast College that there would be numbers of students wanting to take advantage of this arrangement during each period of the school day.

Howard found the presence of “the Twelves” - as he referred to them - in the room to be a particular frustration. Only on very few occasions in our discussions did Howard mention that they worked sufficiently quietly or privately for his liking. Despite the problems associated with the presence of “the Twelves”, Howard stated that he was soft-hearted toward them, recognising their desire to complete work in an effective manner and the pressures they were under. One of the times when he made this clear was during our third interview:

... one thing [students I speak to consistently] identify [is that] ... the numbers [of students] have built up since last year significantly and they do have difficulty getting hold of computers during the day or laptops after school. So I am sympathetic to them ... But I am not prepared to sacrifice my Year Eleven class’ ... productivity to accommodate them ...I made sure that they were doing something focussed and so the numbers built up to about ten in there. I went over once just to see they were all doing the right thing.  

(Howard, Interview 3)
“The Twelves” added to Howard’s work load in the classroom, and I believe that the presence of them was one of Howard’s greatest frustrations when using the computer laboratory, one which he could have solved by simply saying “no”, and yet the presence of “the Twelves” in the classroom is a very real feature of Howard’s teaching with computers.

This concludes my presentation of Howard and of the particular organisational circumstances in which he worked. It is important to note that Howard saw his roles of ISC and ESL teacher as very much integrated and broadly based, and I will discuss these in a following section. I now move to a discussion of Howard’s pedagogy.

**HOWARD’S PEDAGOGY**

In this third substantive section of this chapter, I present a discussion of Howard’s pedagogy. I firstly discuss five important background factors which both influenced and were reflected in Howard’s pedagogy: planning and preparation, values and limitations of computers to the ESL teacher, aims for the year and factors inhibiting the achievement of aims. I then move to an account of the features of teaching and learning in Howard’s classroom which I observed (including a more detailed discussion of six particular classroom routines), followed by an overview of how computers were used in Howard’s classroom.

**Preparation and Planning**

One of the most clearly recognisable aspects of Howard’s pedagogy was his need to plan his lessons and to be well prepared, as he indicated on a number of occasions during the year. During our first interview, he commented,

> [On many occasions, I have] suffered from the occupational hazard of feeling that I do not prepare well
enough or put enough into classroom teaching. Too many other demands. Too teacher-centred when less well prepared.

(Howard, Interview 1)

According to Howard, maintaining a good fit between teaching practice and ideals is a matter of careful planning, and in fact would be quite difficult to achieve, as he commented elsewhere in our first interview:

All teachers get tired, they have a lot of demands on them, they run from one class to the other, they have the loose ends to tie up from the class before, they’re upset by a particular kid’s behaviour, or whatever. When you are under that sort of pressure you are more likely to take shortcuts to do things in ways that aren’t necessarily the best practice.

(Howard, Interview 1)

He was certainly not immune from compromising his ideals in the face of pressure. For instance, towards the end of the school year, in our third interview, Howard admitted, “[In] the last couple of weeks of this term … we’ve just flown by the seat of our pants in terms of Year Eleven ESL”.

Over the time in which I have closely observed Howard, it has become very clear to me that Howard strove for best practice, and adequate preparation and planning was an integral element of that for him. One of his beliefs about ESL teaching (as discussed below) is that it should be student-centred. During our first interview, Howard told me that he has thought of himself as less teacher-centred in computer use as the years have gone on (that is, genuinely handing over responsibility to students). Importantly, he remarked in our first interview that he found it easy to become teacher-centred when not as well prepared. A desire to be well prepared was very closely connected with his fundamental aims of teaching.

I noticed that Howard was meticulous in his preparation for lessons in the computer room. He was very careful to understand the exact commands and procedures which his students would be using when using the computers. He would practise them himself and write down the steps as necessary; how the students would use computers was always very well rehearsed and clear to him. That is not to suggest that he was beholden to
his prepared instructions or did not cope with variations which students might present, but whereas Geoff entered a class being simply comfortable to operate ‘on the fly’, Howard was less sure of himself. He needed specifics and he prepared effectively for his needs. Indeed, I believe his need to plan thoroughly for computer-based lessons had as much to do with feeling uncertain as it did with avoiding teacher-centred teaching.

I have found Howard to be planned, orderly and thoughtful in his teaching. He desired to be planned and organised, and was aware of the ramifications if he was not. He also established four quite specific aims for himself during the course of the study, and had given considerable thought to the value of computers to the ESL teacher; it is these which are addressed next, prior to discussing Howard’s aims for the year.

The Impact of Computers on ESL Teaching and Learning

Throughout the year, I encouraged Howard to articulate his views on the value of the computer-produced work compared with handwriting, and I found Howard to be very articulate and thoughtful on this matter. Whereas Snyder (1996) has commented that the hardware and software facilities available to the English teacher include word processing, databases, computer-assisted learning (CAL), text-analysis programs, hypertext and computer-mediated communication, Howard’s appreciation on the impact of computers to ESL teaching and learning was restricted to word processing. His thoughts also focussed on the values and limitations of computers, which parallels what Snyder (1996) calls the “first phase” of interest in computers in English teaching, when research was concentrated on quality and whether computers could be said to “improve things”. Whilst Howard was articulate and thoughtful, he did not offer any long-range vision of the impact of computers in the teaching of ESL of the sort provided by Snyder (1996) and Lankshear at al. (1997b). He had neither

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17 This piece is contemporaneous with the present study, and looks forward to the emerging Internet technologies which were only just becoming available in schools (Clarke, 1999).
encountered such works, nor was he an unrecognised visionary. In the following paragraphs, I present Howard’s thoughts on the advantages and limitations of computers to ESL teaching and learning, which arise from his own experience.

Throughout the year, Howard sustained four beliefs relating to the value of computers to ESL teaching and learning. Firstly, Howard believed that the computer could be used to assist with drafting, improving spelling and encouraging students to do more writing. There is support for this in the scholarly literature. For instance, Hartley (1993) considers that research into use of the word processor use predicts that there will be more drafting, longer texts and texts of better quality. Specifically, Howard considered that there were four advantages of using the word processor. Firstly, he commented,

I’m not sure [if using the computer will result in students producing more]. Some of them … may well produce more at this stage just by handwriting, but in the long term, given the nature of drafting and redrafting for CAT 1 and CAT 2\(^{18}\), it’s going to help them a lot if they get their skills up to the level where they can do first drafts on the computer. \(\textit{(Howard, Interview 1)}\)

A second belief which Howard articulated was the particular value of spell checking to ESL learning. In our second interview, using the example of the particular needs of one student, Howard commented,

Ben …[is very weak at English, and perhaps more than anyone else in the class] … needs to use a computer … His spelling is something atrocious. I mean, his sentence construction is - well - recognisably English, but his spelling often isn’t and if he could manage to get his text down there, and use the spellchecker, it wouldn’t magically provide the right word on every occasion, but he’d have more of a chance. \(\textit{(Howard, Interview 2)}\)

A third advantage of computers to ESL learning discussed by Howard related to the desirability of students proficiently using computers by Year

\(^{18}\) Common Assessment Tasks 1 and 2 respectively - school-assessed tasks contributing to the overall result of the subject at Year Twelve level.
they will have the ability to produce all of their drafts, for their CATS, and to do their revisions on computer. So, that is pretty significant for ESL students given that it can help them a great deal with spelling. I also think, speaking from personal experience, that one can think more clearly and edit and evaluate your own work when what you are looking at is classy compared with scribbly handwriting.  

(Howard, Interview 3)

A fourth advantage of computers to ESL teaching and learning discussed by Howard relates to the teachers’ role:

Similarly with my ability as teacher to mark or ... to make suggestions, corrections, whatever, kids who give me stuff on the computer I can do it a lot better for them especially if they do as instructed and these kids, these Year Eleven’s are doing as instructed, at least ten or twelve point, double spaced, one side of the paper, printed to a reasonable sort of standard. So they are all doing that and they are doing their revisions so in terms of word processing - heading in the right direction.  

(Howard, Interview 3)

If students are to have these benefits at Year Twelve, then it is most important that they be taught suitable computer skills in lower year levels. Any disadvantages of use in Year Twelve in terms of efficiency would be counteracted if suitable skills were taught in preceding years.

Several times during our interviews, Howard also drew attention to less tangible advantages of using computers in the ESL classroom: students liking for using computers, capturing their interest, and gaining pleasure from their composition and their ability to present work well.

Howard was also conscious of some limitations relating to the use of the computer for composition. He did not draw attention to concerns such as plagiarism or quality of students’ using work, believing, I assume, that suitable technical and procedural solutions can overcome these. Rather, Howard drew attention to the process of composition and the relationship between teacher and students which is necessary to achieve this:

…with the hard copy I have a set of sentences I use for correcting things I teach in Year Ten and Eleven and
employ in Year Twelve, where according to VCE guidelines you are allowed to identity their mistakes but not allowed to correct them for them so “v for verb” and “w for wrong word” and “sp for spelling” and things like that so I can teach them those things and help them get their corrected version when I am using hard copy. I obviously can’t write on the computer in the same way, but I can correct it for them or get them to correct it on the spot and I can write in paragraphs, write in sentences, highlight the words that are wrong on the screen just by double clicking on the word so “OK, these are the verbs you have got to fix up - we are talking about something in the past so we need past tense here”.

(Howard, Interview 4)

Howard was comfortable with the idea that hardcopy and softcopy offered different advantages and disadvantages. He was, in fact, thoughtful enough not to consider the computer (softcopy) as a panacea for all concerns within the ESL classroom, but as a tool which offered many advantages but also with disadvantages which the teacher and student would have to find ways of managing.

<table>
<thead>
<tr>
<th>For learners, word processing</th>
<th>For teachers, word processing</th>
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<tbody>
<tr>
<td>• enhances their perceptions of themselves as “real” writers</td>
<td>• permits them to spend more time on individual supervision and tutoring</td>
</tr>
<tr>
<td>• gives their text a better public image</td>
<td>• directs and controls the work of small groups</td>
</tr>
<tr>
<td>• brings their writing closer to public forms of communication and adult models</td>
<td>• gives a theme store of information on children’s writing and thinking</td>
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<tr>
<td>• gives them a new perspective on spelling and punctuation errors</td>
<td>• makes compositions easier to read</td>
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<td>• enables them to reflect on the thinking that goes on behind the writing</td>
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<td>• makes it easier for them to share their work with others</td>
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<tr>
<td>• encourages and facilitates collaborative writing</td>
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<tr>
<td>• gives them control over the pace and direction of their own learning</td>
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<tr>
<td>• helps them adopt an appropriately self-critical distance from their writing</td>
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<tr>
<td>• encourages experimentation and risk taking</td>
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<td>• provides a focus for group discussion</td>
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Table 5 - Advantages of Word Processing
according to Geisert and Futrell (1990, p. 111)
It is interesting to compare Howard’s perceived advantages and disadvantages of word processing with those presented by Geisert and Futrell (1990, p. 111), as shown in Table 5. Howard’s beliefs relating to word processing correspond very closely with the advantages for learners presented in this textbook which is aimed at encouraging computer use by teachers. Particularly, using the terminology of Siegel and Davis (1986) Howard perceives word processing as “process-orientated” - a tool that places as much emphasis on learning to write as on producing a finished composition.

Feeling that computers offered his students many advantages, Howard set himself the goal of learning to teach more effectively with computers during the year, and had established (in noticeable contrast to Geoff) several aims for himself.

Howard’s Aims for the Year

As I have already noted, Howard had used computers in his ESL teaching in the year prior to the present study taking place. In my opinion, he had used them for the same range of reasons (as described above) during the present study, and in fact he used his participation in this study to consolidate his pedagogy relating to computer use. Commensurate with his desire to be well-planned, in our first interview Howard clearly articulated aims for his work with computers over the year:

1. **Have students produce more.** Howard explained during our second interview that he encouraged his students to

   just go and write as much as they can, no matter how ungrammatical it is, even if they get the wrong words in there, even if they leave spaces for words they don’t know.  

      *(Howard, Interview 2)*

In other words, the issue of having students produce more related to the quantity of thoughts and words composed; Howard saw the use of computers as being a vehicle which would encourage students to
“produce more” because use of computers captures students’ interest and they gain pleasure from the presentation of their composition. I found it interesting that, as Howard himself stated, even though the final exams in the subject were written, Howard’s desire to encourage an increase in the quantity of composition over shadowed any reluctance to favour keyboarding over hand writing.

This aim also related to the efficiency with which the word processor was used, as Howard explained:

Yes, there is a lot of scope for them improving their actual technical skills, and not to waste time with formatting and doing pretty things. I really want them initially to get the words down on the page and later they can fix it up.

(Howard, Interview 1)

2. **Have students follow guidelines accurately rather than following well-worn and stale paradigms of writing.** Howard gave a very clear example of this during our fourth interview:

...they had a very conventional notion of how you do writing when you report about event, so they would always start off formularically [sic]: “on the 17th October ... [Outeast College] held its Presentation Night at Monash University’s Robert Blackwood Hall. The event began at 7:45. The whole school was in attendance. We gathered in the foyer and chatted with our friends and took some photos”. So ... pretty boring stuff ...I did [an oral presentation of that] beginning in a monotone and then I did an alternate version. “Henry ...moves confidently from the edge of the stage out to the centre. He reaches forward and takes the microphone. He bows his head in a moment’s concentration ...”.

(Howard, Interview 4)

3. **Successfully give clear directions in computer room procedures.** Howard explained,

I find it hard to break the link between the kid and their computer once they’re logged in and going it’s hard to get their eyes off the screen. It’s
hard to get their attention again, and so you tell them a particular procedure, but you find that half of them haven’t logged in properly. They think they have or they haven’t really caught on to the basic thing you’ve told them to do, so that’s a challenge.  

(Howard, Interview 1)

4. Use computers for teaching and learning tasks other than word processing, as he explained:

[When I’ve used computers in my teaching in previous years I’ve] mainly ... done word processing. Now, there is obviously a whole range of other things that can be done as an English teacher, and I would like to [do] appropriate work on some of those other things as well.

... And I’m also going to have to develop more skills myself too - insofar as I haven’t used a laptop yet and learn using the ‘net and things like that too.  

(Howard, Interview 1)

The fact that Howard had, of his own volition, formulated aims which we wanted to achieve during the course of this research project is evidence that he not only values planning and preparation, but is deliberately thoughtful about the detail of his lessons. In a later section of this chapter, I consider to what extent these aims were achieved. Before turning to an overview of particular routines and practices which are imbued in Howard’s lessons, it is important to note that Howard recognised that there were two important factors which might prevent his students from achieving the primary aims of “producing more text”. These are discussed in the following section.

Factors Potentially Inhibiting the Achievement of Aims

There were two factors which Howard identified as being important if students are to produce more text. The first is that limited knowledge of
computer operations might mean that lengthier texts might not be produced. As Howard explained:

> Going from personal experience, you think that people with appalling handwriting would be very comfortable to produce text on the computer, ‘cause you’ve done away with that problem. They certainly, I think, like using the computer - but part of it is they like to play with it - to format and stuff. And often, they don’t … maybe we haven’t taught them or they haven’t picked up enough of the skills of how to move around. Like they’ll use the up down cross arrow keys to go all over the page, rather than using the mouse to take a short cut.  

(Howard, Interview 2)

A casual observation which I had made as a result of having taught international students at Outeast College myself, was that I thought these students might have had experience with programs such as “Word Perfect” or “Lotus 1-2-3” (neither of which is necessarily mouse driven) in their home country. I discussed this with Howard. It was not an influence that he had considered, but he agreed that overcoming previously acquired habits and understandings was a problem in relation to efficient computer use. Howard’s basic point above, however, was that use of the keyboard rather than the mouse actually indicated quite low levels of knowledge of computer use, as he elaborated,

> I also find quite a few students, if they get something they feel is wrong - they rub it off - they just delete it all, whereas actually part of it could be useful - or maybe they want to put something else in before, and they haven’t realised that you can actually insert something before the text you’ve already got - so they just wipe out everything they’ve got [and then they’ve got to] type it all in again.  

(Howard, Interview 2)

I discussed with Howard an alternative proposition that there might be a cultural issue at stake here - whether some students might have been in the mindset of only producing work which is perfectly acceptable for teachers, but Howard was quite sure that it was a lack of knowledge about computers.
The second factor which Howard identified as being important if students are to produce more text was that of typing skills of students. As he discussed,

...some of them haven’t done that much and they’re fairly slow ... [of the better students] Leo produces quite a bit of text - Lucy, Emily - now, they have better English skills, too ... [but as for the rest of the class] ...even with writing a lot of them would be pretty slow. So it’s not necessarily a computer problem. Chen, Ben, Hubert, even by hand, they struggle to produce very much. I guess they’re worrying about which word to use, which verb to use, all the constructions. (Howard, Interview 2)

Howard and I also discussed whether producing more text using the computer was a simple combination of good composition skills, good keyboarding skills and good computer-operating skills. Howard considered that there were some differences between writing fast and typing fast. Ease of modification whilst maintaining a well-presented piece of work is an important factor, as Howard acknowledged:

when you’ve handwritten, but you’re less inclined to give it a look, you know it gets pretty messy, whereas with a computer you can definitely edit. (Howard, Interview 2)

In this second interview Howard expressed the view that students with weaker computer skills and concepts tended to treat the word processor as if it were handwritten - writing from top to bottom, and making large deletions rather than editing. Howard also observed that the stronger students were also able to adapt to producing hand written work, where the technology doesn’t provide those sorts of benefits. Howard had recognised that the potential values of the word processor would not necessarily be reflected in practice.

Having discussed the important background factors which both influenced and were reflected in Howard’s pedagogy (planning and preparation, values and limitations of computers, aims and factors inhibiting the achievement of aims), I now move to an account of the particular
classroom practices which I observed in Howard’s classroom. In so doing, it is important to be aware of the physical surroundings in which Howard’s lessons took place. They were conducted in a room known at Outeast College as “Computer Room 2”, which was equipped with 28 computers. A floor plan and technical account of the facilities available in this room are presented in Appendix One, including a description of the room given by Howard in our third interview (presented in Appendix One).

Features of Teaching and Learning in Howard’s Classroom

Whereas Geoff’s classes had seemed to me to be orderly and formal, the immediate impression of Howard’s classes to me was that of informality and even disorder. For instance, whilst it was not expected that senior classes would line up outside the classroom door for their teacher (as did junior classes), there would be up to five minutes between the first arrival to class and the last. The ‘ordinary’ classroom lessons which I observed were conducted in rooms with individual tables and chairs which were supposed to be arranged in neat rows and columns; they rarely were, and Howard’s students would sit more-or-less anywhere.

During the lessons in the computer laboratory, during times of work at the computer, students were free to move around the room. Some students seemed to me to be wandering around the room somewhat aimlessly. Howard, however, referred to them as “conferring” with their peers, and reminded me on several occasions that they might be seeking out other students with whom they share a common language or from whom they can better understand the English. Howard commented that a feature of the dynamic of the class was that weaker students tended to be assisted by their friends, whether or not the friends were any more competent than themselves. As a result, the better students sit together and the weaker students sit together. This accounted for the movement of some students, particularly those identified by Howard as weaker ones, around the room.
Importantly, I learnt that what seemed to me to be aimless, Howard often interpreted as purposeful; what I might have interpreted as a little work (maybe a few paragraphs), Howard was able to interpret as being a lot of good work from a particular student. That is not to suggest that Howard had low expectations of his students - I believe that his expectations were certainly high - but there were many times when classroom activity and student interaction could have been misinterpreted through the eyes of someone (such as myself) who is not an ESL teacher, and I valued Howard’s commentary on lessons in each of the interviews. During our interviews, I noticed Howard’s keen memory of classroom events and his personal knowledge of students. We might have been watching a video of a lesson which took place a week or more earlier, but Howard was able to refer to each student on the videotape by name (Geoff, by contrast, rarely used a student’s name) and he had a clear idea of what each student was doing.

Howard described some of the particular teaching practices that he used:

> ... the **less** you talk the better, and ... the **more** the kids talk, the **more kids do activities** the better. So being prepared means having tasks that are at the right level - and that the students get on with, so on hands-on work for them is really the most desirable sort of model in terms of ESL teaching ...

*(Howard, Interview 1, emphasis added)*

> ... **I get all students to contribute in class** - they’ll tend to sit there and not volunteer answers and I’ve found that students are happy if you single them out and ask them the question and give them time to answer which is something you can do in a class that’s all international students where you don’t have ten local [students] jumping up and down with impatience, and you don’t have time to wait for kids to formulate their answer. Try to give **clear directions in simple language** with **written directions** as much as possible on the board or in terms of handouts, that gives the kids another chance to translate and process the language. They miss a lot of things that are purely verbal - they go right past them, particularly as the day wears on, because it’s exhausting to listen to another language.

*(Howard, Interview 1, emphasis added)*
I saw Howard do all of these things. I also saw him use drama to act out concepts which ranged from a computer operation to the exposition of a subtlety in the plot of a novel. All of these fit very closely with his espoused values and practical theories of teaching, as is discussed in a later section.

**Lesson Structure**

The structure to Howard’s lessons in the computer room roughly followed the same pattern each lesson. Firstly, students arrived, and Howard would ask them to turn computers on and then gather at the front of the room for a time of class discussion (refer to the ‘starting the computers’ routine below). During this opening plenary session, Howard would stand at the whiteboard and both address the class and engage them in thinking by asking questions. In some lessons, Howard would explain what the students would need to be doing, often jotting notes on the whiteboard. His approach during the plenary sessions was consistent with a desire to get all students to contribute, to engage in a minimum of teacher talk and to use simple language. In general, Howard tried to keep the opening brief, perhaps lasting no more than five minutes - long enough to brief the students and to allow the computers to start, but short enough to minimise teacher talk and maximise the time students would have using the computers. The amount of time Howard spent speaking to the class was sufficiently brief that there is no sense that he was trying to control the discourse of the class, which could be symptomatic of teaching unfamiliar content (Carlsen, 1992; Olson, James, & Lang, 1999).

The second phase of each lesson was a time of individual work, when Howard moved among the class as they worked at the computers. Unlike Geoff’s lessons which were regularly interspersed with short activities, in Howard’s classes the phase of individual work was generally not interrupted. Towards the end of each lesson, Howard would remind students to save, shut down and pack up, but I never observed a formal dismissal - students left the room once the bell had gone and they had
finished. Whereas there were very clearly demarcated changes in activity in Geoff’s lessons, this was not the case for Howard’s lessons. Howard’s computer-based lessons were very similar in form to his ‘regular’ lessons, but only in broad outline - the similarity between these two could be detected to a much finer level of detail in Geoff’s pedagogy.

The majority of each lesson time was spent at the computer in individual work, although students were able to confer with one another, as noted above. In this sense, the lessons “just kept going” as Howard expressed it in our fourth interview. Howard elaborated:

…there wasn’t a lot of teaching in there. There didn’t need to be a lot - it was basically them working. They knew what they were doing we’d set it up before so I didn’t have any problems at all. They didn’t have any problems. Everybody was basically focused - on task - knew what they were doing.  

(Howard, Interview 4)

During this time, Howard moved among the class to speak with students or assist them. He moved about the room checking each student’s work as they continued working. Howard provided assistance when difficulties were experienced with either English or computer use on needs basis, with students either raising their hands and waiting for Howard’s attention, or leaving their seats and approaching him as he was working with someone else. Howard might stand behind or next to each student and talk with him or her; or he might kneel down or sit alongside; he might even operate the computer to demonstrate a point or get the student out of trouble. It was certainly the case that he tried to help each student rather than do the work or fix the problem for him or her; it was also the case that he did not appear to be at all afraid of the technology, being willing to intervene quite strongly if necessary. (To a certain extent, the strength of intervention can be judged by his body language, as I have interpreted with Geoff, although it must be noted that Howard suffered from back problems, and so kneeling, sitting or standing may have been as much for personal comfort as for strength of intervention.)
Howard was very much ‘hands on’ in his work with students as they worked at the computers. He was also very busy; he rarely sat down or observed the class from a static location - some of the times when students were out of their places was probably mischief which went unobserved by Howard because he was focussed on assisting a particular student. In a few lessons, I saw Howard sit at the teacher’s desk, marking work which students required to continue in the set tasks, but he moved away from these tasks as quickly as he could. He was always doing something to assist or promote student learning. Because Howard was constantly busy and responding to students on a needs-basis, there was the possibility that some students might not receive a fair share of his attention. As we viewed one of his lessons during our second interview, Howard was particularly conscious of there being a group of students that he was not spending any time with, and he said that he was conscious of trying to follow up those students in a subsequent lesson. He regarded this as unfortunate, but an occupational hazard.

Howard regarded the work in the computer room as very similar to the regular English class. In our third interview, he commented that “… in a way the computer room stuff is regular English teaching”. He gave the example of seeing a need and addressing it; providing opportunities to work in pairs, or in groups; in either case, he would

… go around the groups, you see if they have understood the task. You help them with input where they are not quite mastering what they’re being asked to do. Where they haven’t quite understood the text or you model things to the group or the small class based on what you perceive one of the groups having come up against.

(Howard, Interview 3)

In terms of the assertion that familiar pedagogical patterns are a significant influence on pedagogy in an unfamiliar setting, it is important to observe that Howard regarded teaching in the computer setting as very similar to teaching in the regular classroom, a point which I return to later in this chapter. It is also important that there were several quite particular
classroom routines and practices for work in the computer laboratory which Howard either adopted or developed during the course of the year. The computer was not a silent partner in Howard’s effort to develop his students’ writing - there were certain features of the technology to which he had to attend for his lessons to ‘work’. Unlike Geoff, Howard was not used to issuing and managing equipment, and he was very deliberate in identifying new practices and routines pertinent to his teaching in the computer laboratory. This is a major component of Howard’s intention to develop and consolidate his pedagogy relating to computer use.

A discussion of the new practices and routines is an important contributor to both the portrayal of Howard’s knowledge and learning, and the discussion of the influence of familiar pedagogical patterns on Howard’s teaching. These are discussed in the following sections.

New Practices and Routines

Starting the Computers. Howard found that the amount of time taken for computers to complete the login process (refer to Appendix One for more details) necessitated some particular classroom practices. When students would first enter the computer laboratory, Howard would ask them to login. He would then have some discussion or briefing which would engage the student away from the computers. By the time this activity was completed, the computers would be ready to use. In our final interview, Howard referred to this practice as being an exemplar of a small way in which he had to adapt his pedagogy in order to work satisfactorily in the computer environment. The practice, which he referred to as “turn on, leave, return” was something which Howard identified as having evolved out of “on the job learning”.

Bringing Disks to Class. At Year Eleven level, it was school policy that students were responsible for owning and looking after their own disk or disks. It was also school policy that students would only use a computer if they had a disk of their own onto which they could save their work. My
interaction with students and staff at Outeast College had told me that this was not always enforced. In fact, students would often assume that they could share disks across two or more computers on the presumption that this would cause no technical problems; whereas, in my experience, this caused problems, and happened all too often. In order to minimise difficulties, I had encouraged Howard (along with all my colleagues) to persist with the policy. I found that Howard was very diligent in following recommendations and policy, particularly when he could see good reason for it. Over the course of the year, Howard had seen enough examples of the sort of difficulty which sharing disks could cause that he had learnt, out of experience, to vigorously enforce the policy.

The corollary to the policy and practice regarding the use of disks was that students without a disk were not permitted to use a computer and would be required to hand-write their work. I observed at least one student in most lessons was in this situation, thus losing the advantages which computer use in ESL might have for them. Howard was not troubled by this, seeing it as a matter where good order and discipline take precedence over pedagogy.

*Managing Computer Problems.* From time to time, students at Outeast College would experience difficulty with the operation of a particular computer. In my experience, by far the most common problem was students not being able to save because of a malfunction in the disk drive or on their disk. The strategy which I recommended to each of my colleagues, including Howard, was to have students save early in the lesson and continue to save regularly. That way, if a malfunction was detected early in the lesson, the student could move computers with minimum inconvenience, or if a more serious problem presented itself later on, minimum work would be lost. Howard took my advice seriously, and realised that this was a practice well worth following.

However, this was not the only type of problem which students might experience, and such problems might range from difficulties with the ESL
task, understanding word processing techniques and operations, or might include some kind of computer malfunction. Regardless of their nature, Howard found that it was much more effective to work with individual students or small groups rather than to address the whole class, something which he found was true for working with ESL students in general.

Howard found that his pedagogy was assisted by looking for simple indicators of either problems or progress. For instance, he noted that it is a good sign when people print - it means they’ve logged in properly, remembered their password and possibly even completed a piece of work. 

(Howard, Interview 4)

**Word Processing Practices.** In his classes, Howard stressed the need to enter text first, and then make formatting changes. It was something which he was conscious of having learnt with me during the few sessions of computer training which he had completed. My reason for stressing this to the participants in the class was concerned with the techniques for the straightforward formatting of a document. Howard was aware of the desirability of entering text first for this reason, but it also was a vehicle by which he could encourage his students to be focussing on “producing more text”. He explained in our second interview:

> you get kids that are interested in making a pretty format, in changing their font, in selecting a typeface, size, which I consider a waste of time.

> ... I would like them to be producing as much relevant text on the screen as quickly as they could, and at the end of that process, if they’ve got time they can play around with making it look nice.

(Howard, Interview 2)

**Teaching Computer Skills.** As discussed previously, Howard had identified two major factors which inhibit students from achieving the aims which he set them: their technical skills and their typing ability. Consequently, I was very interested in how Howard approached the teaching of computer skills. Well into the year, during our third interview, he commented that,
I don’t do that in any systematic way but when I go round and find them at a particular point or discuss what they’re doing I teach them a little trick, you know, triple click to highlight the whole thing or double click for the paragraph if they’re wanting to cut and paste. Show them how to use the cut and paste icons rather than down menus. Just saving one step. I always, you know, point out those little things when the opportunity comes up. I haven’t taught the class those sort of things *en masse* … maybe I could do some instruction *en masse* at the start.  

(Howard, Interview 3)

Howard did, however, actually teach some skills which were reasonably complex - footnotes and tables - as he described:

If there was a direct quote of what the person said - because they were quoting the newspaper - or as a quote as to what the newspaper said about them or thirdly in their own words. So we talked about the differences between those things, and how they were all useful in essays in different ways, the conventions of using the quotation marks and the footnotes and what you put in a bibliography. So we did that using a table I taught them how to use a table, that took a while.

(Howard, Interview 3)

During our fifth interview, Howard commented that he required the students to use double spacing - a formatting function which would have had to have been taught. Similarly, so that his student might reap the benefits which he considered were available through the spelling checker, Howard acknowledged that he provided some detailed instruction about using this tool:

... some of them don’t actually use it properly. They tend to - the word comes up and they just say “ignore” when it was a mistake. They don’t quite understand what those different options mean.

(Howard, Interview 5)
Whilst Howard professed to little explicit teaching of computer skills, it is clear that he taught those skills which were directly beneficial to the use of computers in the ESL context; other skills were addressed on an individual basis, as best as he could. He clearly believed that what was holding many of his students back in their effective use of the computer for ESL work was their knowledge of computer skills and their typing proficiency, and from that point of view, I would judge Howard’s lack of response to this issue as unfortunate.

In summary, during the year Howard had developed a range of classroom routines and practices which were quite specific to using the computers in his ESL teaching. The fundamental observation to be made is that such routines and practices were in fact necessary; that Howard found that the computer could not be regarded as a ‘silent partner’, and that certain aspects of using this technology needed to be specifically planned. It is also true that Howard was able to adopt and develop routines which made his teaching with computers both efficient and effective, even though his approach to resolving technical problems and of teaching computer skills have distinct disadvantages. I will argue in a later section that, as appropriate as these routines and practices might be, they are, in essence, only grafted onto Howard’s fundamental understandings and pedagogy of ESL teaching, rather than being the visible signs of reconfigured understandings or pedagogy.

Before I turn to a discussion of Howard’s personal attributes, out of which this argument is developed, I conclude the overview of Howard’s pedagogy by reviewing the software and modes of computer use which I saw in use in his classroom.

**Software in Use; Modes of Computer Use**

Despite his expressed intention to do otherwise, I saw Howard use only Microsoft Word, and this reflects his singular commitment to encourage students to write more. Using the ACS/ACCE (1994/1995) classification
(refer to Chapter Two), I observed Howard work only in the support mode, where the computer is used to enhance the presentation of work. I observed no use by Howard of computers in tutorial, resource or link modes. The use of Microsoft Word as a dominant tool in the ESL classroom is consistent with the findings of relevant Australia findings (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999; Shears, 1995) (refer to Chapter Two). Howard’s regular and committed use of the computers in his teaching, however, is somewhat in contrast to Shears’ finding of a decline in use of computers in senior secondary English classrooms compared with Junior secondary classrooms.

The support mode is often linked to the use of computer as a productivity tool to improve the efficiency of the production of items of work. This is the paramount reason for Howard using computers. He is an English teacher, searching for ways to help his students increase the quantity and quality of their writing. In particular, as discussed earlier, Howard believes that the computer holds potential for this because of the efficiencies relating to drafting and redrafting which it offers, opportunities for improvement in spelling and the ability to edit and evaluate own work, and because students gain pleasure from the improved presentation which a computer makes possible. As he stated in our third interview:

...the kids pretty well are all using their computers for word processing, more or less successfully. And by Year Twelve they will have the ability to produce all of their drafts, for their CATS, and to do their revisions on computer.

(Howard, Interview 3)

This is congruent with the work presented by Hativa (1995) and Newhouse (1998).

In the previous chapter, I indicated that I found Geoff’s work to be competent but uninspiring because the students were focussed almost exclusively on word processing for a whole year. Whilst Howard’s class also used word processing for apparently similar tasks for the whole year, I would not be quite so critical of Howard. Geoff’s natural bravado and problem-solving ability carried him through a lesson, but was not
extended to contemplating what else he might do. Howard did not have the same confidence with computers as Geoff, but he was very clear about what he wanted to achieve: to have his students produce more text. I cannot criticise his determination to observe whether, over the course of a year, the use of computers would help him make a ‘break through’ in what seems to me to be a laudable aim for an ESL teacher. Howard was also very conscious of his limitations, and whereas Geoff had the audacity to try anything, Howard was conscious that learning enough about word processing and how to manage and teach a class in a computer laboratory setting would be enough of a challenge for him. It is rather too early in Howard’s development as a computer-using teacher to be critical of the range of software and the modes of computer use which he employed.

This concludes the discussion of the general features of Howard’s pedagogy. I now move to a discussion of Howard’s personal attributes: those qualities which contribute to his practical theories of teaching and which are expressed in the pedagogy just described.

**PERSONAL ATTRIBUTES**

In this third substantive section of this chapter, I describe Howard’s personal attributes: his knowledge of computer, his pedagogical content knowledge, his practical theories of teaching, the concept of ‘breaking patterns’ as a representation of Howard’s work, and the impact of familiar pedagogical patterns on Howard’s teaching with computers.

**Knowledge of Computers**

Howard’s deliberate attempts to extend and improve his pedagogical knowledge through various routines and practices has already been discussed. In this section, I refer to Howard’s knowledge of hardware, software and pedagogical content knowledge. Howard was aware that his
knowledge of computers was limited, and during our discussions he made a number of statements which clarified for me his knowledge.

In relation to computer systems, Howard considered that his

\[ \text{... use of the computers ... would be adequate for the tasks - probably ahead of most of the kids - in terms of word processing, not a problem. When things go wrong - drive won’t save or something like that - that’s beyond me.} \]

\[ (Howard, \text{Interview 2}) \]

There is no evidence in any of the classroom lessons or in our interviews of any misunderstandings in Howard’s use of terminology (Geoff had, for instance, confused the function of a disk drive and a processor unit), but he was often asking me questions to clarify his understanding of the relationship between the different components of a computer system. That is indicative of Howard’s desire to be ‘a good student’ himself.

Even though Howard described his knowledge of computer systems as adequate for his purposes, he seemed to regard it as being quite low on any absolute scale. After having worked closely with Howard and advised him on many occasions, I believe this is a fairly accurate self-assessment, which seemed to have impact on his level of comfort in the computer laboratory setting. Despite his best efforts, it took much of the year before Howard was feeling comfortable in the computer room. In our second interview, Howard talked of having a low level of comfort in the lesson, and the things which troubled him were

\[ \text{The Twelves were ... [already in the room] ... I actually had to run over to staffroom to pick up things to hand back to [my class], they left a pile of stuff - they came in late} \]

\[ \text{... I was five minutes late into the room - and then the Twelves were there already - some kids didn’t have their disks ...} \]

\[ (Howard, \text{Interview 2}) \]

These problems could in fact beset any teacher and cause a low level of comfort. I sensed from Howard that these factors were magnified by feeling uncomfortable about working in an unfamiliar room and with equipment of which he was essentially unsure. Howard’s desire to be
meticulous in preparation and organisation together with his reluctance to ‘go with the flow’ indicate to me someone who is unsure of himself. Throughout the year, Howard expressed some lingering doubt that there might be some problem which might emerge which he would not know how to deal with. He lacked the knowledge which would give him the confidence to believe that this was not so.

Howard believed that he had a suitable knowledge of the software (word processing) for his purposes. I don’t doubt that this was true, particularly because many of his students had not used a computer before, let alone having been instructed in their use in a foreign language; at the times when Howard and I had sat near each other in the staff room to do some word processing, I had observed that Howard had a good grasp of the basic functions of a word processor.

**Pedagogical Content Knowledge**

At no time did Howard ever express a concern related to the software as ideaware (Olson, 1988b, pp. 55-56) - that is, the teacher’s grasp of the essential ‘idea’ of a piece of software and how that is translated into classroom practice and challenges established pedagogy. Like Geoff’s class, Howard’s class did little more than key in text for the whole year, but whereas Geoff had complained that he found that the educational possibilities of the software were nigh-on exhausted half way through the year, Howard’s instructional purpose was varied, and included argumentative essays, descriptive essays, punctuation exercises and grammatical exercises. Howard considered technologies such as: the use of a TV as a display unit, the use of classroom broadcast technologies19 and the placing of files on the network for students to work with. For Howard, the software had become ideaware - a flexible tool for a wide variety of

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19 That is, technology which allows the image and activity on a teachers’ screen to be simultaneously displayed on all other computers in a room, as discussed in Appendix One.
tasks germane to the teaching of ESL, which is indicative of Howard broadening his pedagogical content knowledge.

Practical Theories of Teaching

In analysing the data on Howard, I have come to see that Howard’s teaching is guided by practical theories of teaching - internal frames of reference which are deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences (Marland, 1994, p. 187; Marland, 1995).

Unlike Geoff, Howard was quite explicit in making links between his values and beliefs and his teaching practice. In our first interview, Howard spoke explicitly of the desire for an observable fit between theory and practice. I asked him what he meant by the use of the word “theory”, and he was very clear that he did not mean “textbook ideas” but the “ideas which people see as desirable”. In fact, Howard consistently demonstrated an awareness of the link between his personal theories of teaching and his teaching practice; he quite explicitly made links between what he was doing in the classroom and his teaching values and beliefs.

I have come to think that Howard’s practical theories of teaching are best described through the presentation of a range of inter-related values to which Howard explicitly drew attention during our interviews and which he strove to make integral to his teaching. His beliefs concerning a student-centred approach which actively engages students in their own learning, minimising teacher talk, and maximising student talk and activity have been discussed earlier. Howard also spoke of valuing academic work, providing activities which allow students to gain confidence and experience success, and developing a genuine personal relationship between teacher and student, and these are presented in the paragraphs which follow.
During the year, on a number of occasions I invited Howard to talk about those things which pleased him about his work in the computer room. Howard did make mention (as discussed elsewhere in this chapter) of technical difficulties, but in the main, there were two aspects of his work which were the main bases for him feeling either pleased or discouraged: the tenor of the class in relation to academic work, and how well the use of computers supported ESL teaching. As he clearly articulated in our third interview:

“I am glad to see some new students who are off and running and who are good. The general tenor of that class is good. The strong students - this is true of Year Eleven ESL generally - they have pulled the weaker ones in their wake. The weaker students, you know, they’re doing pretty well. They get their work in on time, they give their talks when it’s time to give a talk. They’re basically caught up in the productivity of the better students which is the way we like it.”

(Howard, Interview 3)

But also during the same interview, he reflected on a recent lesson which he believed had not worked very well:

“I think the punctuation exercise ... didn’t really get very far. I mean, the most able students managed to produce something, but the others were lost at sea.”

(Howard, Interview 3)

A second aspect of his work which Howard especially valued was that of trying to give all students in the class some degree of success:

“I’ve always felt that often kids who mess about and are troublesome ... because they’re not coping with the work and they would rather be a hero than be a failure - so there’s a bit of a challenge there to find ways for them to be successful - to, you know, to teach in a way that everybody can find what’s happening accessible. It’s always a challenge ‘cause you tend to get mixed ability classes.”

(Howard, Interview 1)

In our first interview, Howard spoke warmly of a teacher who had been a mentor to him when he had returned to Australia to teach. Howard
spoke of this mentor’s personal relationship with the students, and throughout the year often referred to this teacher and the effect that her manner with students had had on him. The importance of a personal relationship with students was clearly a third aspect of his work which he especially valued, and Howard related his own experience in high school to his current practice:

I always had good English teachers, and maybe that’s part of the reason why I studied English … [in] Year Eleven and Twelve, again good English teacher, good literature teacher. Particularly enjoyed those two subjects. We used to go around to the house of the lit. teacher, have … do some of our work around there - friendly sort of social atmosphere …

(Howard, Interview 1)

And then:

You can see what a positive influence people are who have confidence in their teachers, in the school, who understand the way things work. Sometimes those who’ve been troublesome or rebellious earlier on, but who’ve come through that, and maybe even kids who have had a very negative experience of school and teachers before they came here. And, you know, if you can win over those kids, they are good role models for the others. So in terms of all the responsibilities I have in terms of international students, I try to … in the classroom I bring in, in terms of what we study how we study it, I bring in those sorts of things so that my classroom work is part of that process helping these kids be successful here.

(Howard, Interview 1)

After a year of observing and talking with Howard in some detail, I believe that he was comfortable with a multiplicity of teaching approaches and values, some of which would appear to be contradictory. For instance, he had accepted that there were very few teaching/learning activities in which all his values were simultaneously reflected. I had certainly observed Howard doing a fair amount of talking in his classes, but I see this as Howard’s realism and experience: some of his values would be served by teacher-centred activities; others would be served by student-centred activities.
In addition, I would also observe that these aspects of his teaching which Howard particularly valued are those which are often displayed by self-efficacious teachers (Gibbs, 1999); perceived self-efficacy being related to the efforts and perseverance of achieving personal goals (Gorrell, 1990, p. 77) and is consistently found to be an indicator of teachers who are likely to take on innovations and new approaches to teaching. It has been found to be a good predictor of computer attitudes and usage patterns (Olivier & Shapiro, 1993). From my observation of his classes and his interviews, I would describe Howard as highly self-efficacious, and this is reflected in Howard’s fundamental values as a teacher.

I now move to an extension of the discussion of Howard’s practical theories of teaching - a concept which I have come to understand as encapsulating much of Howard’s work as a teacher.

‘Breaking Patterns’ as a Conceptualisation of Howard’s Work

In the third interview, Howard talked about much of what he was doing in the computer room as ‘breaking patterns’:

Well, the pattern’s been broken … I managed to intervene between them and their computer screens. Their propensity to share disks and log in under other people’s names - I’ve broken that, I’ve basically broken that pattern. I’ve broken the pattern of people turning on the computers who don’t have a disk to save it on.

(Howard, Interview 3)

Howard extended this thought to include what he was consistently striving for in his teaching of English:

...they had a very conventional notion of how you do writing when you report about event ... [I’m trying to break that] …

(Howard, Interview 3)

This was the recapitulation of a theme which he had made known in our first interview:

[Of writing tasks] I give them a description of what I expect, fairly explicitly with each piece of writing, and talk about that. Now, their tendency is to fall back on
the types of writing they’ve done before, and all those sort of stale uninspiring patterns of writing - they have expectations of what is expected of them as a student. It doesn’t actually often make for good writing, so it’s a challenge to break through and to get them to write something more authentic.  

(Howard, Interview 1)

I have come to think of the concept of ‘breaking patterns’ as being a crucial component of Howard’s practical theories of teaching. Howard had talked of his combined ISC and ESL role as comprising assistance to ease students into a new educational system; to help them recognise and cope with demands; to endeavour to have them share their own experience and to be open to the experience of others. In these various ways, Howard’s practice could be thought of as having a common thread of ‘breaking patterns’; a concept which has explanatory and predictive power for a range of professional activity, and finds expression in practice. It is what Messler (1989, p. 21) calls his self image - “the concepts of generalised self-portraits, self-understandings (the view one has of oneself) and inner attempts to objectify what one seeks to do and be”. Howard’s practice is, at its essence, emancipatory; it is aimed at giving responsibility and control of student learning to the students, and helping them recognise patterns of action and behaviour as not immutable, but open to change.

This concludes the discussion of Howard’s personal attributes. I believe that he is generally professionally aware and knowledgeable, but his level of knowledge with respect to computers is low. This has an effect on his level of confidence in the computer setting, but he actively strives to increase his knowledge and his related pedagogy. Howard’s values are well established, explicitly stated and expressed in practice. His values are the driving force which sustains his ESL teaching and they also sustain his teaching in the computer laboratory. Howard’s values are indicative of someone who is self-efficacious with respect to his pedagogy. His values, and the practices in which they are represented, are the essence of his teaching in the computer laboratory. The referents for computer use are
both his beliefs and the prescribed content of Year Eleven ESL. Computer use did not promote any particular reflection on Howard’s values or on the content or substance of ESL teaching. Familiar pedagogical patterns are the major impact on Howard’s teaching with computers.

I now turn to the fifth substantive section of this chapter, the identification of the particular concerns and difficulties which Howard experienced when using computers in his teaching.

DIFFICULTIES AND CONCERNS WITH COMPUTER USE

The difficulties and concerns which Howard faced in teaching with computers include issues associated with the organisational situation, his knowledge of the technology and the students’ knowledge of the technology. These are discussed in this section.

As I have reviewed the videotapes of Howard’s teaching, I have been impressed that Howard never seems at all afraid or hesitant when working with the technology. It has only been as I have talked with him that Howard’s discomfort with the technology has been revealed. Examples of the types of problems which he felt unable to deal with were: a disk stuck in a disk drive, a faulty drive or disk discovered too late, inability to login, or problems with obtaining printouts. The “tricks”, as Howard referred to them, of not sharing disks and saving early were entirely pre-emptive. If difficulties did in fact arise, Howard needed to call in someone with more technical expertise. Usually he did this discreetly by asking the student concerned to wait behind for a few moments at the end of the lesson.

By the fourth lesson, however, Howard reflected on these pre-emptive strategies and commented,

No, no problems. They kept on going … I got them to save well in advance of the end of the lesson to check there were no problems with their disk or their hard
disk, and there weren’t … They seem to have got used to the basic routines. I don’t think there were any glitches that period.

(Howard, Interview 4)

By this later time in the year, Howard and the students were used to the routines, and as a result, there were very few times when technical support was actually required later in the year. The contrast with Geoff is interesting, however. Geoff’s natural inclination was to ‘have a go’ and apply his repertoire of problem solving skills. Whilst his knowledge was really inadequate for the task, the model he was presenting to students was that of the individual taking responsibility for problem-solving; the example of his own action and attitude demonstrating that it is within the individual’s grasp to solve the problems which beset the computer-user. Even though Howard presented as being confident and ‘hands on’, because there were occasions when he did need to call in an expert, Howard ran the risk of making the implicit statement to his students that the resources to resolve difficulties are necessarily found in ‘another’.

As suggested previously, two of the biggest difficulties which Howard encountered are those relating to Howard’s organisational situation: “the Twelves” and team teaching. The issue of “the Twelves” was a major difficulty for Howard, as he explained in our second interview:

It’s always difficult in the computer room for a start - with the computer there. I did get them to turn their chairs around, face me rather than facing the machine. The other factor was the ten or so Year Twelve’s in there, some others came in, and even if they’re working relatively quiet [sic] by their own standards they’re still a distraction in a way, just the fact that they’re in there, and they’re doing their own agenda, maybe they’re talking to each other or whatever, but with somebody like that sitting next to you, it’s that much more difficult for the students to concentrate.

(Howard, Interview 2)

Howard expanded on this thought further in our third interview, relating it to what he believed to be appropriate ESL pedagogy:

The fewer words, the simpler words, the clearer the more effective the communication and if you’re answering the door with Year Twelve’s coming in wanting to work, one every three minutes, or the kids
from the other class coming in and a few more coming in, all of that detracts from your ability to keep the whole class going on the task.  

(Howard, Interview 3)

The other organisational issue which created some difficulties for Howard was the combined class during the times when Angie was absent. In our third interview, Howard commented (as much about his planning as his classroom practice) “it has been pretty messy - a number of times that I have been in there - because I have had the class double up”.

During our third interview, Howard highlighted some technical concerns:

There are also often quite a few machines ... I don’t know that many kids do what they are meant to do and notify you when there’s a particular problem with a mouse or a driver or whatever - so it’s annoying for kids to turn a computer on to log in and then to find that the mouse doesn’t work, or come to the end of the period and not be able to save it.  

(Howard, Interview 3)

In this respect, Howard’s lack of control over the facilities was a particular source of frustration: he did not have the influence or authority to effect repairs to ensure that computers were working optimally. In terms of resolving the technical problems which a self-taught computer-using teacher might find, it is hard to argue against prevention being more important than cure.

An issue related to the control over the facilities is the issue of bookings for use of the computer room. Like any teacher in the Middle and Senior School’s at Outeast College, Howard needed to book his classes into the computer rooms when he required it. Participation in this research project ensured Howard of a double lesson each week, but there were many weeks when Howard chose to book more lessons. If there were any difficulties with securing suitable bookings, he never told me about them. The ability for Howard to have access to the facilities as he deemed necessary was not a concern which features in this study.
Howard’s lack of knowledge of computers meant that he was only able to attend to the simplest of technical concerns himself. He acknowledged that he did not actually teach many technical skills which students might rely on to use computers satisfactorily, and relied instead on other strategies. Whilst I believe that Howard was trying to learn about the technology as much as he could, and extend his knowledge to deal with the various technical problems which might arise, Howard’s own technical knowledge was quite unsophisticated. As I have discussed earlier, he was earnest in trying to solve technical problems himself, and developing a repertoire of ‘tricks’, but he inevitably had to rely on other strategies. One of these strategies was to draw on the technical knowledge which he believed many students had, as he commented,

I haven’t been that focused on nuts and bolts of computing. [I focus on] … trying to get them to understand what I am asking them to do in terms of their English work … I guess I’m assuming that they can handle the computer side of it. Some of them are very competent, some of them are less competent.

(Howard, Interview 3)

As discussed previously, Howard did not go out of his way to teach technical skills or skills in computer operations - his focus was on the teaching of ESL. Although I believe that Howard taught skills in computer operations more systematically than he apparently believed, essentially the use of computers did not change the scope and content of the curriculum. The development of technical skills was haphazard, however. Whilst it is laudable to draw on the skills which students possessed to assist in the operation of the classroom, Howard was not in a position to assess whether the students actually knew the most appropriate way to solve a problem, nor was he concerned with how students might learn the skills. As a result, the ability of the class to reorganise in such a way so as to allow computer use to continue when a problem arose was not necessarily any better at the end of the year than at the start of the year.
Issues relating to class management in a computer laboratory do not seem to have been a point of fragility for Howard. Contrary to the findings of Hativa (1995) and Lynch (1999), I did not observe any time when he felt that his competence or authority were threatened, or subject to routines, expectations and knowledge of someone else. Whilst the computer room rules relating to use of disks and login names were not of his own devising, Howard accepted the reasoning for them, implemented them wholeheartedly and tried to have his students appreciate the rationale for them and not mere acceptance of the rule for itself. I have found no evidence to suggest that Howard perceived the physical space of the computer room as being ‘owned’ by someone else. By needing to draw regularly on technical support staff (though not every lesson), Howard ran the risk of his authority being undermined; this did not seem to concern him. I believe that Howard accepted that there were a certain range of difficulties which the teacher and students ought to be able to resolve for themselves (as a ‘first line’ of technical support) and then it was entirely proper to request a ‘second line’ of support. As long as Howard found the boundaries clear to him and his students and he had the personal confidence to work within this ‘first line’ of support, Howard did not feel threatened.

The difficulties and concerns which Howard experienced illustrate the importance of resourcing in numerous guises: sufficient facilities so that he would not feel obliged to admit “the Twelves” to his classes; appropriate staffing so that he would not have to double-up teaching; appropriate teaching loads to ensure adequate planning and the capacity to pursue technical training; and the ability to maintain computer facilities in fully working order. In this respect, Howard’s case shares several features with Geoff, but notably I have found no evidence that technical support was inadequate for Howard’s needs.
Achievement of Aims

Howard had established for himself several aims for the year of the study, and in this section I consider to what extent these had been achieved. Howard’s aims, as presented earlier in this chapter, were to

- have students produce more text
- have students follow guidelines accurately rather than following well-worn and stale paradigms of writing
- successfully give clear directions in computer room procedures
- use computers for teaching and learning tasks other than word processing

During our interviews, Howard did not make much reference to the achievement of these aims. During our third interview, he did observe that

I don’t know that there has been any great noticeable progress ... Those who use the machines well and who are adept - they produce a reasonable amount. I don’t know that there is as much playing around and getting a pretty font and things like that, but still, there’s those who maybe don’t have the skills yet or who aren’t focused enough yet in using the computer.

(Howard, Interview 3)

Howard himself made no comment as to whether students’ writing developed beyond following well-worn and stale paradigms of writing. I have argued that Howard’s consistent approach to ESL teaching was to break such patterns, but there is no evidence that the use of computers in any way facilitated this. It is arguable that the students’ knowledge of computer operations was low, that this in turn did not facilitate production of more text, which in turn did not support the development of different forms of writing.

If Howard’s achievements of his first two aims is at best uncertain, then at least his progress toward the third and fourth aims is at least more clear.
In terms of his third aim (giving clear directions), Howard consistently referred to the “connection” between the student and the computer. Many of the ‘little tricks’ which he endeavoured to amass were his way of developing a strategic response to this. Howard gave a very clear description of his learning in this regard during our fourth interview, when he commented on a strategy of standing in front of the students (rather than in front of the whiteboard) to address the class:

Yes, I’ve used that a couple of times lately for short interventions rather than getting them to bring their chairs and come around to the white board, and disassociate themselves from the captivating screen, I occasionally set up camp peering over the bank of computers closest to the window, and so both rows are facing me.  

(Howard, Interview 4)

Howard was well-intentioned about learning to use other software - his fourth aim - but that never eventuated. I believe that the busyness of the year meant that he did not have time to learn packages such as Microsoft Publisher or an Internet Web Browser himself. Furthermore, he found that students were relatively slow to learn effective word processing techniques and that time to cover English skills was limited: the pressures of time did not facilitate the use of computers.

Overall, Howard’s aims for the year were not achieved. In further elaboration of this, I would firstly observe that Howard’s fundamental values and practical theories of teaching are consistently revealed in his teaching practice: assisting students experience success, developing a personal relationship with students, and helping to break unproductive patterns in both students’ lives as well as their ESL work. These are implicit but laudable aims which Howard expressed and developed throughout the year. Secondly, it is more important to observe that Howard set aims for himself, and his agreeing (as he did consistently throughout the year) that it was valuable to be committed to work regularly in a computer environment and to engage in thinking about that work.
Conclusion

In this chapter, I have presented a descriptive account of the unique perspective of Howard as a self-taught computer-using teacher. I have considered Howard’s particular background, experience with computers and the context of his teaching; Howard’s pedagogy teaching with computers; and the factors which limit and promote his use of computers.

I now turn to the case study of Arlene.
CHAPTER 7 - ARLENE

In this chapter, I present a case study of Arlene and seek to understand, from the perspective of the relationship between knowledge and pedagogy, why teaching and learning occur in the particular way they do in her classes. As for the preceding chapters concerning Geoff and Howard, this involves considering both what teaching and learning I have observed by providing a rich descriptive account of Arlene’s pedagogy and teaching circumstances, and also interpretation of the data to provide an understanding of the relationship between teachers’ knowledge and pedagogy. Both aspects of the discussion are interwoven so that Arlene’s story might be best told.

This chapter is presented using the same organisation as in the previous chapters on Geoff and Howard, in five substantive sections: Arlene’s particular context, her organisational circumstances, the features of Arlene’s pedagogy, Arlene’s personal attributes and the factors which limit or promote Arlene’s use of computers. In the third section the use which Arlene makes of computers in her teaching is discussed, and in the fourth section I consider the impact and implications of familiar pedagogical patterns on Arlene’s teaching with computers.

BACKGROUND

Prior to the commencement of this study, I had known Arlene as a House Co-ordinator and teacher of English and History in the senior levels. Arlene participated in this study as a teacher of Year Seven English, the first time in several years that she had taught that subject. I also knew that Arlene was a late entrant to the teaching profession, but did not know the details of her professional background until this study commenced.

Arlene had grown up in Scotland. After completing her schooling and a secretarial course, she then went to work in general secretarial positions.
As Arlene told me, a result of her secretarial training and employment was that she has always been a proficient typist. After marrying, she emigrated with her husband, and then worked in an airline reservation office before leaving the workforce to have a family. As her children grew older, she found time to return to study. Arlene took several semester-length computing courses at TAFE\textsuperscript{20} in the 1980s, and she learnt word processing, spreadsheeting with Lotus 1-2-3, and programming in the BASIC language. I had observed Arlene typing competently, and that she seemed to rarely have any difficulty with using a computer, but I was quite surprised at the extent of her background in computing; she was always modest and self-effacing when discussing her accomplishments.

The next step in Arlene’s professional journey was to complete an Arts degree at a Victorian university, and she then spent two years working as the personal assistant to a manager of an importing business. In this position, she said that she had used “all her computer skills”. It was after this appointment that Arlene undertook her Diploma of Education studies, and her first teaching appointment was to Outeast College, eight years prior to the commencement of this study.

\textit{Self-Taught and Computer-Using}

In the light of her background, it is not hard to believe that Arlene would be a computer-using teacher. She told me that she has consistently found that using a computer is as efficient as handwriting, if not more so, and that she used a computer for a range of tasks, such as preparing handouts, writing reports, and typesetting exams. Arlene believed that she found the computer efficient for these tasks partly because of being a proficient typist.

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\textsuperscript{20} Technical And Further Education. TAFE colleges have offered a variety of short and community courses and support casual enrolments, in addition to students enrolled in vocational training programs.
It is less obvious that it is reasonable to describe Arlene as ‘self-taught’. Certainly, she is not exclusively self-taught - a competent typist who has studied computing, including some programming! In order to clarify how Arlene might be best portrayed, I explored the notion of being self-taught with her. She felt that it was a reasonable description, because she found the current range of computer technology to be very different from that which she had used when she had studied some computing - particularly the Windows-style interface. Arlene clearly perceived that the developments from a command-line interface (cf. DOS) to a Windows-style GUI interface represented a major leap in one’s ability to use computers and comprehend how they work. This is a position which I have heard expressed by others who have been involved with computers over a long period of time (Chandler & Gough, 1999), despite claims such as those by Townsend (1990, ch. 1) that GUI interfaces are straightforward to learn.

Arlene described how she had gone about learning to use this more recent style interface design. Since she had always had a computer at home, she used computers regularly and to continue learning and resolve problems she used trial-and-error, referring to manuals and online help. Arlene said that she always found it easier to remember how to do things (or how not to do them) as a result of making her own mistakes.

It is important to observe that Arlene was self-taught in relation to her use of computers in teaching. In our first interview, Arlene drew attention to her limited knowledge of computer-based pedagogy stating, “I would like to know how to use computers efficiently within the classroom, not simply as an alternative to pen and paper”. She told me that she had not participated in any professional development concerning how to use computers in the teaching of English or History, and during the year in which this study was conducted, she did not attend any course on computing or how to use computers in her teaching. The data presented in this chapter are not of Arlene’s first exposure to the use of computers in her teaching. As I commented in my journal, I had found Arlene’s use in
previous years to be that of someone who had no real fear of using computers, and had occasionally in previous years brought classes into the computer laboratories for word processing. I had thought of Arlene as someone who was not convinced of the value of computers to her teaching, and who was reluctant to commit to regular and long-term exposure of her classes to the technology.

One might have thought that Arlene’s background would have equipped her to become an early adopter and enthusiast for computer use in her teaching, but this was not the case. Participation in this study, and teaching Year Seven English in particular, committed Arlene to arranging regular use of computers over a long period of time. All participants in this study were expected to use computers regularly with one class, but the exact scheduling of use was not specified. Howard chose a weekly arrangement, Geoff was timetabled into a weekly arrangement, but a tradition had built up at Year Seven that English classes would use the computer room on a weekly basis, and would be engaged in certain tasks. It is this ‘tradition’ which I describe in the following. I now move to discuss this and other organisational aspects of Outeast College which impacted upon Arlene’s teaching with computers.

THE TEACHER IN THE ORGANISATION

In our interviews, Geoff had commented extensively on the organisational milieu and the recent changes therein; Howard had made only occasional guarded reference to these, but Arlene made no reference at all to the structure and organisation of Outeast College. This is not to suggest that she was unaffected by the factors which I have presented in the chapter on Geoff, but they did not seem to enter into her thinking or discussion on pedagogy. There are three facts which I perceive as having a particular bearing on Arlene’s pedagogy: Arlene’s role as a co-ordinator, the origin of the Year Seven English/computing program, and the nature of the Year Seven student cohort.
Arlene as Colleague and Co-ordinator

I had noted in my journal that Arlene had most recently taught Year Eight English several years previously, and a colleague had taught Year Seven English. Their allotments had been ‘swapped’ for the year of this study only because of a timetabling anomaly. So Arlene was teaching a subject which she had genuinely not taught for many years and did not own in the same sense as other courses of study which she had developed. But even this, with its requirement to do extra reading and preparation, was not referred to by Arlene. Arlene presented as very private and ‘professional’ (and, as I noted before, self-effacing and modest), keeping herself and her teaching separated from the vagaries and troubles which the organisation might present.

In addition to her teaching duties, Arlene was a House Co-ordinator. At Outeast College, the students at each year level from Year Seven to Year Twelve were allocated to one of four cross-age ‘Houses’, each with a co-ordinator. The Houses were the basis for all pastoral care and discipline, as well as for sporting and cultural activities and competitions. There was no such thing as a ‘Year Level Co-ordinator’ - this role was taken by the House Co-ordinators - and Arlene was responsible for approximately 100 students, a position which she had occupied for a little over a year. (In his role as International Student Co-ordinator, Howard was effectively a fifth House Co-ordinator.) In my observation, House Co-ordinators were amongst the busiest people at Outeast College, as they were the hub of all communication between staff about students, and Arlene’s appointment to the role is of itself a testament to her interpersonal skills with students and staff alike. It also emphasises the collegiality of the English and History staff, because three of the five Co-ordinators were English/History teachers - there being only three other staff members who taught in these disciplines. So to describe Arlene as a House Co-ordinator is to present her as a busy teacher who shouldered considerable responsibility, and as an integral member of the English/Humanities team whose day-by-day collaboration was considerable.
It is important to describe Arlene’s positions of responsibility in order to portray her situation within the organisation accurately and their impact upon her pedagogy. However, the existing Year Seven English curriculum and the use of computers which had been embedded within it are a particularly powerful influence on Arlene’s pedagogy, and I now turn to a discussion of this.

The Year Seven Program

As already noted, Year Seven English was teaching a subject which Arlene had not taught for many years and the syllabus for it had been developed by another colleague. In fact, the use of computers had been a feature in Year Seven English for several years, and the use of computers which had become entrenched at this year level was an important influence on Arlene’s teaching.

Two years prior to the commencement of this study, I had collaborated with this other colleague to incorporate regular computer use within the Year Seven English program. Indeed, I had been appointed to the school at the start of that school year with the specific brief to ensure that students at Years Seven and Eight were having some exposure to computer use. I chose to work with the English teachers at those year levels, and to assist them to integrate the use of computers in their teaching of English to Years Seven and Eight, and I devised a program to team-teach with the teacher of each class (classes at the same year level were taught by the same teacher). This was the only regular opportunity for students to be learning with and about computers at that year level, although some occasional use was made by teachers in other subjects. In the team teaching arrangement, my role was that of exemplary teacher, technical support person, curriculum support and staff trainer. It was anticipated that the subject teacher would be trained in computer use by learning the same material as the students, and through time spent with the technology in tutorial sessions outside the classroom. He/she would also learn how to integrate
computing within the study of English by working with me on the planning of an integrated program, and I would learn something of the scope of the subject (something of which I freely admitted ignorance).

The year’s program commenced with using a typing tutorial, because of my belief that a fundamental pre-requisite to effective computer use was for users to be able to find their way around the keyboard. By the end of the first term, the class was also using a word processor regularly. My teaching-partner embraced the possibilities of this technology enthusiastically, and all the students’ major projects were to be word processed. She booked the computer laboratory for additional lessons for several weeks prior to the submission of an assignment, so that for substantial periods of the year, all the students’ English lessons were held in the computer room.

In the year following this introduction of computer use into Year Seven English, I worked with the same teacher as in the first year and the program went into a consolidation phase, as I prepared for full withdrawal from providing in-class support in the following year. The actual use of computers in the Year Seven program was only ever loosely documented, but it had become expected that students would improve their typing skills, do a substantial amount of word processing, and possibly some desktop publishing. It was this set of expectations which Arlene took up, along with the set texts and textbooks, when she (somewhat unexpectedly for all of us) came in as the teacher in the third year of integrating computing with Year Seven English.

The pattern of computer use which had been developed by myself and my colleague over the previous two years was based around the class coming to the computer room for one lesson every week. When there was a need for the students to complete an assignment, she made extra bookings. Typing practice was the staple for the first third of the year, and word processing was the major software type used thereafter. An overview of the year in which I observed Arlene’s work shows that her use of the
computers was similar to that of previous years; surprisingly so, because of the lack of actual documentation. It was probably her teaching a course which was new to her and which had embedded within it a pattern for computer use (made known, no doubt, to Arlene in various staff room discussions of which I had no direct knowledge) which led to Arlene using the same pattern of computer use as in previous years. Another factor which I assumed would have influenced Arlene’s adoption of the previous program was her strong support for students developing effective keyboarding skills, something which she had expressed to me clearly over the preceding years. It is also important to note that Arlene’s teaching with computers in Year Seven English remained the only regular opportunity for students to be learning with and about computers at that year level.

Classroom Dynamics and the Nature of the Year Seven Cohort

Geoff’s classes seemed to be me to be orderly and formal, Howard’s seemed to be informal and even disorderly, but in neither case was the classroom activity disrupted by noisy, rude or disobedient students. The three classes reported in this study were actually fairly placid, orderly and accepting of the teacher’s authority. However, I observed a larger range of classroom behaviours in Arlene’s classes than in the others. There were times in Arlene’s classes when a few students were disorderly and disorganised, and whose rambunctious behaviour was a seriously unsettling influence on the class. At different times, I observed students being very wriggly and restless, swinging back on their chairs in an animated way, a mock fight, and students rolling about on the floor (all out of the gaze of Arlene). The implication is not that Arlene was a poor disciplinarian, because when she saw inappropriate behaviour, she certainly acted on it. As Arlene described in our second interview,

[The student] was behaving like a clown - maybe it was before he actually sat down at the computers, so I threw him out and had a quiet chat to him outside, and he came back, and he was OK.  

(Arlene, Interview 2)
I saw more instances of such disciplinary measures in Arlene’s classes than in either of Howard’s or Geoff’s classes, and the need for it reflected the Year Seven cohort. There were many references in my notes for the year to indicate that teachers generally found them to be a difficult group.

There are several observations to be made about this class. Firstly, there were a number of lessons in the computer room during which I observed the students being very focussed and there being no disruptive behaviour. (Arlene told me that certain students who were typical instigators of trouble were absent during these lessons). Secondly, disruptive behaviour was not unique to the computer environment, as I noticed several instances in the regular classroom where students persisted in speaking while Arlene was speaking, and also other minor disturbances over items such as pens and rulers. Thirdly, certain classroom activities seemed to promote disturbance - the class was always silent during whole ‘silent reading’ in the regular classroom, and less disruptive during word processing activities than when using the typing tutorial. Finally, there was less disruption at the end of the year than at the start, as students had both matured and learnt to respond to the boundaries established by Arlene.

The dynamics of the class she was teaching is an important consideration when considering Arlene’s pedagogy. A further consideration is the presence of senior students in the computer laboratory along with the Year Seven class (Howard’s “the twelves”). Their occasional presence did not seem to trouble Arlene at all - she only made one reference to them in our interviews - which is in marked contrast to Howard.

Having now described Arlene, her role in the organisation, and some features of the organisation which impacted on her role, I now turn to a description of her pedagogy.
ARLENE’S PEDAGOGY

In this third substantive section of this chapter, a discussion of Arlene’s pedagogy, I consider the features of teaching and learning in Arlene’s classroom which I observed, which include a discussion of the classroom environment, the lesson structure, instructional activities and how Arlene managed technical difficulties. This is followed by an overview of how computers were used in Arlene’s classroom.

Features of Teaching and Learning in Arlene’s Classroom

The lessons when Arlene’s Year Seven English class used the computers were conducted in the room known as “Computer Room 2”, the same space as Howard’s class. A floor plan and technical description of the facilities is presented in Appendix One. The room was equipped with 28 computers, and so tolerance for system malfunction was low since there were 26 students in Arlene’s class. In my notes on the first video, I had written that it “seemed like a very full class”, which was an impression which persisted over the year.

Arlene chose to use her English lesson on the last period on Wednesdays for time in the computer laboratory. This, I would contend, would hardly be the time in the week when students would be most responsive or at the height of their academic prowess. I see this choice of time related to Arlene’s desire to provide variety and purpose in her teaching during the one English lesson in the week when it was perhaps hardest to be academically engaging.

Seating Arrangements

Arlene used a seating plan in her regular classroom, but not in the computer room. As she stated,
I have got a seating plan in the classroom ... In the computer room, there was only a couple of kids I wanted to keep apart on computers ... They’re not really too bad ... if they’re sitting beside someone who’s not their friend or whatever, you might not have the same interaction, the same sort of sharing.

(Arlene, Interview 3)

I wanted to explore the issue of the seating plan, including any relationship to my observation that the class was somewhat disruptive, so during our third interview, I asked Arlene if coming to the computer room might be a cue to the students to behave differently. She replied that they tend to behave better in the computer room and don’t need the seating plan. Arlene capitalised on opportunities to motivate and provide effective learning for her students. The choice to use the computer room during an afternoon was more based on observation of effective learning, than it was a soft option.

The Working Environment of the Computer Room

Arlene and I talked about whether the layout of the computer room affected the teaching/learning environment. Arlene commented that it affected the range of activities, that the nature of the room made it difficult to have a whole class discussion, for instance.

The layout of the room also influenced the effectiveness of monitoring all 26 students in the room. Arlene had observed students being off-task and doing mischievous things such as touching one another’s machines and pressing keys. I enquired how Arlene thought this compared with the regular classroom, where their pen and paper cannot be seen by the teacher the whole time, and the students might still be writing notes to each other; was the phenomenon restricted to the use of computers? She responded,

... you’ll get kids writing notes to each other in any classroom BUT the difference is with the piece of paper you see it being passed so you can grab it. With the computer, when you can’t see that screen and you feel,
“Oh-oh! That kid’s doing something!” - by the time you get there they’ve got it off the screen.  
(Arlene, Interview 3)

In our second interview, Arlene had commented that “apart from growing eyes in the back of my head, I don’t really know what you [sic] can do about that”.

Arlene commented that in the computer laboratory, students tended to be more talkative than the regular classroom:

They’re chatty enough in the classroom but they still tend to chat even more in the computer room. They look at each other’s work more ... [which I think is a good thing] ... They share each other’s work and now they will talk about what they’re writing. Yeah it’s good in that sense ... They read what’s been written so ... that helps the weaker ones as well, if they’re sort of stuck, or... [they can] look at someone else’s.  
(Arlene, Interview 3)

Arlene did not mean “chat” as necessarily having negative connotations:

No, I don't mind chat - if it is work chat. And I think that most of it is in there, apart from the usual couple who will talk about anything else but work.  
(Arlene, Interview 3)

I believe that Arlene appreciated the computer environment because, through it being ‘chattier’, group work and collaboration were promoted, which she valued.

I wondered if this might be an example of a more general principle - differences in students’ conceptions of private working space compared with the regular classroom. Arlene commented,

Maybe because it is up there on the screen they don’t feel that it is sort of privately owned the way something written on a piece of paper would be. A bit more public.  
(Arlene, Interview 3)

The contrast with Howard is interesting. Howard found that a problem was the persistent “connection” between computer and students, as if the student had entered into his/her own world with the computer, which he tried hard to overcome. Arlene found the opposite problem - work in the computer room was more chatty, more collaborative and more public.
Common to them both was that work with computers brought some changes to both the learning and social environment to which they had to adapt - Howard strove to find a format of giving instructions to more effectively “break the link between the kid and the computer” and Arlene tried to be more vigilant at identifying undesirable behaviour. Interestingly, if the symbolic form of the classroom was to influence teaching practice and reflects values and teaching and learning (Packer & Winne, 1995), the design of Computer Room 2 might be expected to lead to the relationship between the students and the computer as the primary mode of learning to be stressed. I had found this idea to resonate with Geoff’s teaching practice, but Howard or Arlene’s classes are examples of teachers and students being able to place their own stamp on the learning setting, regardless of whatever might be implied by the physical environment.

**Lesson Structure**

The structure of all Arlene’s lessons in the computer roughly followed the same pattern: a very brief introduction, a substantial period of time working at the computers, and a time of packing up and departure. In the paragraphs which follow, I provide a descriptive overview of Arlene’s teaching in these phases of her lessons.

Before the commencement of each lesson, students lined up outside the room, and they then entered with Arlene, which was the practice as for the regular classroom. Once the class was in the room, there were two different ways of starting the lesson which Arlene used over the year. I observed several lessons where the class gathered together on the floor at the start of the lesson (unlike Howard’s older students who sat on chairs, Arlene’s class of younger students sat on the floor). Arlene explained,

> I have started that ... over the past three weeks because I find that no matter how I tried, they all race in there and try to fight to sit beside their friends which I don’t like, so I’ve tried to start off with them sitting on the floor,
and I’ll tell them what we’re going to do and then sort of send them off to the computer.  

(Arlene, Interview 2)

From having taught in Computer Room 2 myself, I have observed that this race can be attributed to: students wanting to sit with their friends, some students wanting to sit in parts of the room where they are least likely to be noticed, and the more computer-savvy students wanting to ‘claim’ computers which they thought were better\(^{21}\). So, Arlene’s strategy was in response to behaviour which was particular to Computer Room 2. From sitting on the floor, students were sent off to the computers, on different lessons, either individually or all together. This introductory plenary was quite brief, typically lasting no more than five minutes, with Arlene briefing the students as to what they would be doing during the course of the lesson. The amount of time which Arlene spent speaking to the class was sufficiently brief so that there is no sense that Arlene was trying to control the discourse of the class, which could be symptomatic of teaching unfamiliar content (Carlsen, 1992; Olson, James, & Lang, 1999). Any work resources that the students needed were distributed, using a variety of means: sometimes as students moved to their seats, sometimes Arlene as she moved around the room, and at other times by students who were selected to help.

Another strategy Arlene used for starting the lessons was for the students to progress directly to the computers to work. She explained:

I haven’t ... [asked students to sit on the floor] in ... about the past three weeks. I haven’t done it because they have known what they had to do when they went into the computer room. They have been working on the novel assignment, so no. Next week I would probably do it again, because they will be starting something different.  

(Arlene, Interview 3)

\(^{21}\) As discussed in Appendix One, the computers in Computer Room 2 were substantially identical, but some would run slight faster or slower than others, and some would be more prone to breakdown than others. In my observation, students were very well versed in the rumours about which computers were better.
I did not observe Arlene using this kind of strategy in the regular classroom; her classes always commenced with some kind of plenary activity or briefing. Arlene’s strategy of commencing lessons with the class gathered together, in addition to briefing of the students in an earlier lesson, was designed to maximise computer use, and constitutes a particular response to working in the computer environment.

The second phase of each lesson was a time of work with the computer. This activity occupied approximately 80% of the time of lesson. In the chapters portraying Geoff’s and Howard’s classes, I have described this as a time of individual work because it was clear that the emphasis was on each student interacting with the computer on an individual basis. In Arlene’s classes, there were lessons with an individual focus, such as the keyboarding lessons, but there were also times when students were working as a group (though not necessarily as several clustered around a computer), such as producing their newspaper and using the Internet. Like Howard’s lessons, but unlike Geoff’s, the phases of individual work were generally not punctuated with activity.

As was common to each of the teachers in this study, whilst students worked on the tasks set, Arlene was very active, moving around the computer room, speaking to students. This paralleled her work in the regular classroom. I had noticed her moving among the students to deliberately speak to each one in the first classroom lesson which I had observed. On several occasions, I asked Arlene what she was speaking with students about as she moved around the classroom, which she described in our fifth interview:

Some of the words they use or the spelling or the way they’d set out or the form you know just different things like someone was using that Wingding thing, funny writing.  

(Arlene, Interview 5)

Arlene found that she did not always have enough time to see every student each lesson, particularly in the keyboarding lessons when she was busy assessing student performance as well. In our second interview, she
told me that in these lessons she would be lucky to see eight or ten students in a lesson.

During the lessons, particularly when printing was required, there was a fair amount of movement around the classroom as students moved to the print. This tended to exacerbate the problem of monitoring the students, because on their way to or from the printer, some students would interfere with others out of Arlene’s view. There was also more movement around the room because of the group work which Arlene encouraged, and consequently more talk between students. As mentioned earlier, Arlene found that working in the computer laboratory, students tended to be more talkative than the normal classroom. Group work and collaboration, were features of learning which Arlene valued.

As she moved around the class to speak with students, I observed that Arlene did not stand very close to students, nor did she kneel down and lean over onto the computer and very rarely did she take control of the computer from the student. I have suggested in earlier chapters that body language such as this was indicative of the extent of the teacher’s involvement with students’ work, and their strength of intervention when students experienced problems or work making mistakes. My initial interpretation of Arlene’s action was to think of her as distant, removed in her interactions and perhaps even a little scared of the computers. In the light of other evidence of Arlene’s confidence with computers and her striving to be approachable and personable, I have come to interpret this action in several ways. Firstly, her stance and actions seemed to be no different in the computer laboratory than when working with individuals in the regular classroom, so I doubt that fear of the technology was a major component. Secondly, Arlene is shorter in stature than Howard or Geoff, and probably did not need to bend down so much to be in the student’s personal space. Thirdly, I believe that whilst Arlene endeavoured to be highly approachable, she had a strong respect for their personal space. Fourthly, Arlene did not find any need to be especially vigilant when observing students’ work - she tended to assume
that they knew how to do it, and didn’t take too much trouble to teach or correct computer skills. Finally, she was also probably less visual in instructional style than Geoff or Howard; Geoff and Howard leaned in to point at the screen, but Arlene used words to explain.

During some lessons which I observed, the students were expected to both commence and complete a writing task in the one lesson. This meant that towards the end of the lesson, students would start printing their work and Arlene would start commenting on or correcting work as it was submitted. As she moved around the room, Arlene was quite happy to make corrections and suggestions by viewing work on the screen, but for a final copy of a piece of work she would want to mark in the traditional manner, using hard copy form and with a red pen. Indeed, when there was an opportunity to do so, Arlene much preferred to comment on hard copies of drafts rather than working with an on-screen copy.

The routine at the end of each lesson in Arlene’s classes I have found to be less formal than with either Howard’s or Geoff’s. Rather than remaining in their seats until actually dismissed (as was the case with Howard’s and Geoff’s classes), when given an indication to start packing up, students would invariably stand in their place, or congregate around the door or teacher’s table. Only once did I observe any kind of plenary session or instructional conclusion to the lesson. When the bell finally rang, Arlene would say something like “you may go - make sure your shirts are tucked in”, but it would look as if the class was just drifting out without much regard for the direction she had given. During our fourth interview, Arlene expressed some disappointment over how the room was left by the students, rarely pushing chairs in. Whilst the students usually logged out and turned off their computers (which was expected at the end of the school day) Arlene consistently tidied the room for them. I observed her spending ten minutes or more tidying the room after the students had left.

This concludes the discussion of the structure of Arlene’s lessons. I have noticed a good deal of similarity between Arlene’s teaching in the
computer laboratory and the regular classroom, although not to the same level of fine detail as I observed in Geoff’s case. For instance, Arlene applied a certain formality and order to the classroom, allowed students to be in control of their work (working at their own pace and in their own way), was active in monitoring student work, and required hardcopy submissions. There were also a number of strategies which Arlene made in response to the computer room environment: maximising the use of computers, trying to be especially vigilant to maintain classroom order, valuing students ability to manage the technology.

Over the year, Arlene used more types of software than either Howard or Geoff, and for this reason I now proceed to a discussion of her teaching of those, which emphasises important traits in Arlene’s teaching.

*Instructional Activities*

The software which Arlene used most throughout the year were the typing tutorial and the word processor. Arlene was also one of the first teachers at Outeast College to use the Internet in her teaching, and I will now describe Arlene’s instruction in relation to each of these.

I have earlier commented that Arlene had been a long-standing supporter of developing efficient keyboarding skills, and keyboarding occupied the first third of the year’s work. The teaching of keyboarding was essentially a self-directed learning activity. Students had access to a typing tutorial program which gave them practice at certain keyboarding skills, in increasing complexity and difficulty. Each student also had a sheet which detailed these criteria, and they would ask Arlene to tick that they had completed each exercise before moving on to the next one. She explained:

> They practise the exercise a couple of times, and when they feel that they’re ready to get a little tick-box done, then they call me over, and I stand and watch that they’re not looking at the keys and using the right fingers.

*(Arlene, Interview 2)*
The students’ sheets were collected at the end of the lesson and kept on file.

In our second interview, Arlene spoke about the “old fashioned” way of learning keyboarding which she had experienced as a student. Typewriters were arranged in straight rows, the teacher stood at the front and students wore a shield which covered the keyboard so that it could not be seen. Arlene did not consider even trying to use that model because “I suppose it would work with some kids and others it would just put them right off” (Interview 2). Perhaps more importantly, even though her teaching method required her to be in eight to twelve places at once, Arlene preferred to be working among the students, rather than distant from them, noting that,

... they can work more at their own pace now. Whereas in the old system they were sort of held back until everyone was at the same level, then you went on to the next.

(Arlene, Interview 2)

Arlene taught keyboarding, partly because it had been a traditional component of Year Seven English, but she also drew attention to the improved presentation of the product which efficient use of a computer would result in. Arlene elaborated:

Oh, yes, I think so, [it’s] definitely [an important skill]. And I think they’ve got an advantage. I know I shouldn’t say this, and I know it shouldn’t be an advantage but a piece of work that’s presented well - it just gives a good impression straight away, and if they can use a computer well, then I think they’ve got an advantage.

(Arlene, Interview 2)

Siegel and Davis (1986) have described a “process-orientated” approach to using a software tool as one where as much emphasis is placed on learning to write as on producing a finished composition. Arlene does not appear to have this view of word processing, and I believe that her valuing of the presentation of work is critical in understanding her pedagogy in the computer room. This, and other ideas which Arlene
values which I interpret as critical in understanding her pedagogy, are discussed in more detail later in this chapter.

Like Howard, Arlene had some specific expectations of how students would use a word processor. She commented:

In the typing of assignments they tend to spend an awful long time, sort of deciding which font they are going to use, so they tend to play with that a bit ... but ... on the whole they are pretty good. ... They tend to like to see how big they can get the headings and how curly they can get the writing. You know, they like doing that rather than getting straight into the work. ... I've been trying to get them to type in the work first, then go back and start, you know, using the fonts and things and setting out the pages but they prefer to "play". But they get there.

(Arlene, Interview 3)

Arlene was not especially particular about how students should go about using the software. The repertoire which she expected of students was fairly limited: bold, underline, centre. In our fifth interview, Arlene responded that “some of them” use the spelling checker, and that its use is “OK until it comes to a word that they’ve spelled badly that the computer can’t even find something that matches then they say ‘Oh, something is wrong’ ”. Arlene further commented that the spelling checker

...is good as long as they read through them and think about the words that are there and they don’t just click on something they think’s right - because it should make them look at the words, shouldn’t it?

(Arlene, Interview 5)

Arlene clearly saw that there are some advantages of the spelling checker, along with some disadvantages. She did not press students into using it, and apparently did not consider its potential as great as Howard did, and also, unlike Howard, she did not seem to value many of the purported advantages of word processing (Geisert & Futrell, 1990), as shown in Table 1 of Chapter Six.
During our fifth interview, Arlene contrasted students learning about the technology (which Arlene referred to as “us[ing] the word processor as a skill”), with students learning in various subjects (“technology as a tool”). She considered that her role was assisting the students to effectively use the tool, and whilst she taught some technology skills over the year, she did very little of this. Along with Arlene’s valuing of the presentation of work, I believe this statement is critical in understanding Arlene’s pedagogy in the computer room, because she in fact did extremely little teaching about the technology.

Arlene’s class used the Internet (a term which I am using as shorthand for the use of Netscape Navigator as a Web Browser to access the World Wide Web) as a tool for gathering information during the latter part of the year. This occurred during a time when the Internet was not commonly available in schools, was not known to most students, and the capacity for more than one user to access it simultaneously had only recently become available at Outeast College (see Appendix One).

The class had been studying a book which was set in World War Two, and a research task was set for students to gather some information about the war and the war-years, to set the work in context: when it was, who the leaders were, why children were sent away from main towns, etc. Working in groups over several weeks, the students were to present their work as a newspaper. Within each group, each student had different roles:

...they chose within the group. They all had to do at least two articles - one the general world news and one related to the text and then they had to decide who was going to do things like ads, and the heading and the name of the newspaper ... cartoons you know things like that, and that was really up to each group to work that out.

(Arlene, Interview 5)

The ninth lesson in which I had observed Arlene involved the students using the Internet to locate information for their project. They had been given some preparation on this topic, having talked about it in class, and
spent a lesson in the library where they’d used books to find information. Working in their groups (six groups in all), they then used search engines on the Internet to type in key terms such as “World War 2”, “Hitler”, “War”, “History”, and “War in Europe”. The lesson, however, was “a bit of a disaster” (Interview 4) because of technical problems with the school’s Internet connection (the class was just unlucky that the problems emerged just as they were to trying to use it). A further problem was the students’ skill in using search engines. Arlene told me that none of the key terms used turned up any particularly useful pages of information. Arlene had neither tried out possible search terms beforehand, nor had done any work with the class on creating suitable search terms.

Arlene’s experience of using the Internet suggests three things. First of all, there is the importance of preparing adequately and identifying suitable search terms which the teacher can be reasonably confident will work. Secondly, there is Arlene’s confidence and resilience at using computers. Her response to the problems which emerged was firstly to “try and get it going, and then to console them that they couldn’t get in” (Interview 4), and then to assist students to begin some other activity. I believe, this indicates a fair knowledge of, and confidence with, the technology. As Arlene explained:

they all ended up doing different things, some of them used Publisher to make a front cover for the assignments, others typed bits of the assignment that they knew. They were all doing different things in the end.

(Arlene, Interview 4)

After the events of that lesson, Arlene decided that it would be easier to go to the library and find books! Despite this, Arlene thought that she would like to use the Internet again, and she stated quite enthusiastically,

I would like to. I’d like them to be able to get into it and see what they can find out … [but] make sure the equipment is working!

(Arlene, Interview 4)
Thirdly, Arlene’s use of the Internet was another example of the lack of explicit teaching about how to use computers. Arlene acknowledged that this was a new technology for many students, and yet Arlene provided minimal instruction on how to use it; students worked in groups, and it was expected that the more knowledgeable ones would help the less knowledgeable ones. If it was reasonable to make some assumptions about students’ knowledge of how to use the word processor, then it was much less reasonable to do so with respect to the Internet. In fact, Arlene’s reference to the computer as a tool (earlier in this chapter) seem particularly apt. It is almost as if Arlene approaches student use of computers in the same way as she would their using a pen in the classroom; she would not have to show students how to use a pen (that knowledge can be assumed), and the content of the class can proceed on the assumption that students know how to use that technology. It seems to me that Arlene made the same kind of assumption about computers - appropriate use was assumed (either learnt already, or acquired from peers in the classroom), and the lesson content proceeded regardless. The computer was largely a ‘silent partner’ in her teaching of English. Arlene made use of a range of tools in her teaching of English, but she made considerable assumptions of the adequacy of requisite knowledge. It is quite conceivable that some of her students would have learnt some dreadfully inefficient techniques for using software.

There were times when Arlene taught some computing concepts, and an example of this was the use of tables in the word processor. Students were expected to use tables in an assignment, and she prepared them for this. Arlene described her intended strategy:

I will have them on the floor to begin with, tell them what we are going to do. When we did the card last week, what I tried to do was sort of give instructions that they followed and then had to wait - but I found that - it worked with most of them, but some of them just kept pushing keys, so it didn’t, so I think that this time I’ll get them to write down the instructions first of all, and then go to the computer - or then, switch the computers on and try them. Do it from there - so it may be a mixture of using the whiteboard, which I haven’t used yet in the
After copying down a list of instructions, students would be expected to follow them in the future lesson. Arlene’s idea was that the students would gradually internalise the process so that they would be able to do it without referring to a sheet. This seems to me to be a suitable, if didactic, way of teaching new concepts which could have been employed more frequently throughout the year, although Arlene chose not to do so.

I believe that this collection of observations of Arlene’s instructional activity reflects both what she perceives herself as capable of doing as well as her fundamental values and beliefs about English teaching: valuing the presentation of work and teaching ‘with’ the tool rather than ‘about’ the tool. These are discussed further in the section on Arlene’s practical theories of teaching which follows later in this chapter.

I now turn to a consideration of the final feature of teaching and learning in Arlene’s classroom - how she managed problems which arose with the computers.

Managing Computer Problems

There were a number of technical problems with which Arlene had to contend over the course of the year. As I noted with Howard, the most common problem at Outeast College was a malfunction of the disk or disk drives. When all students were present, Arlene’s class consisted of 26 students, and Computer Room 2 contained 28 computers, which did not leave much margin for error, and there often seemed to be two or three machines that didn’t work. It was also unfortunate that Arlene’s class was affected by system problems over consecutive weeks: a total network failure, a serious malfunction with the printer, and problems with the school’s connection to the Internet. Notably, these problems did not seem to trouble Arlene greatly, and her intention to continue using computers was undaunted.
Arlene employed the strategy of detecting likely problems early in the lesson, and if necessary the student could then move to another computer. Problems with logging in or saving were used as sure indicators of present or impending difficulties. Arlene left most of this diagnostic work to students; in at least five lessons I noticed students moving to find a suitable computer. There were very few occasions when she spoke with a student to help with the diagnosis of a problem, and this is consistent with her instruction about different software types. Unfortunately, in one of the lessons which I observed, the same three students had to move several times before they found a working computer.

Unlike Howard, Arlene was not especially vigilant about the ‘no disk - no work’ policy. Many of the tasks did not require a disk: it was certainly not required for keyboarding practice, and a disk was arguably not required if a student was preparing a piece of work to be printed out at the end of the lesson and which did not have to be saved for future use. Arlene was clear that she did not want to provide any student with an excuse to avoid work, so saving regularly was encouraged but not over emphasised.

I have expressed concern in my discussion of Howard and Geoff that their calling in of a technical expert might imply to the students that the ‘real knowledge’ for being able to use computers effectively is not in the hands of English teachers and students (for instance), but resides with an ‘outside’ expert. In Arlene’s case, the calling in of an expert only happened when there was a technical issue which genuinely required specialist knowledge - the repair of a printer, rectifying network problems, and the correction of a password problem. In our second interview, Arlene had noted that there were a number of students with password problems. She commented that they needed to seek assistance from the technical staff outside of class time, but invariably failed to do so. We noted that this would not actually affect their ability to do typing, but it did mean that they could not obtain a printout. Arlene placed the responsibility for resolving this onto the students: they needed to seek technical support outside of class time, which was standard policy and practice.
In summary, Arlene seemed to have a much better grasp of the technology than either Geoff or Howard, and was able to more accurately identify those times when computer problems were genuinely beyond the gasp of her or her students to solve. It is this greater knowledge which possibly leads to her low levels of stress when problems did arise. Arlene’s students needed to be responsible for much diagnosis and corrective action, and Arlene’s apparent lack of direction or instruction in this regard is typical of her general instructional approach.

Before turning to a discussion of Arlene’s personal attributes where the notions of presentation and of not teaching computer skills will be further developed, I conclude the overview of Arlene’s pedagogy by reviewing the software and modes of computer use which I observed in Arlene’s teaching.

**Software in Use; Modes of Computer Use**

During the course of the year, I observed Arlene use several different software types with her Year Seven class. In the support mode (ACS/ACCE, 1994/1995), where the computer is used to enhance the presentation of work or increase the accuracy or efficiency that the student might otherwise be able to achieve, Arlene used a typing tutorial, a word processor (Microsoft Word), and a desktop publishing program (Microsoft Publisher). Arlene also used computers in the resource mode, where it was a means of accessing information and other resources. In an era when Internet access was relatively new to schools, and few students had experience with this technology, I observed a group of lessons which incorporated the use of the Internet to access information on a topic (that is, computer use in the resource mode), which has been discussed earlier.

As Arlene commented, during the first term, the focus of the computer lessons was on keyboarding, but towards the end of the term she elaborated:
I’ve found that they’re getting bored - well, they started to get bored just doing keyboard lessons every week, so last week we made a Mother’s Day card and they were great. They really enjoyed it, and the majority of them ended up printing it out and taking it home. This week I think we’ll get them to make tables, getting ... in preparation for an assignment they’re going to be doing, and leave keyboarding for a little while.

... [To date, this class has been doing] mainly keyboarding - some of them have written a story using the computer for a shape poem - forming a poem in the shape of a tree.

(Arlene, Interview 2)

The shape poem was, in fact, an opportune diversion from the regimen of typing practice, which reflected the intention which Arlene had shared with me during our first interview of providing variety in her teaching so that students wouldn’t get bored. Likewise, so was the production of a Mother’s Day card, produced using the greeting card wizard feature of Microsoft Publisher.

I observed no use by Arlene of computers in tutorial or link modes. The use of word processing as a dominant tool in the Year Seven English classroom is consistent with the findings of Shears (1995) and Meredyth, Russell, Blackwood, Thomas, & Wise (1999) relating to computer use in Australian secondary schools (refer to Chapter Four). However, Shears’ findings of the decline in the use of computers in the senior secondary classroom compared with the junior secondary classroom might imply greater use at Year Seven than Arlene arranged.

The support mode is often linked to the use of the computer as a productivity tool to improve the efficiency of the production of items of work, along with improving the standard of presentation of these. Arlene’s reasons for using computers especially relate to the use of the computer as a presentation tool (as discussed in greater detail later in this chapter). She does not draw attention to potential benefits of using computers, such as: efficiencies to drafting and redrafting, and opportunities for improvement in spelling and the ability to edit and evaluate own work. Hativa (1995) and Newhouse (1998) suggest that
teachers usually draw attention to these potential benefits. I would therefore assert that Arlene’s rationale for using computers arises from her own particular mindset and is relatively immature.

Of the three teachers in this study, the greatest variety in the types of task and software is found in Arlene’s class, and I see this as reflecting her desire to provide students with some variety and interest in the lessons. In particular, it served a valuable purpose in the context of a class which could be noisy, disruptive and difficult to handle and during the lesson in the week when the teaching and learning conditions were least ideal. That is, there was a strong general educational reason for using computers in addition to their particular value to the teaching and learning of English. I applaud Arlene’s use of a variety of software types and her confidence to use them with a class, but it is apposite to note Arlene’s apparent lack of knowledge or interest in exploring the more sophisticated features of the software and, through these, allowing computer use to more considerably impact on the English curriculum.

This concludes the discussion of the general features of Arlene’s pedagogy. I now move to a discussion of her personal attributes - those qualities which amount to her practical theories of teaching and which are expressed in the pedagogy just described.

**PERSONAL ATTRIBUTES**

In this third substantive section of this chapter, I describe Arlene’s knowledge of computer systems, pedagogical content knowledge and her practical theories of teaching.

**Knowledge of Computers**

Arlene believed that she had a suitable knowledge of both computer systems and software for her purposes. Certainly, at the times when I had
observed Arlene work at the computer, I had observed that she was indeed a competent typist and was a competent user of a word processor. During our second interview, she explained:

Yes, I’m quite comfortable - at the moment probably because I know how to use a keyboard myself - maybe when we try to do something I’m not so sure about I won’t be as comfortable - like teaching them, well, Publisher was OK last week with the little card, but if I wanted to do anything more complicated, like - you know - a Gazette page or something I would find I would need to practise a lot before I could teach the kids so, yeah - at the moment I’m quite comfortable. (Arlene, Interview 2)

It is noteworthy that Arlene had worked out how to use the Internet with little trouble. She was not at all troubled by using a new software type.

Arlene drew a contrast between learning about the technology compared with its application to learning in various subjects. She considered that her role is assisting the students to use the tool effectively, but she commented during our fifth interview that “the technical part of it would need someone who knew a lot more about it than me”. Arlene did not, as I have consistently noted, do very much teaching about the technology. This is partly due to her beliefs about the use of computers in English (it was simply not her place to do so), but it also reflects her level of knowledge about the technology - sufficient to be comfortable with using computers, learning the rudiments of new software, overseeing students’ use of computers and identifying serious technical problems, but not really enough to teach about the technology.

**Pedagogical Content Knowledge**

In some respects, I believe that Arlene had a good grasp of software as ideaware (Olson, 1988b, pp. 55-56) - that is, the teacher’s grasp of the essential “idea” of a piece of software and how that is translated into classroom practice and challenges established pedagogy, that is pedagogical content knowledge. She used a variety of software types and had an
almost intuitive grasp of the potential for each of these in the teaching of English. However, she was inclined to use many software types at a somewhat superficial level, rather than investigating the use of each type in any depth. Word processing, for instance, is seen as little more than a new-fangled way of preparing neatly typed work, not as a tool which could be central to improving the quality and quantity of composition. I have earlier noted that Arlene did little teaching which would extend students’ knowledge of the software, and suggested that part of the reason could be the combination of her own (lack of) knowledge of ‘advanced features’, combined with her not having an intuitive grasp of the English tasks which would benefit from students’ knowing these. She did not seem to have the same curiosity as Howard, to probe for ideas to exploit the computer network to its full efficiency and benefit for her teaching (such as placing files on the network). My overall interpretation is that Arlene’s general ability to translate software into ideaware is quite good, but the depth of her knowledge of each software package could be a limiting factor.

After observing and talking with Arlene for a year, I have come to believe that it was not her knowledge (which was generally quite good) but her practical theories of teaching which were the dominant influence on the use which she made of computers. It is these which are discussed in the following section.

Practical Theories of Teaching

Practical theories of teaching are those internal frames of reference which are deeply rooted in personal experiences, especially school-based ones, and are based on interpretations of those experiences (Marland, 1994; Marland, 1995). Unlike Howard, Arlene made no explicit links between her values and beliefs and her teaching practice. Geoff, too, made no explicit links, but Geoff spoke at length about all manner of things, and from the sheer quantity of text I have been able to infer Geoff’s internal frames of reference. Arlene was much less verbose, a much more private
person when talking about her teaching, and the task of inferring practical theories of teaching from the data available has been much more difficult.

Nevertheless, there are a number of cues throughout our discussions which I would interpret as constituting Arlene’s practical theories of teaching. In our first interview, Arlene had told me that she tries to

- motivate students so that they want to learn rather than feel that they have to;
- ensure that all students have opportunities to express a point of view and for students to recognise that others may have a different viewpoint which is equally valid;
- be understanding, recognise if a child is having difficulties and hopefully have the ability to help the child overcome it; and
- be approachable, so that the students feel they can come to her for assistance with problems of work, organisation and even at a personal level.

In our first interview, Arlene clearly indicated that these arose as a response to how she had been taught. She recalled that in her school days children were expected to sit in the classroom and absorb everything the teacher said without question; that there were teachers who had been very unapproachable and often engaged in heavy-handed discipline. In contrast, Arlene recalled that “one piece of advice I was given when I first began teaching was ‘not to smile until Easter’22. That did not last ‘til Valentine’s Day”. I had also made note of the tribute paid to Arlene by the Year Twelve students of the previous year. At their valedictory dinner, Arlene was described as a teacher who had ‘mothered’ them and had been an ever-present person to talk to and shoulder to cry on. In one of the lessons which I observed, Arlene clearly shares excitement of the news or discovery with two girls, jumping up and down in delight like a girl

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22 The school year in Australia starts in late January or early February.
herself. In our third interview, she told me that her role when the
technology did not work as it should was not to panic or be despondent,
but to console the students. In spite of a somewhat non-interventionist
and removed approach when monitoring student work, it has seemed
very clear to me that Arlene is approachable, friendly and pastoral whilst
maintaining a professional distance.

Throughout our discussions, it became clear to me that Arlene valued

• students not getting bored, and I observed considerable variety in her
  regular classroom lessons - spelling tests, writing a play, reading a play,
  designing a poster, writing a short story;
• students presenting work well and taking pride in their work;
• students producing completed pieces of work, achieving both a good
  quality and a good quantity of writing;
• academic enterprise - more work, less play in the classroom; and
• group work, and she made particular comment in our first interview
  that when students work in groups of mixed ability they can help and
  encourage one another, a way of making a conscious departure from
  the chalk-and-talk and empty-headed model of teaching and learning
  which she had experienced as a student herself.

I believe that Arlene found that using computers in her teaching
supported her desire to promote these values and beliefs. The most
strongly recurring themes in Arlene’s work throughout the year are the
notions of having students present their work well, and to take pride in
their work; the motivation which using computers provides to students to
take care with a piece of work and to complete it thoroughly are recurring
themes. In our second interview, Arlene noted that students find
computers quite motivating “normally they are all desperate to get a
machine” (Interview Two), a sentiment which other researchers have
noted (e.g. Schofield, 1995), and she also found that there was less of a need
to persist with a seating plan in the computer room because students were
better behaved. Furthermore, Arlene believed that “it looks as though
they’ve taken time with it when they do present it on computer” (Interview Two), and these points of view alone, were, to her, strong justifications for the use of computers in English.

In our second interview, Arlene developed her thoughts on the desirability for students to take pride in their work, commenting,

I’m not saying that some kids don’t write essays well, and present them neatly that way, but other kids’ handwriting is terrible, and that’s where I think they get a bit of motivation when they can see how nicely they can present something. (Arlene, Interview 2)

The use of the computer to enhance the presentation seems almost trite compared with Howard’s high hopes for word processing to improve drafting, revisions, spelling and quantity of writing. However, it is not without support within the scholarly literature on the use of computers in the teaching of English. Snyder (1996) has written:

The fluidity of word processing transforms not only the content but also the appearance of the text. By allowing writers to consider every aspect of presentation, it enables the text to be reshaped for varying purposes and audiences, and to look like a published document. Writers can choose from a variety of fonts and formats, and at any stage of the writing process can see the format the words will assume in print. The visual aspects of composing can be manipulated: page layout and design - columns, margins, tabs, fonts, pitch and point size. No longer a distraction from what has long been considered the more serious uses of written language to express and develop complex ideas, the graphic dimensions of writing themselves become important. (pp. 3-4)

Over the course of the year, I observed Arlene’s class engage with tasks where the presentation was important: shape poems, Mother’s Day cards, a newspaper layout. In fact, there were relatively few ‘standard’ compositional or essay-writing tasks. Arlene’s use of computers reflected her beliefs in the value of computers, which have basis in the teaching of English. However, like Howard she was fundamentally interested in matters of quality, and had a relatively narrow vision of computers in
English compared with that provided by authors such as Snyder (1996) and Lankshear et al. (1997b). Furthermore, whilst Howard was very articulate and thoughtful on this matter, there was no evidence to suggest that Arlene had considered these in the same degree of depth as Howard.

The use of computers to promote students enjoying their work and not being bored was an important advantage in the teaching of English. Arlene told me that the lesson in which students produced a Mother’s Day card was set because it was “something that the students would enjoy”. The variety of learning activities in her regular classroom lessons is paralleled by the variety of tasks that were performed using a computer and the variety of software types used, which is elaborated on later.

Arlene’s emphasis on using computers for presenting work well brought with it some encumbent difficulties. In our second interview, she acknowledged that many students produce hand-written work well, and reflecting on student achievement in the computer room during our third interview, she commented:

> Some of them produce very nice work, I will say that. But not from kids that would surprise me with. I mean, they quite often produce that sort of work on the computers at home and hand it in anyway.

(Arlene, Interview 3)

If students are regularly producing well-presented work using hand-writing or by using technologies available to them at home, then I wonder if there is sufficient value in computing for sustained use in English. The newspaper task actually amplified this problem. The computer could have been used to produce a completely desktop published piece of work.

Olson (1988b, p. 30) has distinguished between “expressive purposes” for using computers (directed to the formation of an impression of oneself in the eyes of others) and “instrumental purposes” (motivated by necessity). Whilst Arlene had made the use of computers in her teaching over previous years, it was neither often enough nor for the kind of tasks which I consider to be a means of her drawing attention to her knowledge
and capabilities with computers in any way. Arlene has constantly appeared to me to be a too modest and self-effacing person to draw attention to herself, anyway. I have come to believe that Arlene used computers regularly in her teaching mainly because of the instrumental purposes related to presentation of work, motivation and promoting the enjoyment of work.

I now turn to the fifth substantive section of this chapter, a discussion of the concerns and difficulties which Arlene experienced when using computers in her teaching, including class management, technical problems, lack of knowledge and impact on the English curriculum.

**DIFFICULTIES AND CONCERNS WITH COMPUTER USE**

During the course of the year, when I asked Arlene about the difficulties and concerns which she was experiencing, she consistently commented on issues concerning the layout of the room and **class management**. She commented on the ability to attend to all the students in the classroom, and not being able to see what was going on behind her due to the physical layout of the classroom:

… not being able to see what’s going on behind me - and getting around to all the kids. I felt there was one row that I don’t think I went to very much at all - and I don’t if it is because they seemed to be behind me most of the time - I was always sort of facing that way and they were back here so they may have had their hands in the air waiting for me and I didn’t notice them …on the video …I just sort of noticed I wasn’t in that little final row very much.  

*(Arlene, Interview 2)*

These sentiments are consistent with Shears’ (1995) findings. Contrary to the findings of Hativa (1995) and Lynch (1999), I did not observe any time when Arlene felt that her competence or authority were threatened, or subject to routines, expectations and knowledge of someone else. Similarly, I have not found any evidence to suggest that Arlene perceived the physical space of the computer room as being ‘owned’ by someone else.
Recurring technical problems, and the teaching/learning time which was wasted because of them, were a frustration to Arlene and would be accurately perceived as a point of fragility because issues of printer breakdown, computer malfunction and Internet connectivity were beyond the scope of the classroom teacher or her students to rectify. Arlene consistently demonstrated sufficient knowledge of the nature of the problems not to waste time, as Geoff did, trying to fix the unfixable. Arlene was able to assist her student participate in alternative activities when Internet troubles were experienced, and so her lessons did not ‘break down’ in the same way as Geoff’s. Frequently Arlene’s lessons were organised in such a way that they could be reorganised around problems with computers and printers, and calling on technical assistance in those circumstances.

Arlene identified lack of knowledge as a concern. Arlene’s pedagogy did, however, seemed to speak of a confidence due, in part, to her earlier grounding in computing. The lack of depth to which any piece of software was explored, and the incumbent restricted grasp of software as ideaware is an important concern, constitutes a point of fragility because it ultimately implies limitations on the extent to which computers would be used for the teaching and learning of English.

Research (Becker, 1994; Schofield, 1995; Shears, 1995) has indicated that a common complaint of teachers is that computer use in teaching reduces the time available for the teaching of the content of the subject and downgrades the salience of content. Throughout the year, such concerns were relevant considerations for Arlene, impacting on the extent of computer use. In fact, even though Arlene was a strong proponent of good keyboarding skills, she would have preferred not to have been responsible for ‘taking’ English time to teach these.

Newhouse (1998) has drawn attention to haphazard development of skills. Certainly, Arlene’s students developed computing skills in a haphazard fashion, and in the long term, this could be a point of fragility if a teacher
was to presume pre-requisite knowledge which had in fact not been learnt by students.

Arlene’s apparent focus on the importance of presentation, and the ability of computers to assist with that, could in fact be used as an argument against her use of computers. Arlene found that many of her students used a computer at home to produce work, and that many others produced acceptably presented hand-written work. It is hard to believe that the continued use of computers in English would be sustained on the basis of presentation alone, and as such one of the prime driving forces behind Arlene’s use of computers is a fundamental area of concern, though unrecognised by her.

Like the cases of Geoff and Howard, Arlene’s case illustrates the importance of resourcing as a point of fragility. She was reliant on technical support for the resolution of certain pressing problems, but also for the continuing maintenance of all computers so that they were working effectively. With a class which nearly filled the computer laboratory, it was especially desirable for all computers to be working.

This concludes the fourth major section of this chapter, the discussion on the difficulties and concerns experienced by Arlene in her teaching with computers. Of the various frustrations and difficulties suggested by the literature and experienced by Arlene, I believe that the following constitute points of fragility: pedagogical content knowledge (software as ideaware), technical difficulties and resourcing.

**EPILOGUE**

*Achievement of Aims*

If we rely on Arlene’s explicitly articulated aims for teaching, then we have a portrayal of Arlene who uses the computer room mainly because
she is obliged to do so. However, if we attend to Arlene’s fundamental values, it can be seen that she uses computers consistently to assist students present work well, take pride in their work, motivate students and provide opportunities for collaboration between students. Arlene was also aware that her lessons represented the only regular time when the Year Seven students would use computers, and she was committed to maximising that opportunity. Each lesson, Arlene created a lesson which fulfilled both the values which she sought to express and the aims which she had thought of as being foisted upon her. Even though Arlene did not identify or articulate specific aims for the year (in contrast to Howard), she is, like Geoff, purposeful in her teaching with computers.

**Conclusion**

In this chapter, I have presented a descriptive account of the unique perspective of Arlene as a self-taught computer-using teacher. I have considered Arlene’s particular background, experience with computers and the context of her teaching; Arlene’s pedagogy teaching with computers; and the factors which limit and promote her use of computers.

I now turn to the final chapter of this thesis, the first part of which is a presentation of the common characteristics and themes manifested in the three individual case studies, which is an essential component in analysing and presenting a collective case study (Stake, 1994).
CHAPTER 8 - DISCUSSION AND CONCLUSION

There are several sections to this chapter. The first section is a discussion in which the common characteristics and themes of the three individual case studies are presented. It is within this section that an overview of the pedagogy of the self-taught computer-using teachers is provided. This is followed by a summary of findings, a consideration of the research question, a consideration of the generalisability of the findings, a presentation of practical implications of the study, a consideration of the limitations of this study, and a discussion of the contribution of this study to knowledge in the field.

DISCUSSION

In this section, the common characteristics and themes of the individual case studies are presented, and it is organised into eight sections. This organisation is derived from the structure and findings of Chapter Two, and the following are considered in turn: the teachers, their pedagogy, their use of computers in teaching, the difficulties and concerns with computer use which they experienced, personal factors which impact on computer use, the difficulties and concerns which are points of fragility, the implications of practical theories of teaching, and teacher learning and reflective practice.

The Teachers

In Chapters Five, Six and Seven, the three teachers in this study were depicted as busy and committed professionals, each of whom had taken on administrative or pastoral duties which demand high levels of interaction with students and staff. A relatively narrow range of teaching disciplines is represented in this study - PE/generalist (Geoff) and English/SOSE (Howard and Arlene). Each of the organisational divisions of Outeast
College are represented (Geoff - Junior School, Arlene - Middle School, and Howard - Senior School).

I have previously described Geoff, Howard and Arlene as self-taught computer-using teachers, although there is diversity in what this term represents of each teacher’s experience. Certainly, in each case, their knowledge of the pedagogy of computer use is entirely as a result of being self taught. Geoff’s knowledge of computers, and, to a lesser extent, Howard’s, is also as a result of having been self-taught. Arlene had completed some formal studies in computing, but on systems different from what were available to her throughout this study. Howard was a very inexperienced user. Geoff and Arlene were more experienced, but in Geoff’s private use of computers, he used functions and software in ways which experienced users would be unlikely to employ, as discussed in Chapter Five. Each teacher was committed to using computers for personal and professional/organisational purposes.

The three teachers had very different purposes for using computers in their teaching. Drawing on the distinction made by Olson (1988b; 1989a; Olson & Eaton, 1987) between “expressive purposes” (those directed to the formation of an impression of oneself in the eyes of others) and “instrumental purposes” (that which is out of necessity or mandate), I have interpreted the purposes of each teacher as follows. Geoff’s purposes were strongly expressive, seeking to demonstrate that he was ‘more than’ a PE teacher and that he had acquired valuable skills and knowledge in the field of computing, and that he was confident and capable. Howard’s purpose was weakly expressive (he told me that it was fashionable to be using a computer in class) and strongly instrumental in that he perceived many advantages of computers to ESL teaching - the ability to do such things as change the format of text, delete and replace text, and save for future reference. Arlene’s purpose was instrumental, related to her valuing the presentation of work, and the use of computers as a source of motivation, promoting students’ enjoyment of their work. Computer use also allowed Arlene to better express some of her fundamental ideas about
teaching than did teaching in the regular classroom, such as the value of collaboration and group work, and provided a forum for her to be approachable, helpful and valuing of students’ individual efforts.

Howard, Geoff and Arlene have each had very different career paths. Howard and Arlene in particular have had diverse life and teaching experiences, whereas Geoff has only ever been a teacher at Outeast College. In terms of Huberman’s (1989) review of the literature on phases in the career teacher, it is reasonable to assume that they have passed through the early phase of “survival and discovery”, and have entered into a phase of “stabilisation” (often not fully realised until eight years or more of teaching), if not a phase of “experimentation/activism” (pp. 33-38). The evidence of the case studies - indeed, the very participation of Arlene, Howard and Geoff in the study - suggests that the participants have established themselves in their profession and are looking for new challenges and opportunities. There are no apparent personal factors (Measor, 1985, p. 62) which should influence these teachers’ responsiveness to change and innovation. In summary, from the point of view of career development, they are good candidates to be among the group of teachers who would be keen to introduce some innovation into their pedagogy. The changes in the policy and administration at Outeast College do not seem to have affected their interest and willingness to innovate.

Furthermore, Arlene, Geoff and Howard each bear the hallmarks of being self-efficacious. They describe their class settings in terms of warm, interpersonal relationships, emphasise academic endeavours (Gibbs, 1999), and are willing to take on innovations and new approaches to teaching, and persevere with the challenge this presents (Gibbs, 1999; Gorrell, 1990). Self-efficacy has been consistently reported as a good predictor of computer use (Albion, 1999b; Borchers, Shroyer, & Enochs, 1992; Enochs, Riggs, & Ellis, 1993; Jacobsen, 1998; Olivier & Shapiro, 1993). This further suggests that the teachers in this study were personally and psychologically ready to take on innovations.
The Pedagogy

In this second section of the discussion of the themes and characteristics which emerge from the case studies, the pedagogy of the participants in this study is compared and discussed. Indeed, the three classes which I observed were very different from each other. Both Howard’s Year Eleven ESL and Geoff’s Year Four were quite small class groups, a factor which Becker (1994) has identified as often leading to a work environment which is more likely to lead to computer use. Arlene’s Year Seven class was larger, occupying nearly all the computers available in a laboratory, and was also more boisterous.

The planning practices and collaboration were different for each teacher. Geoff did not plan any of his lessons, partly in response to the busyness and fragmentation of his work life, and partly because he liked the thrill of ‘flying by the seat of his pants’. Geoff’s position as a specialist computer teacher saw him involved with two other colleagues, however the group lacked leadership and planning. Howard planned and team-taught with another colleague, and was especially meticulous in planning how his students would use computers. Arlene planned her program outline and her lessons regularly, yet her use of computers was substantially influenced by how they had been used in the same subject in previous years. Geoff, Arlene and Howard each equated planning with subject matter preparation, and that when they felt prepared, they saw little need to plan (cf. Grossman, 1989, p. 205). Howard was the most active in preparation because he was the least confident with computers. In contrast Geoff tended to be over-confident and blasé. Overall, each teacher’s planning practices were substantially devoid of influence by their respective use of computers.

Each of the teachers prepared lessons in the computer laboratory which were purposeful and which endeavoured to maximise student use of computers. Their lessons were structured, and clear student outcomes were established. Their classes made use of the computer laboratory for at
least one period per week, which was a fixed booking for a whole year. As a specialist, Geoff was not able to take the option of increased use of computers, and Howard and Arlene made minimum use of the opportunity to make additional bookings, reflecting concerns they had about the scope and content of the curriculum and a need to maximise subject-based teaching time.

There were differences between the tone and atmosphere of each teacher’s classes in the computer laboratory, which paralleled those of the regular classroom. There was a sense of order and formality about Geoff’s classes, reflected particularly in the way students addressed Geoff, the way they moved around the classroom, the procedures for greeting and dismissal of students, and the use of a seating plan. Howard’s classes were more informal in style, reflected particularly in their arrival to class and the seating arrangements (no seating plan). Arlene’s classes, with a disorderly group, were ordered yet informal in style. She did not use a seating plan because she believed the students were better behaved in the computer room than in the regular classroom.

The three teachers used two major teaching and learning activities when working in the computer laboratory: plenary activities and individual work. The plenary activities were used to organise the class and communicate information to students, and were thus times when the teacher transmitted information to the students. Howard and Arlene deliberately spent little time in transmission. In many lessons, Geoff spent considerable time in this mode, which is surprising given the shorter concentration span of his younger students. In the same way that he was keen to ensure that students might know the rules of hand-ball or safety concerns in the gymnasium, for instance, he was particularly keen to ensure that students were informed of the ‘correct approach’.

During times when the students were working individually, each teacher was busy and multiply attentive, acting as trouble-shooter, adviser, encourager, and maintainer of order. Only Arlene made particular
reference to the demands which this made on her attention and energies, but then, her class was the largest and most demanding. When they were assisting students, Geoff and Howard interacted very closely them, and intervened strongly to rectify problems which were being experienced. Arlene’s intervention was less intensive, however her students were also generally more knowledgeable than the others. The format of the classes as consisting of plenary and individual work and the way in which the teachers interacted with students during this time paralleled their work in the regular classroom. This was particularly true for Geoff, and it was certainly true for the writing/composition classes which I observed of Arlene and Howard. Arlene made particular reference to the limitation of the computer environment for certain types of teaching/learning activities.

Work on the computer was individual in each class, but there were variations. Geoff’s class produced pieces of work which were individually thought-through, which is consistent with Geoff’s orientation towards the achievement of outcomes, and so this style of work occurred in his classes effectively by default. Individual work in Howard’s classroom was in response to his explicit goal of producing more writing. In Arlene’s classroom, collaboration was encouraged and students were generally more talkative than in the regular classroom (though productively so). The nature of the relationship between the computer and the student also varied between classes. It suited Geoff’s implicit orientation for students to enter their ‘own little world’ with computers, whereas Howard worked hard to break this link between the computer and the student. Arlene identified less with a private working space in the computer laboratory than in the regular classroom. How the students worked as individuals and how they worked within the space of the computer laboratory varied considerably between the classes, but in each case it was congruent with the teacher’s objectives and not at any great variance to the pedagogy observed in the regular classroom.
The ways in which the three teachers managed problems and difficulties with the technology varied. Geoff did not have ready-access to technical staff, and tried to resolve computer problems himself. Under these circumstances he struggled, but then he was not rigorous in applying pre-emptive strategies. Howard found it difficult to manage anything but the simplest problem without calling for assistance, but was rigorous in applying pre-emptive strategies. Arlene’s style of teaching placed the management of computer problems onto students, and she also encouraged pre-emptive strategies; she was also the most confident of the participants in re-organising the lesson when problems occurred.

As I have investigated the work of Howard, Arlene and Geoff, I have seen pedagogy which is purposeful and orderly, with strong parallels with their work in regular classrooms. When working with students in the regular classroom, they do not operate in a way which could be described as “frontal teaching” (Hativa, 1995), but neither are there any particular patterns of classroom interaction which can be especially attributed to computer use (Goodson & Mangan, 1995).

**Computer Use**

In this third section of the discussion of the themes and characteristics which emerge from the case studies, the ways in which the participants in this study used computers in their teaching is compared and discussed. Word processing was the most prominent software type used by all three teachers, indicating computer use in the support mode. Howard, in particular, viewed word processing as process-orientated - a tool that places as much emphasis on learning to write as on producing a finished composition (Siegel & Davis, 1986, pp. 151-152). In contrast, Geoff and Arlene tended to be more concerned with the product.

The extent to which word processing is used to the exclusion of other software types is perhaps greater than expected, compared with Shears’ (1995) study. In this respect, the three teachers in this study are not
representative of Victorian teachers. With the high reliance on word processing, there is a certain sameness about Geoff’s teaching and the tasks which were set throughout the year. This is not quite so true for Howard, who provided variety by using similar software features for different instructional purposes. There was a variety introduced into Arlene’s classes because she used a number of types of software as well as word processing (keyboarding practice, Internet and Desktop Publishing) and used word processing for a variety of purposes. The data, as presented in Chapter Five, Six and Seven, shows that the use of computers by Geoff, Howard and Arlene relates to their knowledge of computers and their grasp of the software as ideas for teaching, and both of these influences on pedagogy are developed in a later section of this chapter.

In each participant’s classroom, students’ skills for using the computer developed haphazardly. Newhouse (1998) has argued that this is an important consideration in a school where integrated computer use is facilitated through a laptop computer program. There is evidence in the observed pedagogy of Howard, Geoff and Arlene, that the same issue is true for a desktop program. Arlene’s students were generally computer literate and were often able to complete computer-based tasks without much instruction. She did not consider that she was sufficiently knowledgeable to provide instruction in computer use, had the time to do so, or that it was her role to do so, and consequently she did very little of it. Howard was somewhat more proactive, teaching skills which were required, and making a point of correcting errors in students’ operation of computers. He did not, however, take any responsibility for the systematic development of computer skills. Geoff taught the computer skills which were required, but he yearned for a co-ordinated approach to the systematic development of computer skills, and he only applied himself to teaching that which was immediately apparent. Howard and Arlene both made a heavy reliance on informal peer teaching by students to support the development of computer skills.
Difficulties and Concerns with Computer Use

In this fourth section of the discussion of the themes and characteristics which emerge from the case studies, the difficulties and concerns with computer use which they experienced are compared and discussed. Two types of difficulties and concerns are discussed here: those identified by the teachers themselves, and those arising from an interpretation of the data.

Each teacher made reference to the use of the computer impinging upon the scope and content of the curriculum, which has been a factor acknowledged by many researchers (Becker, 1994; Goodson & Mangan, 1995; Richards, 1997; Schofield, 1995; Shears, 1995). Howard was constrained by the Year Eleven ESL syllabus, and mentioned that he was “running out of time” on a number of occasions, and his concerns were not always related to his use of computers. This is congruent with Newhouse’s (1998) findings. Geoff found that his role as a specialist computer teacher was particularly unrewarding because he was only teaching computer skills. Arlene valued keyboarding skills, yet was ambivalent about teaching them in the context of Year Seven English, and generally felt that spending time on teaching about computers was depriving her of valued English lesson time. In each case, teachers saw a distinction between skills and application, and as the discussion in Chapters Five, Six and Seven has illustrated, this dichotomy did not soften over time, in contrast to what others have found (Goodson & Mangan, 1995; Ringstaff, Sandholtz, & Dwyer, 1992). It is apparent that use of computers for only one period per week is not strong enough intervention to challenge conceptions of subject areas. Furthermore, concerns over curriculum scope and content, by Howard and Arlene especially, were resolved by severely limiting the amount of teaching about computers which was done.

Each teacher also referred to technical problems as a difficulty and concern which they experienced. Such issues have been widely identified by other researchers (e.g. Schofield, 1995; Shears, 1995). Arlene, Howard and Geoff
each experienced technical problems which they were not able to adequately resolve and which disrupted what was planned for any given lesson. Only Arlene, on one occasion, referred to teaching/learning time as being “wasted” due to technical problems. Both Arlene and Howard made use of technical staff who were on call to support them. There was no such readily-available support to Geoff, and if there had been, some of his problems with printing might have been minimised. In the face of technical problems, each teacher felt that their knowledge was inadequate. Howard and Arlene both used established school procedures for reporting faults and seeking technical assistance, but there were no such avenues for support available for Geoff. Howard and Arlene consistently referred to the inadequacy of their knowledge; the ability to deal with the problems personally and on-the-spot is to be preferred to requesting others to rectify problems. Howard and Arlene appreciated the limitations on available resources, but pointed to the need for technical staff to be responsive when fixing problems. All three teachers felt that they were disadvantaged by not being able to exercise some control over the management of the facilities, to effect repair and locate disks for instance.

There were issues of the organisational setting which Geoff and Howard identified as difficulties impinging on their teaching. Geoff especially drew attention to issues of co-ordination and planning of courses. Howard was hampered by the presence of senior students needing to use the computer facilities, and also his team teaching with Angie and his teaching of Angie’s class when she was absent.

The issues which the teachers addressed were essentially those of resourcing: technical support, maintenance, appropriate teaching loads to allow time for training, planning and experimentation. Notably, though, none of the teachers made any reference to any fundamental inadequacy in the standard or sophistication of hardware or software (cf. Newhouse, 1998; Shears, 1995), or with access to facilities.
Several other difficulties and concerns of importance arise from an interpretation of the data. Unlike the findings of some other scholars (e.g. Lynch, 1999; Schofield, 1995; Shears, 1995), the data in this study do not provide any evidence to support the idea that problems of class management and social dynamics in the computer laboratory are related to the threat of that space to the teacher’s competence and authority, or the perceived ownership of the space by someone else. This could well be a characteristic of the participants in this study - an indicator of their confidence as teachers and their ability to adapt. It might also reflect the importance of strategies at Outeast College to ensure that one room was not the perceived territory of the computer expert, and of the low level of intervention of myself (as ‘computer expert’) into the teaching affairs of my colleagues. Whilst it was not a part of the present research to address why such obstacles did not appear to beset Geoff, Howard and Arlene, it is certainly the case that they were always comfortable working in the laboratory and were not intimidated by more knowledgeable students or teachers. Each teacher ran the risk of their authority being undermined by calling in technical support, but this did not have a disruptive influence nor appear to demean them in the eyes of their students. Within limits, Arlene, Geoff and Howard were able to modify existing teaching/learning routines or develop new ones (cf. Cumming, 1988/89; Hativa, 1995; MacArthur & Malouf, 1991; Miller & Olson, 1994; Olson, 1995; Schofield, 1995), including routines for the identification and rectification of simple technical problems.

A further area of difficulties and concerns which emerges from the data is the concept of software as ideaware. Geoff genuinely believed that he would completely exhaust the teaching of Clarisworks, and have nothing else to teach. Whilst Geoff cast his concerns in fairly extreme terms, the same issue is also reflected in the teaching of Howard and Arlene. Without much conception of ideaware, one’s ability to teach with computers and to explore the more sophisticated concepts of each software type will be extremely limited.
As described in the preceding paragraphs, numerous difficulties and concerns were identified in this study. Those of particular interest pertain to the “fragility” of the classroom. The term “fragility” refers to the classroom as a self-organising system, consisting of teacher, students and computers, and its ability to reorganise in a way that allows computer use to continue when problems emerge (Lankshear et al., 1997a, pp. 14-15).

From the cases of Arlene, Geoff and Howard, two types of fragility can be identified: firstly, fragility at the level of operations and secondly, fragility related to role and curriculum specification resulting from regarding the teachers as constructivist learners capable of developing (and expected to develop) their own teaching/learning programs. The case studies illustrate that each of the teachers experienced considerable fragility related to role and curriculum specification. This issue strikes at the heart of the adequacy of the self-taught approach to learning to be a computer-using teacher, and is considered in the discussion of the research question later in this chapter.

At the level of operations, there are only two difficulties and concerns identified in this study which I interpret as genuine points of fragility. They are gross hardware or system failure, and knowledge of software as ideaware. There was no case when hardware or system failure caused a lesson to be aborted, although Geoff and Arlene were seriously inconvenienced on a few occasions. On one occasion (use of the Internet) Arlene was able to reorganise the classroom activities so that the lesson could proceed, but she was reliant on the continuing operation of the basic network system, even though there were problems with the Internet sub-system. The issues of both hardware failure and software as ideaware points to the need for adequate technical support, and procedures to communicate faults with technical staff. Both points of fragility indicate the need for adequate content and pedagogical content knowledge relating to computer use.
In this fifth section of the discussion of the themes and characteristics which emerge from the case studies, the personal factors which impact on the use of computers by the participants are compared and discussed. In Chapter Two, the work environment, technical factors and personal factors (including knowledge of computers, pedagogical content knowledge, routines, attitudes and confidence, and practical theories of teaching) were identified as having impact on the extent to which teachers use computers.

Except for smaller class sizes for Geoff and Howard, the incentive structures for improving computer use described by Becker (1994) - network of computer-using teachers, organised support, staff development activities, and a full-time co-ordinator of computing - were not a feature of this study. The data do not suggest that the social and professional situation (Hativa, 1995; Lynch, 1999) of the teacher, nor the impact of the computer expert (Jacobsen, 1998; Watson, 1993) has had any significant impact on the use of computers by Geoff, Arlene or Howard. Equally, there is no evidence that the technical capacity of the computers limited computer use (cf. Plomp & Pelgrum, 1992; Shears, 1995; Tyler-Wood, Putney, & Cass, 1997; Woodrow, 1992).

As described in Chapters Five, Six and Seven, the three case studies indicate that five personal factors (confidence, knowledge of computers, pedagogical content knowledge, knowledge of routines and practical theories of teaching) are the most important influences on how Arlene, Geoff and Howard use computers. These personal factors are discussed in the following sections.

**Confidence with Using Computers**

Teacher confidence has been considered to be an important contributor to whether teachers will use computers (Dunn & Ridgway, 1991; Hativa,
I have already mentioned that Howard, Arlene and Geoff bear the hallmarks of being self-efficacious and are well-placed in their respective career paths to effectively introduce innovative practices. Each of them also had adequate personal access to computers, which Tyler-Wood, Putney and Cass (1997) and Umbach (1997) have suggested is an influence on confidence. Knowledge of teaching methods, too, has been thought to be an important influence on confidence (McCoy & Haggard, 1989; Richards, 1997). As I have observed them, and reported in Chapters Five, Six and Seven, all three teachers appeared as confident teachers with well-established methods of teaching. Arlene and Geoff, in particular, readily adapted these to their use in the computer laboratory, and Howard worked consciously to tailor his ways of teaching specifically to that setting.

The final two factors which have been indicated as impacting on confidence and attitudes are classroom experience (Albion, 1996; Dunn & Ridgway, 1991; Hativa, 1995) and knowledge of the technology. In Chapter Two, I found that there is much still to be learned about the relationship between knowledge of the technology and confidence. There are findings in the literature which are contradictory, such as Tyler-Wood, Putney and Cass (1997) who found that knowledge was not a good predictor of confidence, compared with Yildrim (2000) who found that participation in an educational computing class improved confidence and reduced anxiety. In this study, Geoff, Howard and Arlene each clearly indicated that whilst they believed their knowledge of computers was adequate for their purposes, they lacked confidence in their knowledge of the technology. One particular impact of limited knowledge was the reduced ability of participants to solve technical problems in the laboratory, which in turn led to diminished confidence. Arlene, though, with a greater degree of knowledge seemed less troubled by problems and was especially able to empathise with students when problems emerged and calmly re-adjust the classroom activities in response.
That personal confidence should increase following positive classroom experiences is a manifestation of the important psychological phenomenon of instrumental conditioning (Taylor, Sluckin, Davies, Reason, Thomson, & Colman, 1982, ch. 13). Because Arlene and Howard (and to a lesser extent, Geoff) had a degree of personal choice as to whether they used computers in their teaching, that they had received sufficient positive reinforcement is evidenced by the fact that they persisted with computer use throughout the year. Arlene, especially, indicated a desire to keep using computers and the Internet despite significant difficulties which were encountered. Instrumental conditioning also calls our attention to those things which could be done to improve the experience, and one area is the minimisation of problems which occurred; in particular, to provide adequate technical support, and to ensure the teachers are sufficiently knowledgeable to feel confident in those situations.

**Knowledge of Computers**

Any direct influence of knowledge of computers on computer use is rather unclear. In the previous section, however, knowledge of the technology was noted as an influence on confidence, which in turn is an influence on computer use. In addition, Becker (1994) found that formal training in using and teaching with computers was an important predictor of computer use, and Larner and Timberlake (1995) indicated that knowledge about computers was critical for computer use. Johnson (1997), offers a qualification, having found that a minimal level of skill (e.g. basic word processing) was important, but beyond that basis, much more important was what he termed an ‘openness’ to using computers, a readiness to learn about them whenever possible, and an interest in improving pedagogy.

My interpretation of the data presented in Chapters Five, Six and Seven is that Geoff, Arlene and Howard had reached this important minimum level of knowledge (they each stated that they believed they were sufficiently knowledgeable to use computers for the particular purposes
which they had chosen, and they were, after all, computer-using teachers). These same data, as also discussed in the earlier chapters, show that a lack of knowledge was a particular influence on Arlene, Howard and Geoff’s use of computers - not so much for its own sake, but because of the implications it has on confidence and whether a rewarding classroom experience can be ensured. Johnson’s (1997) assertion that a readiness to learn about computers and an interest in improving pedagogy are more important than a high level of content knowledge when seeking to advance teachers’ use of computers is considered in relation to Arlene, Howard and Geoff in a later section of this chapter.

**Pedagogical Content Knowledge**

Pedagogical content knowledge addresses the extent to which Arlene, Howard and Geoff were able to re-think subject/content knowledge from a “pedagogy-with-computers” perspective (Albion, 1996). Their knowledge of software as “ideaware”, the knowledge of the range of functions available as means by which content knowledge can be re-presented, is critical. I believe that each of the teachers faced difficulties in their teaching with computers because of their pedagogical content knowledge. Arlene demonstrated a fairly good, intuitive grasp of ideaware across a range of software types. I did not see her try to use any of the more sophisticated functions of the software (she did not use desktop publishing for the production of a newspaper, for instance), and so I interpret that the ways in which content was re-presented using computers was to be found in breadth rather than depth of software type. Howard was perhaps the most conscious of the limitations of his knowledge about software, but he used this relatively limited range of software functions as an aid to a range of teaching/learning activities.

Geoff was very concerned that his knowledge of software was so limited that he would run out of material to teach. He seemed to have a limited appreciation that the same range of computing skills could be recycled as a component of different teaching/learning activities. Even though his
circumstances were unique, in that he did not have direct control of the subject area being studied or how it could be approached, his basic concern highlights a limited grasp of software as ideaware. Geoff’s expression of his concerns were consistently in terms of his knowledge of the software, not in terms of pedagogical content knowledge, which is my interpretation. The concept of pedagogical content knowledge would have been an abstract and unfamiliar one to him. However, I see his expression of his concerns as entirely congruent with my interpretation because in Shulman’s (1986) conception of pedagogical content knowledge, content knowledge is regarded a necessary pre-requisite to it; there is no basis for even considering pedagogical content knowledge unless there is first a body of content knowledge.

It is one thing to consider pedagogical content knowledge as the representation of content through the functions of a computer, but it is also valid to consider the representation of computer concepts and skills through subject content. This will be particularly important if one is going to teach about computers at all. There is no evidence that such matters were given any serious consideration by any of the participants, which is congruent with them not wanting to teach about the computer. In fact, it is the productive overlap of both aspects of pedagogical content knowledge which would make effective integrated teaching of computing possible. This difficulty has been identified by Richards (1997) who recognised that teachers find connecting basic computer skills and literacy with applied knowledge in different curricular and disciplinary areas to be a particular challenge.

Knowledge of Routines

Knowledge of routines has been regarded as an important influence on pedagogy (see Chapter Two). Routines did not present any difficulty for Arlene, Howard or Geoff, but interact with their pedagogy in different ways. Issues such as disrupting normal routines to move to the computer laboratory were not an issue for any of the teachers (it should be noted that
since Outeast College was a small school, a move to the computer laboratory for Arlene or Howard took them no more than two minutes). Arlene was particularly careful to note that the computer room was not a suitable environment for some activities (such as group work), and made sure that she was not booked in on any such occasion. For convenience, Howard used the computer room for a variety of activities including class discussion and student talks, and found that even though the physical environment of the computer laboratory presented some difficulties, it could be used for such activities.

Each teacher had a good working knowledge of the rules and expectations associated with the computer room, and managed to develop suitable strategies related to these. This was a much more deliberate action on the part of Howard than of Geoff or Arlene. As a PE teacher, Geoff was used to managing and issuing equipment, and developing routines for managing computer equipment seemed to come more ‘naturally’ to him than to Howard or Arlene. Again, Howard worked very deliberately at identifying new and suitable practices. For Howard, the computer was not a ‘silent partner’ in his teaching of English, as he very specifically went about developing routines which accommodated computer use and management into his practice. It is much more of a silent partner for Arlene, who left students to be responsible for their own management of the resources.

The basic routines of each teacher’s teaching were essentially unaffected. If it was their practice to move around the room as students were writing (as was the case for Arlene and Howard), then they did this in the computer laboratory too. The same applies for such things as the correction of hardcopy (not softcopy) work, routines for the commencement and dismissal of classes and for keeping rooms neat and tidy. The most striking example is the consistency of the pattern of Geoff’s lessons and how closely they parallel his work as a PE teacher, such was the extent to which he had internalised the routines for teaching and that he was on ‘autopilot’.
There is a very important link between the durable, practical pedagogy of a teacher and his/her practical theories of teaching (as described in Chapter One) which will be explored in the next section of this chapter. Within the literature it is often unclear, however, whether the term “routine” is used to refer to those grand, holistic and often implicit forces which guide pedagogy, or whether it is referring to ‘smaller scale’ issues such as how a teacher might distribute resources (such as books) to students in a class, whether moving rooms is a disturbance to teaching (perhaps due to the resources available in one room and not the other), or how a unit of work has been ‘traditionally’ taught.

Miller and Olson (1994) found that their teacher, Ms Jensen taught thematic units with the aid of database in much the same way as she always had, and children wrote and composed on the computer in much the same way as they did using traditional tools. They consider that “the computer did not drive her in radically new directions” (p. 136). Similarly, the pedagogy of Arlene, Geoff or Howard was not significantly reshaped. Geoff is a special case, because there is no precedent for his role as a specialist computer teacher, but it is certainly true that the class teacher with whom he worked did not adapt her practices in response to the exposure to computer use which Geoff was providing. The production of the newspaper in Arlene’s class was a clear example of doing things in the old way with a computer - students typing up work with a word processor, and manually cutting and pasting to a newspaper layout. Howard’s practice comes closest to working in a new way, as he chose to use computers specifically because of certain advantages which they offered. In reality, however, there was very little change in how he taught composition.

The literature (see Chapter Two) has indicated that routines related to using computers in teaching are very important, yet the teachers in this study found no difficulty in adapting existing teaching routines for work in the computer laboratory, and adding new routines to their repertoire as was needed. Overall, they found that, as Howard said, “… in a way the
computer room stuff is regular English teaching” (Interview Three). The durable, practical pedagogy which underlines these routines is pervasive, yet flexible, and allowing these teachers who were ostensibly unfamiliar with teaching with computers to do so effectively, however there was no discernible transformation of practice.

The underlying practical theories of teaching will be explored in this next section.

Practical Theories of Teaching

As presented in Chapter One, it is a fundamental assumption of this study that classroom actions of teachers are guided by internal frames of reference which are deeply rooted in personal experiences - practical theories of teaching. As presented in earlier chapters, I have come to understand the pedagogy of Geoff, Arlene and Howard as reflecting their practical theories of teaching.

As discussed in Chapter Five, Geoff’s pedagogy reflected him valuing: participation for all students and an atmosphere of belonging and achievement; a belief that learning should be enjoyable; an endeavour to value students and knowledgeable participants and to create opportunities for experiential learning; and working for positive and affirming relationships with students. Moreover, as discussed in the earlier chapter, I see two themes as powerful forces at the heart of his pedagogy: firstly, his skills as a problem-solver, modifier, innovator and ad-libber, and secondly his concentration on students’ achievement of outcomes. These practical theories of teaching have been formed out of the cut-and-thrust of Geoff’s realities of having worked exclusively at Outeast College (he referred to himself as a “product of the school”), and they address general issues of education and his day-to-day survival as a specialist.

As discussed in Chapter Six, Howard’s pedagogy reflects him valuing: a student-centred approach which actively engages students in their own
learning; minimising teacher talk; maximising student talk and activity; valuing academic work; assisting students to gain confidence and experience success and developing a genuine personal relationship between teacher and student. As discussed in the earlier chapter, in addition to these values arising from Howard’s beliefs about good ESL teaching and learning, I also see “breaking patterns” as a major theme which spans his professional activity. This practical theory of teaching has arisen out of his deep consideration of ESL teaching and learning and what he seeks to do and be as a professional.

Arlene’s pedagogy reflects her valuing: the motivation of students; ensuring that all students are able to express a point of view; being understanding; being approachable; students not being bored; students taking pride in their work; students producing pieces of work of good quality and quantity; academic enterprise; and group work. I see her use of computers driven primarily by a desire for good quality presentation of work (which, unlike Howard and Geoff, is not a driving force at the heart of all her teaching). I find this to be quite a narrow and not easily extensible vision for computer use.

As Hodgson (1995, p. 27) has noted, “successful use of the computer depends essentially on … [the teacher’s] pedagogical agenda”. I have found that each teacher’s use of computers is shaped by a pedagogical agenda which in turn is shaped by powerful practical theories of teaching, as elaborated in Chapters Five, Six and Seven. As others have found in different contexts (Louden & Wallace, 1990; Miller & Olson, 1994; Olson, 1988b; Ridgway & Passey, 1991; Wallace & Louden, 1992), pre-existing practical theories of teaching are an enormously powerful influence on how Howard, Arlene and Geoff used computers; they shape computers to their purposes (Miller & Olson, 1994, p. 137). To fundamentally change how the teachers in this study use computers would necessitate a “change in world view”, as Ridgway and Passey (1991, p. 7) have suggested. This is the central thesis of ‘teacher thinking’ understandings of change and innovation, as discussed in Chapter Two. Helping teachers to change their
world view and finding ways to use computers which resonate well with their world view are discussed later in this chapter, as a ‘practical implication’ of this study.

Implications of Familiar Pedagogical Patterns

Ridgway and Passey (1991, p. 7) have observed that teachers bring existing constructs to bear when they introduce computers into their teaching and Louden and Wallace (1990) have illustrated how pedagogy, in an unfamiliar subject area, can be appropriated directly from the teaching of a discipline with which teachers are more familiar. As discussed in Chapter Five, I have found that the pedagogy of Geoff, Howard and Arlene, when they use computers, remains true to their practical theories of teaching. Furthermore, there was remarkable consistency in Geoff’s pedagogy in the computer laboratory compared with his regular (PE) classroom down to quite a fine level of detail: the pattern of his lessons, how he managed the issuing of equipment, the monitoring of student work and behaviour, and the arrival and dismissal of classes. Because his pedagogy arises substantially out of his work as a PE teacher, Geoff is essentially a PE teacher who is teaching computing. Perhaps, though, it is more accurate to regard ‘Geoff as Geoff’ no matter what he teaches: he has developed his own particular style and pedagogy which is essentially unchanged regardless of context and he can operate almost on ‘remote control’.

The consistency of Howard’s pedagogy is not as marked as Geoff’s. ‘Breaking patterns’ is a theme which unites much of what Howard was striving to achieve in his professional life, and his raison d’être of computer use is to break the pattern of uninspiring and abbreviated writing. As discussed in Chapter Six, Howard recognised that classes in the computer laboratory ‘look’ very much like those in the regular classroom, yet Howard nevertheless had to develop some new routines and practices so that his lessons would run smoothly. Howard was conscientious about developing his pedagogical content knowledge, and he actively sought ways to improve his teaching of ESL with the
computer: the ESL content, values and even method are the constant, whilst computer use is the variable with which Howard experimented. The use of computers did not challenge his core understandings of ESL: past pedagogy determines computer pedagogy.

Arlene’s classes in the computer laboratory looked very similar to those in the regular classroom. In the same way as she would expect students to look after their own equipment (e.g. pens, rulers) in the regular classroom, so in the main they were expected to look after and manage the computer equipment. It was not that she could not teach about the computer, she chose not to. By taking the approach that she did, Arlene challenged students to be responsible and individual learners, but she was able to intervene as necessary. There were effectively no new routines and practices which she needed to adopt, and the use of computers did not challenge her core understandings of English. Like Geoff, she was able to operate, in large measure, on ‘remote control’.

At one level, as congruent with the literature (Chapter Two), I have found that the implication of Geoff, Howard and Arlene’s familiar pedagogical patterns and practical theories of teaching is that they are very robust and form the basis (and perhaps even the fine detail) of pedagogy when teachers teach with computers. However the implications run deeper than that, to the suitability of the familiar pedagogical patterns to teaching with computers. Louden and Wallace (1990, p. 187) have found that when pedagogy is appropriated from one subject area, it can do a dis-service to the content being taught. For instance, methods of teaching which present content in a way that is linear and rational might be appropriate and the basic ‘tools of trade’ in some disciplines, but they may not apply well to the application of experimental method in the Science classroom. Conversely, Whelan (1992) found that lack of experience and authority promoted an environment of scholarly contestation and reflection, the very essence of legal studies teaching.
It is important to ask, then, what the implications of the appropriation of established pedagogical practices are for the participants in this study. Geoff is a problem-solver, modifier, innovator and ad-libber, who focuses on the achievement of student outcomes. D’Ignazio (1995) has argued strongly that, whatever else they might be good at, computers provide opportunities to teach problem solving. Geoff modelled problem solving and sought to empower students to solve their own problems. Moreover, he coached students in the solving of their own problems. Regardless of how effective he might have been at actually solving problems, there is a congruency between his established pedagogy and the needs of teaching in a computer-based environment. There are also disadvantages of Geoff’s approach. In what he did (and did not do), it is implied that ‘doing’ is important (compared with thinking or creating, for instance), and that the relationship between the individual and the computer is the most important (compared with interpersonal interaction, for instance).

Problem-solving is a pragmatic basis for teaching which suits the itinerant teacher, but the itinerant does not have to be the subject-matter expert, and Geoff’s low level of pedagogical content knowledge did not equip him to adopt highly creative ways of using computers. Geoff’s approach also did not lend itself to questioning whether individual work was in fact the most desirable way of students using computers, or whether the physical design of the room was complicit in promoting certain modes of learning over others.

Howard’s established ESL pedagogy resulted in him moving among the class solving individual problems and addressing individual concerns, which aligns with D’Ignazio’s (1995) view that teaching with and about computers offers the opportunity to teach problem solving. Howard is an excellent model to the students that people with relatively low levels of knowledge can find ways to solve most of the problems that come their way and can assist others in working, thus confidence and knowledge are built through collegiality. Howard’s emancipatory intent is applied very narrowly as the promotion of quantity and quality of writing, but his orientation to emancipation has also led Howard into seriously
considering the student-computer interaction and trying to find ways to break the ‘link’ between student and computer so that other forms of learning can occur. Disadvantages of Howard’s familiar pedagogical patterns in the computer laboratory seem very few. Geoff’s problem solving approach lends itself to teaching about the technology (whether it is a trampoline in the PE classroom, or a computer); Howard’s approach lends itself to teaching the subject content.

By attending to Howard’s emancipatory intent, it can be seen how practical theories of teaching provide a very broad and powerful framework for considering further possibilities for computers in teaching. For instance, if one wants to improve a students’ grammar or vocabulary, then presumably there are computer programs which can help with that; if one is searching for a reason for using electronic mail, then Cohen and Riel (1989) have shown that this technology can lead to improvements in the quality of students’ writing. By extrapolation of this argument, a relationship between practical theories of teaching and pedagogical content knowledge can be suggested. The application of pedagogical content knowledge to computer use (Chapter One) implies that it is a matter of acquiring a broad and diverse repertoire of strategies of how the use of computers can be deployed in the teaching of a particular concept. However, I would suggest that a teacher will only embrace those strategies which allow him or her to express his/her practical theories of teaching - Howard would most naturally embrace new strategies which enable him to further his emancipatory interests, Geoff would most naturally embrace strategies which enable him to continue to present himself as a problem-solver and Jack-of-all-trades.

Arlene’s ‘hands off’ approach to using computers in her teaching seemed to work quite well, however I think she was fortunate to be working with a class with reasonably good computer skills. Her modelling of problem solving was limited, but students nevertheless managed to solve many of the problems which emerged using their own knowledge and initiative. Certainly, Arlene’s approach is consistent with her belief that it was not
her core business to teach about the technology. Arlene’s case demonstrates that, if a teacher and a class are confident using the technology, the students are enabled to use the computer to simply do their work as if the computer laboratory were no different to any other classroom. This approach has the advantage of students using the computer as a tool ‘naturally’ whenever appropriate. A closer engagement with the technology seems desirable, however, so that new possibilities and uses can be promoted (consider the desktop publishing task discussed in Chapter Seven). Thus, skills do not develop haphazardly and students do not learn clumsy or inefficient ways of working. I believe that the most problematic aspect of Arlene’s approach, however, is to be found in her rationale for using computers. The emphasis on presentation seems to be rather too narrow compared with an emphasis which acknowledges that computers might have some advantages in the process of learning to write. Furthermore, as Arlene herself noted, many students either produce work on a home computer or have quite presentable handwriting. Arlene’s ‘hands off’ and ‘presentation’ approach does not reflect a sustained commitment to the use of computers.

The reader might consider that some aspects of the above discussion on the implications of familiar pedagogical patterns drifts from interpretation into conjecture. Such discussion is certainly a result of a sustained consideration of all the data available and of the situations in which I have been immersed. In Chapter Two, the widely accepted notion of practical theories of teaching providing an explanation of why innovation is difficult, was extended to understanding what pedagogy occurs when a teacher teaches a subject outside his/her realm of experience, and to recognising that there will be implications for such appropriation. The case studies of Howard, Geoff and Arlene have allowed me to ‘test’ the significance of practical theories of teaching in this full, extended sense. What I have learnt from the data can be reduced to the following five statements, which I have sought to exemplify in the preceding discussion. Firstly, that practical theories of teaching are powerful influences on the pedagogy of the self-taught computer-using teachers in this study.
Secondly, that the influence of practical theories of teaching includes the possibility that, in a deep sense, there is almost no difference in the pedagogy of a teacher in the regular classroom compared with that of the teacher in the computer laboratory. Thirdly, that there are deep issues concerning the compatibility of established pedagogical practices to work in the computer environment. This parallels similar findings and concerns elsewhere in the literature (Briscoe, 1991; Kloss, 1987; Tobin & Espinet, 1989). Fourthly, practical theories of teaching influence the pedagogical content knowledge which can develop, framing the diversity of strategies which might be included in a teacher’s repertoire. Finally, such issues are almost completely unrecognised by the teachers in this study; this is not to imply that they are avoiding a consideration of these issues, but rather points to the degree of reflection embedded within the pedagogy of Geoff, Arlene and Howard, a matter which is discussed in depth in a later section of this chapter.

**Teacher Role and Philosophical Orientation**

The capacity for computer-based teaching to promote a change in a teacher’s philosophical orientation from knowledge-transmission view of learning to one of constructivist-compatible instructional strategies is a proposition which has been widely canvassed (see Chapter Two). I find that there has been no fundamental change to the teachers’ philosophical orientation due to the use of computers, just as I found that there was no pattern of classroom interaction particularly attributable to the use of computers. Arlene, Howard and Geoff are not particularly teacher-centred in their general teaching practice, reflecting the general emphases of teaching and learning in Australia (Bishop, 1994; Bishop, 1996; Russell, 1992). Howard is the only one who spoke about actively aiming to be student-centred, however.

What happened, then, to the technology-induced belief change that Becker and Ravitz (1999), and Ringstaff, Sandholtz and Dwyer (1992) have observed, and growth in subject matter knowledge and
reconceptualisation of subject area noted by Confrey, Piliero, Rizzuti and Smith (1990, p. 6)? There are several possible explanations. Firstly, perhaps such changes will be observed only when teachers start out as extremely teacher-centred in philosophy or ‘frontal’ in approach. Secondly, Arlene, Geoff and Howard were not immersed in technology to anything like the extent of the teachers involved in the Apple Classrooms of Tomorrow project. Perhaps contact with adequate (but not leading-edge) computers for only one session per week is insufficient to promote much reconsideration of philosophy or pedagogy. Thirdly, the teachers in this study were not especially inclined toward reflection on their own practice (as discussed in a following section), and maybe if this were promoted, changes would ensue.

**Teacher Learning and Reflective Practice**

Sparks-Langer and Colton (1991) have written that to be reflective is to not mindlessly follow unexamined practices or principles. I am sure that Geoff, Howard and Arlene are reflective in that sense. More helpfully, quoting Kolb, McCutcheon (1992) considers that reflective practice occurs when

> immediate concrete experience is the basis for observation and reflection. An individual uses these observations to build upon an idea, generalisation or ‘theory’ from which new implications serve as guides in acting to create new experiences. (p. 83)

Drawing on Sparks-Langer and Colton (1991), McCutcheon (1992) and Mewborn (1999), it can be said that the reflective teacher must also: draw upon immediate and concrete experience; be introspective with respect to their own actions; generate solutions within problematic situations; and enact the generated solutions. I consider the reflectivity of the three teachers according to these four criteria.
Unlike Howard or Arlene, Geoff spoke very explicitly about his learning and reflection throughout our interviews. During our first interview, he said,

> I probably have been over the last six weeks trying to find out which one [of the various roles] works best and what sort of flavour you can create within your classroom.  

(Geoff, Interview 1)

Throughout the year, Geoff continued to speak of setting goals to improve, but he commented,

> I usually take on one or two [areas to improve my teaching] a year ... all of a sudden these things can't run because of the structure, and I've been given all these other things - and I've got to work out a balance - do I keep these things running as well or do I push them aside - I don't do those things - and, at the moment ... I'm lost, you know - I'm making my own model [for teaching computing] up, you know - and it's really hard.  

(Geoff, Interview 1)

He also commented

> Every now and then I try to read - yes, I do - so I wish there was an extra four hours in every day - so I'd like to do ... an hour of reading every day - would be great. I'm not divorced from learning - I really enjoy it but I just - my life at the moment [with four kids at home] ... there just isn't time.  

(Geoff, Interview 1)

Geoff liked to be able to draw upon immediate and concrete experience and to be introspective with respect to his own actions, but as the year progressed, Geoff found it increasingly more difficult to find time for these activities. Despite good intentions, there is no evidence that Geoff taught in any way other than ‘remote control’. Howard, however, was very active, for instance, in enquiring how a task could be done on the computer, and then returning with a range of suggestions and questions as to how it could be done better. He drew on experience and was introspective, but there was no sense in which he was completely systematic about it. Arlene, on the other hand, seemed to be quite content with what she was doing. She asked me technical questions less
frequently than Geoff or Howard, and her deliberate choice of how to start classes (by having students seated on the floor at first) was one of the few obvious instances that she had thought about the incumbent difficulties which teaching in the computer laboratory implied.

Geoff’s problem-solving disposition meant that generating and enacting solutions to problematic situations was implicit to his teaching practice. There were few times when he explicitly generated solutions to identified problems. When Howard and Arlene had identified problematic situations, they followed through to the generating and enacting of those solutions. The limitation was that they did not scrutinise the pedagogical events which might have led to the problem situation emerging in the first place.

A further dimension to the participant’s reflection is what each reflected about and what types of professional issues were of concern, an understanding of which is assisted by van Manen’s (1977) analysis of levels of reflectivity. van Manen’s lowest level of reflectivity is when the professional is concerned with the technical application of educational knowledge and basic curriculum principles. The evidence which I have presented throughout indicates that Geoff, Arlene and Howard are certainly concerned with such matters.

van Manen’s second level of reflectivity is when the professional is concerned with the process of analysing and clarifying individual and cultural experiences for the purpose of orientating practical action. I believe that Geoff’s practical action arises much more from his desire to apply basic curriculum knowledge than through his consideration of his own, or the students’, individual or cultural experiences. Each of the participants was apparently unaware, for instance, of the importance of the practical theories of teaching as powerful forces ‘driving’ and even being expressed in their teaching, or indeed how they might be conceptualised. To give him his due, Howard did speak about his personal ‘theories’, but it
was in fairly linear terms, referring to his goals and directions, rather than identifying more holistic concepts.

van Manen’s highest level of reflectivity is when the professional is concerned with the consideration of the worth of knowledge and the nature of the social conditions necessary for raising the question of worthwhileness. Geoff raised the issue of the value of the tasks for which his students were using the computer; he wondered whether greater creativity would be fostered by using pencils to create a drawing than a computer, and whether there was any value in, for instance, Senior School students using computers for their mathematics assignments. To that extent, Geoff is a critic, a devil’s advocate and consistently engages in a consideration of the worthiness of the knowledge of computing and what he would be teaching. However, like Howard and Arlene, he does not apply this reasoning to his own knowledge and its formation.

Based on the interpretation of the case study data presented in the preceding paragraphs, the teachers in this study could not be considered to be reflective. To the extent that they are, they are concerned with pragmatic and technical issues, rather than the development of their own knowledge. I have interpreted that it is their knowledge, their practical theories of teaching, which are the strong guiding influences at the heart of how they teach with computers. In the absence of subjecting their knowledge and learning to scrutiny, it is hardly surprising that there is little change in their teaching with computers over the course of the year. When left substantially on their own to teach with computers, the participants in this study did not reflect, and certainly not on matters of deep importance, such as their role, philosophical orientation, practical theories of teaching and the implications of these when applied to teaching with computers.

Johnson (1997) has suggested that only a ‘certain minimum’ of skill is required when there is a readiness to learn about computers whenever possible and an interest in improving pedagogy is important. Howard,
Arlene and Geoff did not participate in any significant professional development over the course of the year, nor did they deeply reflect. They were concerned with fairly concrete issues of technology throughout the year. Given the focus of their concerns and their lack of deliberate and deep learning, it is perhaps not surprising that expressing concerns about knowledge of computing (particularly as it impacts on confidence, problem solving and pedagogical content knowledge) was a significant factor in my observation of these self-taught computer-using teachers.

**SUMMARY AND FINDINGS**

The three teachers in this study, whom I have described as self-taught computer-using teachers, are characterised by the following factors:

- Their knowledge about computers is ad-hoc and incomplete, and perceived by them to be at a fairly low level.
- They were willing and committed to the use of computers with a particular class at least once per week for a whole year.
- They were well placed to be innovators, from the point of view of career development and organisational and personal factors which may impinge on them.
- They presented as being generally self-efficacious in their teaching.
- They were confident in established methods of teaching in their home disciplines.
- They showed no sign of being intimidated by the technology.
- They were more interested in teaching and learning than in the technology.
- They experienced no problems with gaining access to computer laboratories equipped with current (though not leading-edge) technology, and in these laboratories, there was at least one computer for each student.
- They had access to a modest degree of technical support.
• They had personal access to computers for private and professional purposes.
• They had only modest organisational support. There were others on staff at Outeast College responsible for maintaining the facilities and providing limited point-of-need support (though repairs and fault-finding is not especially responsive), but apart from this, there was no organised support. There was no organised network of teachers who were implementing computer use in their teaching, and there were no formal staff development activities arranged or provided by the school.

The first finding from this study is to affirm the capability of self-taught computer using teachers; at least in the conditions described above, such teachers can deliver purposeful, structured lessons which enhance student involvement with the technology. There was much similarity in each participants’ pedagogy in the computer laboratory compared with their pedagogy in the regular classroom.

Computers were used almost exclusively in the support mode, with the use of the word processor dominating, and minimal variation in the type of activity for which they are used. In the classes observed, student skills for using computers developed unsystematically and haphazardly, often relying on informal peer-tutoring. So, whilst the basic competence of the pedagogy should be celebrated, the second finding is that the use of computers was frequently predictable, mundane, uninspiring and failed to exploit the full range of possibilities which the software offered.

The teachers in this study were generally confident in their use of computers, but they consistently referred to their knowledge of computing as a limiting factor, even though they also believed that they had adequate knowledge of the technology for their purposes.

The teacher’s pedagogical content knowledge (software as ideaware) was limited, both in terms of the repertoire of strategies for representing subject content through computer use, and also, conversely, the repertoire
of strategies for representing computer skills and concepts through subject content. The limited scope of pedagogical content knowledge is interpreted as the major reason for the restricted range of teaching/learning activities used, and also a major contributor to the lack of resolution of the skills/application dichotomy.

The pedagogy of the three participants in this study, whilst similar, can be seen as arising from different fundamental practical theories of teaching. Practical theories of teaching and familiar pedagogical patterns are very robust and form the basis of the pedagogy of these self-taught computer-using teachers. Each teacher’s practical theories of teaching present different issues and implications for teaching with and about computers.

The third finding of this study is that teachers’ knowledge, in all its forms and constructions (content knowledge, pedagogical content knowledge, and implicit and explicit practical theories of teaching), is a powerful influence on the pedagogy of self-taught computer-using teachers. The study has shown that the influence of teacher knowledge on pedagogy is a powerful framework for understanding the second finding (above).

The fourth finding is that an ethnographic case study has been a useful method of studying the relationship between teachers’ knowledge and pedagogy. Naturalistic enquiry into the ‘ordinary’ response of ‘ordinary’ teachers working with ‘ordinary’ equipment with ‘ordinary’ classes has delivered an important range of findings.

Considering teachers’ knowledge and its development as discussed earlier in this chapter, the fifth finding is that when left on their own to teach with computers, the participants did not engage in activities which would promote growth and development in their pedagogy. During the course of this study they did not participate in relevant professional development (such as attendance at seminars or enrolling in short courses). In particular, the participants’ engagement in reflection was minimal, and what occurred did not focus on matters of deep importance, such as their
role, philosophical orientation, practical theories of teaching and the implications of these when applied to teaching with computers.

The sixth finding is that technology-induced belief change and reconceptualisation of the subject area did not occur, nor did the perception of the skills/application dichotomy soften. There were no significant changes in the teacher’s role. The teachers did not perceive that a core part of their role was to teach about computers, and a corollary of that is that student skills for using computers developed haphazardly. It is my hypothesis that the amount of exposure which the participants in this study had to using computers in their teaching was insufficient to promote reflection on, or fundamental reformation of, their beliefs and practice.

In this study, only two problems have been identified as sufficiently critical for the classroom to be unable to re-organise in a way to allow computer use to continue: gross system failure and an understanding of the possibilities of the software so that the teacher does not run out of ideas with regard to what to teach. On the assumption that a desire to improve practice is a given, the seventh finding is that the most critical difficulties and concerns of the participants in this study would be alleviated by providing adequate technical support and increasing teachers’ knowledge of computers, together with an improvement of teachers’ pedagogical content knowledge.

The last finding is that the preceding findings apply to each of the three participants in the study. That is, the essential issues identified in this study transcend apparent differences such as year levels taught, subjects taught and subject subcultures. In this respect, the participation of three teachers with heterogeneous backgrounds has led to a better understanding of self-taught computer-using teachers.
THE RESEARCH QUESTION

The question presented in Chapter Two was: when teachers begin to use computers in their teaching, is it sufficient to assume that they are active, wise, knowledgeable professionals, capable of making meaning and developing pedagogy and to simply leave them alone to get on with their work? This question has been explored in the particular context of the pedagogy of three teachers at Outeast College.

In the cases of Arlene, Howard and Geoff, the answer is that this form of professional development is not sufficient. There are several reasons for this, each linked with each of the forms of knowledge identified in Chapter One.

Firstly, drawing on the research literature and the analysis of data in this study, teachers’ practical theories of teaching are demonstrably very robust and form the basis of their pedagogy. This study has confirmed that this feature of practical theories of teaching can lead to self-taught computer-using teachers teaching purposefully with computers. However, such knowledge, when uncontested, led to a use of computers which was frequently uninspiring, predictable, tame, and not exploiting the full range of functions offered by the software. In addition, each teacher’s practical theories of teaching presents different issues and implications for teaching with and about computers. Fundamental change in pedagogy, or the reformation of practical theories of teaching so that they might better suit the use of computers, does not seem likely without a change in each teacher’s “world view”. Neither Arlene, Geoff nor Howard, of their own initiative, reflected on such issues.

The second reason why the do-it-yourself model of professional development was not satisfactory is related to pedagogical content knowledge. In this study, each teacher’s pedagogical content knowledge was limited, both in terms of the repertoire of strategies for representing subject content through computer use, and also, conversely, in terms of
the repertoire of strategies for representing computer skills and concepts through subject content. The limited extent of pedagogical content knowledge meant that they had no deep understanding of what they should be doing by using computers, and so their pedagogy included little that was genuinely new. There are minimal examples in Shulman’s work (Shulman, 1986) of how pedagogical knowledge can be developed, except for adequate content knowledge, immersion in the field (cf. Grossman, 1989), and exposure to examples, particularly in an environment which facilitates discussion debate and consideration (Hollingsworth & Clarke, 1998; Wilson, 1989). Of their own initiative, Arlene and Geoff did not participate in such activities. To a certain degree Howard did so and was a persistent enquirer, and I would argue that he demonstrated growth in his pedagogical content knowledge.

The third reason why the do-it-yourself model of professional development was not satisfactory is related to the content knowledge of the participants and to them being self-taught in respect of this. It was found to be the case, as hypothesized in Chapter One, that their knowledge about computing and pedagogy was ad-hoc, incomplete and inaccurate in some respects. The development of it was at each participant’s own initiation and each did little to comprehensively improve their knowledge of computers.

Whilst Howard, Geoff and Arlene each considered that their knowledge about computing was generally adequate for their purpose, they each considered that it was an area in which they had limited understanding. Such concerns over content knowledge corresponds with an observation in Wallace and Louden’s (1992) investigation of teachers who had no background in teaching Science. One of their teachers stated “I looked deep in my heart and I couldn’t find much scientific information” (p. 510), and Wallace and Louden comment,

Here, without realising it, Johanna was speaking on behalf of the vast majority of her colleagues. She was articulating the fundamental dilemma in elementary Science - that teaching Science is difficult because it
requires a pattern of practice based on knowledge that most elementary teachers do not have, including pedagogical knowledge and content knowledge of Science. This simple, but profound comment of Johanna explains why Science remains a “little added frill” … in elementary classrooms. (p. 518)

On reviewing the data presented in Chapters Five, Six and Seven, I believe that the above comments apply exactly to the use of computers by Howard, Geoff and Arlene. When these teachers looked for content or pedagogical information relating to computer use within themselves, they said that they did not find much. Their established patterns of practice did not include computer use. They were able to make some revisions and reconfigurations to these established patterns of practice to embrace the use of computers, but in the absence of any comprehensive knowledge of computing content or pedagogy they found their experience when teaching with computers sometimes unsatisfying and at other times even somewhat of a charade.

Strategies for teacher development with computers (Australian Council for Computers in Education, 2000) rightly do not take a narrow view of only considering content, but the importance of content as a fundamental and enabling factor cannot be underestimated. Knowledge of computers has been shown to be a pervasive influence on a variety of factors (see Chapter Two), such as confidence, planning and implementation of classroom practice, ability to solve technical problems, the development of pedagogical content knowledge, and the promotion of a consistently good experience when working with computers. Each of these aspects of Arlene’s, Howard’s and Geoff’s pedagogy was effected (to varying extents) by the teacher’s minimal content knowledge. I would still assert, with Johnson (1997), that only a certain minimal level of knowledge about computers is required (after all, no-one will have complete knowledge of a discipline), but this study has shown that it is critical to the success of ‘self
teaching’ as a form of professional development for teachers to achieve a suitable minimum.

The teachers in this study had minimum knowledge of computers, and limited associated pedagogical content knowledge. When left to their own initiative, reflective practice was negligible, practical theories of teaching were left unexamined and the scope and content of the curriculum was not challenged. *It matters* that the knowledge of these teachers was ad-hoc and incomplete. *It matters* that its development was exclusively at the initiative of the teachers themselves. In the case of the participants in this study, the do-it-yourself approach to professional development was not adequate.

Henaku-Aboagye and McDougall (1997) have written of approaches to classroom use of computers that

> traditional prescriptive methods of teaching, with teacher-structured learning activities, are now widely acknowledged to be ineffective in providing meaningful learning. However, it is clear that a totally teacher-free, open, unstructured, student-centred environment in which students are left to themselves without any form of guidance or supervision is equally unsatisfactory. The teacher has a major role to play, as a competent guide, a resource person, or a technician. (pp. 127-128)

The parallels with professional development are clear. Whilst the notion of teachers as blind, mechanistic implementors of already-established curriculum programs has been discredited (Cornett, 1990; Marsh & Stafford, 1984, ch. 5; McCutcheon, 1992), in at least the cases of Arlene, Howard and Geoff, this study provides evidence that a do-it-yourself professional development and curriculum environment where teachers are left to themselves without any form of guidance or supervision is equally unsatisfactory.
GENERALISABILITY OF THE FINDINGS

This study could be described as very personal. I cannot claim that the study could be replicated, given the idiosyncratic nature of the teachers, students, school and facilities available. It was born out of my professional curiosity, located in a particular setting which was of particular interest to me, so that I might learn something of the pedagogy, computer use and the emergent issues pertaining to particular computer-using colleagues. As much as anything, I wanted to learn whether leaving my colleagues to work out for themselves how to use computers in their teaching was worth doing; part of a broader effort of mine to identify suitable strategies for the professional development of computer-using teachers.

As an interpretive and etic study, it could be argued that the findings of this study pertain only to me, as the data gathering and interpretation is exclusively from my own frame of reference. This is a consequence of an epistemology and methodology which has been entirely appropriate for the investigation of the research question, as argued in Chapter Three. It is, however, important that case study work, such as this study, should be conducted in such a way that it sheds light on a wider context (Spindler & Spindler, 1992 p. 71). The study was born with high aims of working out desirable strategies for the professional development of computer-using teachers, and it is natural that the reader might expect that it would make recommendations as to how schools might remedy the deficiencies which result from teachers being self taught. Thus, the prima facie limitations of the methodology have been a concern to me, and I have reflected on them constantly.

Lancy (1993, p. 165) suggests that long-term immersion in the field gives credence to the researcher’s claim to speak for similar groups or situations. The findings of this study resonate with my experience of many other self-taught computer-using teachers over many years, and so I come back to what is personal about the study. The methodology was such that the practical implications of the study would first and foremost affect me in
my work in understanding the pedagogy of computer-using teachers and arranging suitable strategies for the professional development of computer-using teachers. By conducting the study, I have been able to formulate a theoretical knowledge base for my work in the professional development of teachers who are learning to use computers in their teaching, a knowledge base which is continuing to emerge but has been constructed by me as a result of my conducting this study. The major product of my reflection on this study and its findings is a personal manifesto for how I will try to work with self-taught computer-using teachers, and this is presented in Appendix Three. A major feature of this manifesto is a commitment to continue to engage in systematic enquiry and to periodically revise the manifesto itself, which I regard as a work-in-progress.

The study, its theoretical framework, its findings and even the manifesto may or may not resonate with others’ experience, but when they do so there is a natural basis for generalisation by the reader (Lancy, 1993, p. 165). Where the reader finds that his/her experience resonates with that expressed in this study, that it contributes to an emerging perception of ‘truth’ about the world as experienced by the reader, he/she can build the findings of this study into his/her own professional action. To make a claim other than this - for instance, to suggest that my personal manifesto should be accepted without question by anyone else - would be to deny the constructivist epistemology which is central to this study. I would note, though, that in formulating practical implications of this study, it has been tempting, just as Elbaz (1983, ch. 9) found in her research, for a positivist approach to surreptitiously enter my thinking and seek to develop generalisable ‘solutions’ to ‘problems’.

This study does, nonetheless, shed light on a wider context, and facilitates an understanding of something beyond the cases described, which, according to Stake (1994, p. 237) and Spindler and Spindler (1992 p. 71), is important for case study research to do. The fundamental understandings of this study, expressed in Chapters One and Three are that important
ways in which teachers’ knowledge can be framed is in the terms of content knowledge, pedagogical content knowledge and practical theories of teaching and that knowledge for teaching is personal and develops in a constructivist manner. Reflecting on these and the results of this study in general terms, a number of practical implications of the study have become apparent. These implications are presented in the next section. The practical implications are addressed to teachers, educational researchers, educational administrators and school-based practitioners who assist teachers to use computers or support their professional development, whom I call school-based teacher educators.

**PRACTICAL IMPLICATIONS OF THE STUDY**

*Commitment to Enquiry*

This study has demonstrated that case study research is a suitable way to understand the pedagogy and issues concerning self-taught computer-using teachers. The first practical implication of this research is the need for continued research.

The participants in this study did not engage in any systematic enquiry into their own pedagogy. They were unaware of the practical theories of teaching from which their pedagogy arose and were not engaged in any cycles of professional improvement. The implication for teachers, particularly those who are learning to teach in unfamiliar situations such as with computers, is that they should be engaged in research into their own pedagogy - to be fully, and genuinely reflective practitioners. If the classroom use of computers is to be improved in anyway, then it is the teachers themselves who must understand their own pedagogy and make adjustments (this thought is developed in more detail later in this chapter). It is important that teachers formulate their own theoretical knowledge base for the influences on their pedagogy as a basis for future action, and systematic enquiry is the only way to achieve that. In addition
to advocating that teachers participate in sustained enquiry, a further practical implication of this study is to demonstrate the viability of a particular frame of reference for understanding pedagogy. In this study, teachers’ knowledge has been found to be genuinely illuminative, and from that point of view, it is worth their while ‘trying out’ understanding their pedagogy in terms of knowledge. Teachers should, of course, search for suitable frameworks for understanding their own pedagogy and not, as Robson (1986) has warned, treat conceptions of teacher knowledge as a kind of methodological straightjacket for interpreting pedagogy.

The implication for school-based teacher educators is similar to that for teachers. There is no substitute for understanding deeply, and at close hand, those teachers with whom one works. I will not be working in a support/development role alongside Arlene, Geoff and Howard again, as my place of work has changed. My manifesto is situationally specific to my work with them, but it provides a basis on which my future actions and research can be constructed and will be revised progressively throughout my career. It is important for those who seek to influence the professional development of others to formulate their own theoretical knowledge base for how their work should be constructed, and systematic enquiry is the way to achieve that. As for teachers, this study has demonstrated that it would be productive for these professionals to at least consider the extent to which conceptions of teacher knowledge can contribute to this knowledge base.

Case study research and ethnography are but two of the ways in which personal theories of professional development and computer use can be revealed. I am particularly attracted to strategies such as collaborative action research (Baird & Mitchell, 1987; Baird & Northfield, 1992; Johnson, 1995) which simultaneously addresses the need for research by both teachers and other school-based teacher educators, and in which practical action is integral. In such models, professional development is viewed as professional, personal and social development (Bell & Gilbert, 1994) which involves shared adventure, collaboration and purposeful enquiry to form
an ongoing spiral aimed at bringing about better learning and teaching (Baird, 1992).

There is also an implication for educational researchers. There is still much to be learned about the psychological and social factors which influence how teachers teach with computers, and how they might best be encouraged to do so. Whilst there will never be a substitute for teachers and other professionals constructing for themselves a theoretical knowledge base for action, the quest for scholarly knowledge is not diminished. This study has shown that teachers’ knowledge is a productive theoretical framework in which the pedagogy of self-taught computer-using teachers can be understood. As suggested earlier in this chapter, the participants in this study would have been inclined to interpret their pedagogy in terms of difficulties and concerns. Educational research, therefore, has a role to play in suggesting a range of theoretical frameworks in which pedagogy might be understood, and thus broadening the enquiry of teachers and related professionals. In time, too, emerging from a body of many case studies, and from different styles of research entirely, general (rather than personal) theories will emerge which will help us better understand teachers’ learning, and provide a framework for teachers’ own reflection.

**Content Knowledge**

The second practical implication of this study concerns content knowledge. In Chapters One and Two, it was identified that the influence of content knowledge on pedagogy has been little studied. This study contributes to the literature on teacher knowledge, in addition to the literature on computer use in teaching, because content knowledge of computers has been identified as a significant influence on the pedagogy of Arlene, Geoff and Howard. However, content knowledge was not so much identified as an influence for its own sake, but because it affected attitudes and confidence, pedagogical content knowledge, and the ability of
teachers to find working with computers to be a rewarding experience. There are several practical implications for this emerging understanding of the importance of content knowledge.

*Teachers* need to take learning about the technology seriously. It is also a useful theoretical framework in which their pedagogy can be understood, particularly in respect of the confidence or satisfaction they have.

*School-based teacher educators* need to take heed of Stager’s (1995, p. 1080) comments - that computer-based staff development efforts often assume that teachers need to be only computer literate enough to unjam the printer or to use one piece of “canned software” with their students. Stager believes that this line of reasoning deprives teachers of the type of intellectual empowerment which their students experience when using the computer as a vehicle for constructing knowledge. To attend to content knowledge is fundamentally enabling.

The issue of content knowledge in this study highlights a research agenda for *educational researchers*. The relationship between content knowledge and pedagogy remains unclear. There is indirect influence, as has been noted, and the need for a ‘certain minimum’ of knowledge about the technology has been noted throughout this chapter. A research agenda should include extending our understanding of the influence of content knowledge on pedagogy, including whether any direct influences of content on pedagogy can be established and whether it be possible to more closely define what that certain minimum might be.

**Pedagogical Content Knowledge**

The third practical implication of this study concerns pedagogical content knowledge. In Chapter Two, it was shown that pedagogical content knowledge is increasingly studied, but no specific reference to the influence of pedagogical content knowledge on teachers’ use of computers has been identified. This study has demonstrated the importance of
pedagogical content knowledge on teachers’ use of computers, and thus makes a significant contribution to the literature. There are several practical implications of the importance of pedagogical content knowledge.

As with the development of content knowledge, teachers need to take the development of their pedagogical content knowledge seriously. School-based teacher educators also need to attend to the development of teachers’ pedagogical content knowledge in relation to computers. A few strategies have been suggested (Hollingsworth & Clarke, 1998; Shulman, 1986; Wilson, 1989) as ways to improve pedagogical content knowledge: developing knowledge of the technology, reflection on case study material, immersion in the field, and opportunities for reflection. As part of their on-going commitment to research with teachers, school-based teacher educators would be wise to incorporate strategies such as these into the professional development programs in schools.

Because little attention has been paid to the relationship between pedagogical content knowledge and computer use by teachers, the building of a better understanding of this relationship is an important research agenda for educational researchers. Earlier in this chapter, I suggested a relationship between practical theories of teaching and pedagogical content knowledge, and this is a further aspect that warrants investigation. Whilst some researchers have suggested means by which pedagogical content knowledge can be developed, the range of strategies is rather small. The use of reflective studies of cases is one of the strategies which has been advocated to aid the development of pedagogical content knowledge, but Hollingsworth and Clarke (1998) comment the use of cases has not been explored as widely in Australia as elsewhere. Here, in particular, is a challenge and opportunity for Australian researchers.

**Practical Theories of Teaching**

The fourth practical implication of this study concerns practical theories of teaching. As indicated in Chapter Two, the influence of practical theories
of teaching on teachers’ use of computers has been quite widely studied
and commented on. Practical theories of teaching are deeply rooted in
teaching experience and personal history, and, borrowing Messler’s words
(1989, p. 21), reflect each teacher’s core understandings and values of
teaching and their attempts to objectify what they seek to do and be.
Practical theories of teaching are extremely robust, and consequently to
achieve much change in pedagogy may require a fundamental change in a
teacher’s world view. I would also extend these ideas on the practical
theories of teaching (which is a concept pertaining to the individual) to
the subject subculture, which are a kind of corporate practical theories of
teaching and even to the broader culture of the school. Studies abound
which consider the press of the culture of the institution on pedagogy,
among them Bullough (1991), Bullough, Knowles and Crowe (1989) and
Kuzmic (1994).

A number of important practical implications of practical theories of
teaching can be seen in Robinson’s (1989) work. Robinson has developed
an interesting approach to professional development, grounded firmly in
an understanding of teachers as knowledgeable, rational professionals
who are continually learning from their experiences and making
informed choices. He also recognises that attempts to orchestrate change
in pedagogy have regularly failed, and embraces Clark’s (1992, p. 77)
oxamination that adult development is voluntary and that no-one can
force a person to change, learn or grow. Robinson (p. 280) adopts a line of
thinking from Gestalt psychology to argue that change occurs when one
becomes what he/she is, not when he/she tries to become something that
he/she is not; that change in other people is most likely to be facilitated by
abandoning altogether the aim of trying to change them and giving them
instead the opportunity to be fully themselves, a vision of the choices
around them, and the support to embrace any venture they choose.

This study has shown (see earlier in this chapter) that Geoff, Arlene and
Howard have adopted uses of computers which resonate with their
practical theories of teaching. To increase Howard’s use of computers, for
instance, would be best approached by finding ways of using computers which further his emancipatory interests, rather than trying to mould him into something that he is not. One implication of the importance of practical theories of teaching is that there will be a much greater chance of computer use being embraced when the opportunity to use computers becomes a way of the teacher expressing his/her core understandings (Messler, 1989, p. 21), and his/her pedagogical agenda (Hodgson, 1995, p. 27).

In contrast to Robinson, there is a range of studies (e.g. Briscoe, 1991; Kloss, 1987; Mostert, 1992; Ritchie & Russell, 1991; Tobin, 1990) which have endeavoured to promote teacher change by identifying a teacher’s world view, investigating the implications of it, and devising alternatives. Studies of this genre acknowledge that rational argument alone will not promote fundamental changes in teacher’s deeply embedded practical theories of teaching, world view, or sense of self. An appropriate (if somewhat radical) response to this, argues Wubbels (1992), is to focus attention on modes of expression and thinking which are concerned with synthesis, totality, and integration (what might be called ‘right brain thinking’) compared with modes of expression and thinking that are concerned with logic, reason, explanation and interpretation (what might be called ‘left brain thinking’). Thus researchers such as Bailey and Horton (1984), Costa and Garmston (1987), Tobin (1990), Briscoe (1991), Kloss (1987) and Ritchie and Russell (1991) have been able to help teachers make fundamental changes to their world views through the use of techniques such as metaphor, imagery and mental rehearsal. The point of referring to this literature is to acknowledge that whilst there is much merit in Robinson’s approach, it should not be thought that helping teachers change their core understandings of themselves or their pedagogical agenda is impossible or unwise.

For teachers, the implications of practical theories of teaching is that they provide a very important basis for reflection. To grasp one’s core understandings, along with departmental and school-based
understandings of teaching and learning, provides a basis for identifying the ways in which computers can be increasingly incorporated into one’s teaching.

The identification of a teacher’s practical theories of teaching is an important research agenda for school-based teacher educators. Little genuine progress on the use of computers in teaching will occur unless a teacher is known at this deep level. As Robinson (1989) notes, it is important to provide computer-using teachers (a) the opportunity to be fully themselves (b) the vision of choices around them and (c) the support to venture down any road they choose. One of these courses of action might be for the teacher to seek to revise his/her world view, using strategies such as the holistic reflective practice documented by Mostert (1992) and Ritchie and Russell (1991).

The issues surrounding practical theories of teaching provide a research focus for educational researchers. The influence of practical theories of teaching on pedagogy have been quite widely recognised, but little attention has been devoted to certain factors. Firstly there is the relationship between practical theories of teaching and pedagogical content knowledge, secondly the influence of practical theories on pedagogy when a teacher teaches a subject which is outside his/her realm of experience, and thirdly, the implications for the appropriateness of the pedagogy which emerges in such situations.

The Nature of Professional Development

The fifth practical implication of this study concerns the nature of professional development. In addition to reinforcing the viability of teacher’s knowledge as a framework for understanding pedagogy and the need to continually engage in enquiry, this study has highlighted two important principles. The first of these is the nature of teachers’ development. The second of these, discussed in the next section, is a renewed attention to the basic principles of research. Both of these
provide important guidance for teachers, educational researchers and practitioners who seek to help teachers use computers or support their professional development.

Clark (1992, p. 77) observes that adult development is voluntary; no-one can force a person to change, learn or grow. If a teacher does not wish to learn how to use computers effectively in his/her teaching, very little can be done to change that. Similarly, if a teacher does not wish to become a reflective practitioner, he/she cannot be forced to do so. Clark (1992, p. 77) further comments that voluntary participation in professional development is likely to result in a change in pedagogy. The key to professional development (including helping teachers make more effective use of computers in their teaching), therefore, is for teachers to commit to developing themselves as professionals (Robinson, 1989; Thiessen, 1992) and thus engage in reflective practice and seek strategies to - for instance - improve their content knowledge and pedagogical content knowledge.

To take the nature of professional development seriously suggests that there are realistic boundaries within which school-based teacher educators can work. It also suggests that attention must be directed as much to developing a school culture of teaching in which teachers are personally motivated to developing themselves as professionals as to providing particular support or training programs.

**Ockham’s Razor**

Ockham’s Razor, the maxim of an ancient scholar (Williams, 1997, p. vii) that the simplest explanations are often the best, is the basis for the sixth practical implication of this study. In my reflection on this study, I have become convinced that scholars and school-based teacher educators alike should attend to certain basic principles of learning. For instance, personal confidence with using computers in teaching is supported by ensuring positive classroom experiences is an example of the psychological
principle of instrumental conditioning (Taylor et al., 1982, ch. 13) and is also related to the importance of positive self-efficacy beliefs for promoting computer use (see Chapter Two). The importance of this principle is not highlighted strongly in case studies of Howard, Arlene and Geoff, but it is certainly arguable that Geoff’s enthusiasm for computer use, for instance, diminished as the year progressed because of recurring negative experiences with computer use, reflecting the curriculum support provided and technical problems experienced. My conjecture is that, notwithstanding the importance of a culture of research and reflective practice, content knowledge, pedagogical content knowledge and practical knowledge which this study has demonstrated, practitioners ought not overlook what is obvious or fundamental.

What is required to provide a positive experience will vary from one situation to another, and school-based teacher educators will need to attend to local factors which are required to provide a positive experience that will vary from one situation to another and may include: providing reliable equipment which is easy to use, providing technical support, improving content knowledge, effective curriculum planning, resource materials and a supportive collegial environment.

Teachers who seek to use computers in their teaching, in their reflective practice should be careful not to make matters too complicated. If a teacher is experiencing difficulties with computer use, he/she can ask him or herself, for instance, “what are some strategies which would make my experience when using computers more rewarding”? The results of reflection on a fundamental issue such as this can become the basis for modifying one’s practice or for discussion with colleagues on how to bring about improvements in computer use.

The implication for education researchers is similar. As detailed in Chapter Two, in the literature a great deal of attention has been paid to a vast range of factors which might influence computer use in teaching. I would not reject any of these as helpful explanatory frameworks, at least
in some circumstances, but I would suggest that much scholarly and practitioner knowledge about computer use could be garnered by attending to Ockham’s Razor. There is, as noted in Chapter Two, an emerging line of research concerning self-efficacy and computer use, but little concerning instrumental conditioning effects per se. Despite reviews of research, such as Bents and Howey’s (1981), which indicate that teachers can be at a variety of developmental levels which can impact on their pedagogy in a variety of ways, little attention seems to have been paid to the well-understood psychological phenomenon of maturation (Taylor et al., 1982, ch. 3) on teachers’ use of computers and related pedagogy. Similarly, little attention seems to have been paid to teachers’ learning style. The point, though, is not to re-constitute a study grounded in teachers’ thinking perspectives (see Chapter One) as an argument for classical psychology, but to strongly indicate that there is much scope for productive scholarly enquiry in furthering our understanding of how and why teachers use computers, and a need to always take Ockham’s Razor seriously.

**Resourcing**

In the discussion of the difficulties and concerns experienced by Geoff, Howard and Arlene (Chapter Five, Six and Seven), I have consistently identified resourcing as an issue: technical support, maintenance of computer facilities, and appropriate teaching loads. The final practical implication of this study concerns resourcing. The preceding practical implications have stressed the need to learn more and to reflect more, but the teaching lives of Howard, Geoff and Arlene were already busy and even fragmented. The presence of school-based teacher educators to support and resource teacher’s development has been assumed. A further practical implication, therefore, directed at educational administrators, is to ensure the adequacy of resourcing. Begg (1992) has noted that one of the origins of the self-taught approach to teacher development is an effort to cut costs. This study has demonstrated the inadequacy of this approach, and that professional development strategies for self-taught computer-
using teachers can be developed. None of these are zero cost. The importance of adequate computer facilities and technical support is probably taken for granted by many administrators, even if they do not have adequate resources to direct to these tasks. Resourcing teachers so that a culture of enquiry and of continual learning can develop is arguably more important.

A final dimension of resourcing relates to those things which a school should do to minimize fragility related to role and curriculum specification. Schools should provide clear policies on computer use - for instance, to articulate quite clearly what it means at a particular school for computers to be used in an integrated manner. There is a need for curriculum leadership, role clarity and staff development. The development of all of these are important, and each are a cost to the school.

**LIMITATIONS OF THE STUDY**

As I have reflected on my work in conducting this study, I am conscious that the teacher in this study of whom I have been least critical is Howard - the teacher who is most like myself, teaching senior classes and preparing students for the examinations and rigours of the end of their secondary schooling. I am also conscious that the teacher of whom I have been most critical is Arlene, who is female. Olson (1988a) has observed:

> as a former secondary [school] teacher, the practices of … [junior school] teachers are not at all familiar to me. Their practices are significant in ways I don’t understand. They engage in rituals whose significance I cannot yet fully construe.  

(p. 168)

It is possible that the analysis of the data has been clouded by my perspective as a male whose specialist teaching discipline is information technology in the senior levels. It is possible that there is significance in Geoff’s or Arlene’s pedagogy which I have neither seen nor interpreted appropriately. It is also possible that a female researcher would view the
data differently. I have used each of these possibilities as a basis for reflection and critique of my work throughout. At the conclusion of the study, I am convinced that my portrayal and analysis of the pedagogy of the three teachers is as honest, level-headed and as free of obvious bias as it can be, my particular experiences, frame of reference and gender notwithstanding.

Throughout this study, I have paid minimal attention to the choice of software or to the particulars of the computer hardware. I did not want the focus of the study to be on the hardware or software, but on pedagogy. There is no evidence that changes to hardware or software would significantly impact on the essential findings of this study, but it is a possibility which was not within the purview of this study. Similarly, there are social and political factors which I have largely found to be of minimal influence on the pedagogy of Arlene, Howard or Geoff, but these might be stronger influences in different settings, or even in the same setting through the eyes of a different researcher. My specific interest has been the influence of teachers’ knowledge on pedagogy (the investigation of self-taught computer-using teachers as being “self taught” was the origin of a focus on knowledge - see Chapter One), and even though I am convinced that this frame of reference provides a helpful portrayal of pedagogy and is a basis for a range of practical implications, the possibility of other frames of reference offering different explanations remains to be explored.

Even within the domain of teachers’ knowledge, this study has focussed on a subset of constructs which seem to be important for understanding pedagogy with computers (see Chapter Two). Borko and Putnam (1995), for instance, have suggested that there are seven domains of knowledge upon which teachers draw as they plan and carry out instruction: knowledge of subject matter, pedagogical content knowledge, pedagogical knowledge, knowledge of students, knowledge of other content, knowledge of the curriculum and knowledge of educational aims. This study has interpreted the pedagogy of self-taught computer-using teachers
in terms of the first two, but that is not to say that in some circumstances, other domains of knowledge might offer an equally productive theoretical framework. This is something which has not been explored in this study, nor has it been considered in the literature (see Chapter Two). There is clearly much scope for further research.

A final area of limitations of the study relates to the methodology. This ethnographic, interpretive and etic study which has considered the relationship between teachers’ knowledge and pedagogy, delivered findings particularly applicable to the researcher’s frame of reference. In so doing, the study engaged three teachers in thinking, talking and reflecting about their work. In other words, the study itself contributed to the teachers’ adaptation to teaching with computers even though this was not an aim of this study. In line with the recommendations urging schools and teachers alike to be committed to enquiry, it would be important to seek teachers’ views of theories which are developed (the time delay between data collection and analysis made this impossible in this study), and to capitalise on the power of studies which incorporate perspectives of the teacher’s voice to interpret knowledge and pedagogy to proactively encourage reflection and change.

**CONTRIBUTION OF THIS STUDY TO KNOWLEDGE IN THE FIELD**

Results from case study research necessarily relate to a particular context, just as the research endeavour itself is embedded in a social context and influenced by it. Some findings may be applicable in other contexts, but many will be unique to the situation investigated, a point elaborated on in an earlier section.

Despite this cautionary note, it can be claimed that this case study of the use of computers by self-taught computer-using teachers has arrived at some significant findings. In particular, this study confirms the central
importance of knowledge about computers in understanding how teachers use computers in their teaching, the influence of which has been largely presumed, and has been somewhat under-represented in the literature. Similarly, the influence of pedagogical content knowledge on teaching with computers is little recognised in the literature, and this study has identified it as an important influence. The influence of practical theories of teaching has been rather more represented in the literature, and this study has confirmed the importance of these. Furthermore, this study has shown that practical theories of teaching are not only helpful in providing an explanation of why innovation is difficult, but to understand why pedagogy occurs when a teacher teaches a subject outside of his/her realm of experience, and the implications there might be when familiar pedagogical approaches and beliefs are applied to as-yet unfamiliar teaching situations. For instance, there are certain ‘world views’ of teaching (e.g. problem solver, emancipator) which seem to be a better fit with the classroom use of computers than others, although there are disadvantages of each.

The finding which has widest applicability, beyond that of the specific context of self-taught computer using teachers, is the inadequacy of the do-it-yourself model of professional development. It is entirely appropriate to recognise that teachers are active, wise, knowledgeable professionals, capable of making meaning and developing pedagogy, but it is unwise to simply presume that reflective practice and a reconfiguration of self and pedagogy will automatically ensue. It is essential that resources be allocated to promote a culture of reflective practice and on-going professional development.

The research completed, whilst drawing on the work of other researchers, has drawn attention to specific issues related to the professional development and pedagogy of self-taught computer-using teachers. The techniques used provided valuable data on the research questions selected. The pedagogy of self-taught computer-using teachers has been documented and analysed through a theoretical framework, which has
been shown to be a productive one. Practical implications of the study have been discussed, including possibilities for further research. The research completed has made a significant contribution to the knowledge base about computer use, and about the possibilities and difficulties related to introducing teachers to the use of such technology.
APPENDIX 1:

COMPUTER RESOURCES AT OUTEAST COLLEGE

A description of the computer resources used by the participants in the study is given in this Appendix.

Room Layout and Facilities

At the time of the present study, the computer facilities at Outeast College consisted of three laboratories and two banks of laptop computers. The following sections provide a description of the facilities, together with an overview of the software available and the operating procedures for the systems.

Junior School

The laboratory in the Junior School (known as the “Junior School Technology Room”) consisted of Macintosh computers (Lu, 1992; Luehrmann & Peckham, 1994), arranged in a layout as shown in Figure 2. All specialist computer classes were conducted in this room, both by Geoff and our specialist colleague. This room was a shared space with the Junior School library, as Figure 2 shows, although separate classes were not simultaneously conducted in both spaces. I wrote the following description in my journal:

The Junior School Technology Room is multi-purpose, and there is no clearly defined front. It is a large room, and to me it has always felt large and empty. Certainly, Geoff's relatively small class of Year Threes seem to rattle around in it. At one end, the library collection for the Junior School is housed. There is one stand of library shelves, stacked full of books on both sides, which subdivides the room. Library classes would sit on the floor, gathered around a teacher sitting at the wall-end of the library space, and adjacent to two catalogue
computers. On the third wall of this space was a set of very large, box-like shelves up to waist height. These were used for book display purposes.

The room is sufficiently large to be thought of, and occupied, as two rooms in one. There have been several occasions when I have observed two full classes in the room - one down the library end, and another on the computers. This was crowded, noisy, undesirable, but possible. (This did not occur with any class which I observed in this study, however.) It was almost an unwritten code of practice among the Junior School students that if you were ‘doing library’ you never ventured toward the computers (except passing through), and if you were ‘doing computers’ you never ventured into the library space. I never saw any of Geoff’s Year Three students venture into the library space at all.

In the ‘computer half’ of this room, in-built benches are affixed to one of the walls and under the windows, and computers are placed on these. There’s a child-size chair at each place. Essentially, this part of the room is like a large open space framed on one side by the invisible dividing line of the library, on another by windows, and computers on benches under them, on a third side by a wall with computers, and a fourth side as a teacher/equipment/junk area. The number of desks or chairs in this space (if any) would vary from lesson to lesson: class teachers elsewhere apparently considered them superfluous to this room, and when there was a need elsewhere, they were borrowed, and sometimes returned. There is no obvious ‘front’ to the classroom, or focal point for whole-class discussions. When necessary, classes typically sit on the floor in front of the teacher who would position him or herself on a chair, wherever that chair happened to be.

The computer facilities consisted of 13 Apple LC 475 computers and two colour printers. The group of computers under the window was connected to one of the printers, and the group of computers along the wall was connected using the same technology to the other printer. The room also housed 12 Apple Powerbook laptop computers (on the storage shelves) which were sometimes borrowed by staff for use (with students) in classrooms, and they were also in the Technology Room itself to increase the number of computers available.
Each of the computers in the Junior School Technology Room were equipped with the program *At Ease*. This program provides a menuing system which is almost impossible to circumvent and thereby allows the user to interact with the computer via a simple (and restricted) set of options. This package was configured to require students to save their work onto a floppy disk, and they were prevented from saving to the computer’s hard disk. In the main, this was helpful as it assisted the younger students to manage their disks and files effectively, but it sometimes caused problems if there was a disk error (in such a case, the student would be unable to save his or her work).
Senior and Middle Schools

The computer facility for Senior and Middle Schools consisted of two technically equivalent laboratories which ran Microsoft Windows 3.1 as an operating system (Burns, 1992; Geyer, 1994) and a bank of 27 NEC Versa 500D laptop computers. The laptop computers were available from the library and were configured to be technically equivalent to the desktop computers in the laboratories. The room known as “Computer Room 2” (Figure 3) was the room designated for the integrated use of computers, and teachers throughout the school could book times for their classes to use this room. This was the room in which Howard’s and Arlene’s classes were conducted.

During our third interview, Howard described Computer Room 2:

Rectangular in shape. Windows on the south side, blocked in with green in the lowest panels to stop students spending their time gazing out the windows and maybe minimise the light on the screen ... three banks of computers, as I remember it. Two shorter banks, which are the ones, the ones along the south wall and up the west wall, that’s obviously the biggest group so they’re in an “L” shape completely, along the back wall and along the side wall then the two banks are parallel with those, and not as long. And all the students are facing towards the south except those on the west wall and they are facing the west.

...it’s pleasant enough. It sometimes gets a bit hot in there. Because windows are rarely open and you have to actually kneel up on the bench to open windows. The lighting’s OK. The carpeting’s good. As a number of students have commented in their writing, it is odd to have a music room, with loud music right next to the computer room ... often one has a fairly dominating sound coming from the music room. That is a significant level of interference with activity in the computer room.

...There are also often quite a few machines that don’t work for one reason or another and I know that [the technical staff] are run off your feet trying to keep up with the things that are down.
... I find that there is a big open space there as you come through the door. I find that is a little bit of a void and it’s hard to bridge that to get to the kids at the back along the south wall and along the west wall.

Figure 3 - Computer Room 2

Computer Room 2 consisted of 28 IBM-compatible computers, a mixture of 486- and 386-class machines. They were equipped with colour monitors, mice, 3.5” disk drives, with some computers also having a 5.25” size disk drive. As students used 3.5” disks, this could lead to some confusion as the 3.5” drive was not consistently either A: or B: throughout the room. None of the computers were equipped with hard disk drives. The room was equipped with one high-speed laser printer which handled all the printing needs of the room.

The computers in Computer Room 2, and the room adjacent to it, were interconnected as a Local Area Network (LAN), and managed through a common Novell Netware fileserver. During the second half of the year of the present study, a LAN-based connection to the Internet was also

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23 A system very similar to the one at Outeast College has been described by Morelli (1996).
established. As none of the computers were equipped with hard disk drives the fileserver acted as a common hard drive for all of them. There are numerous technical advantages in this arrangement, but it is not pertinent to the present discussion to detail them here. However, the disadvantages are relevant: a fault with the fileserver would render none of the machines operative; a fault with the network cabling would render at least half of the machines inoperative; and a fault with the network connection on any particular computer would render at least that machine inoperative.

**Operating Procedures and Available Software**

In this section, I will outline the processes by which a student typically gained access to the computer systems. In doing so, I highlight those particular features which, in my experience, often caused difficulty to teachers (not Geoff’s, Howard’s or Arlene’s classes in particular).

**Junior School**

Each of the Junior School computers were switched at a power outlet at the rear of each computer, and also on the main computer unit and on the monitor; there was no master switch controlling the power to all computers. Occasionally, the need to have three switches turned on caused difficulties for both staff and students.

Once turned on, any computer in this laboratory, would go through a startup sequence and then present the screen shown in Figure 4 to the user.

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24 That is, it was technically possible for all computers in the two rooms to access the Internet simultaneously through a single link. Technical details of an Internet connection very similar to the one at Outeast College have been described by Hilbig (1996).
If this screen did not come up, it would indicate a fault with the computer, and the teacher or student would not use it, leaving it for a technical repair at a later time.

This menu system (Figure 4) is the one provided by the program *At Ease*. All Junior School students would select the ‘class’ option using the mouse or arrow keys, and then either press the ‘return’ key or use the mouse to click on the ‘start’ button. Unlike the other login options which were used for special purposes (and not relevant to the use of computers in the present study), the ‘class’ option was not password protected. On selecting the ‘class’ option, the screen shown in Figure 5 was presented to the user.
This screen shows the various programs available to the students of Geoff’s class. It should be noted that very few programs were available: mouse practice, learning about the Macintosh, a keyboarding tutorial, Clarisworks and Microworlds. Except for one lesson, all the lessons of Geoff’s which I observed involved the use of Clarisworks (in the one exception, Microworlds was used).

From this menu, the user would use the mouse to click on the desired application. For example, after selecting Clarisworks, the screen shown in Figure 6 would be presented to the user.

Clarisworks is an integrated package, providing word processing, drawing, painting, spreadsheet, database and communications facilities. Geoff’s Year Three class used the first three of these tools.
Once the application program (cf. Clarisworks) had started, the user would need to insert a disk in order to save his or her work. Each computer had been configured to print to one of the two printers in the room, and under normal circumstances, a student would simply need to issue the print command in order to obtain a hard copy. However, there were frequent difficulties with the network cabling or the printer configuration which meant that obtaining a printout from a particular computer was not possible. At Ease meant that configuration problems could not be resolved by students, and only with some difficulty by teachers, and so was normally left for technical support staff to attend to at a later time, as were any cabling difficulties.

The routine for quitting and shutting down the computer in the Junior School Technology Room was firstly to quit from the software pack being used (e.g. Clarisworks). This would take the user back to the screen shown in Figure 5, and the disk could be ejected. Quitting from this menu would take the user back to the screen shown in Figure 4. At this point, the computer could either be left for the next user, or could be shut down and turned off. It was important for all users to follow this process (and for
teachers to insist that their students follow this routine), or damage could be done to the system.

**Middle and Senior Schools**

The computers in Computer Room 2 were switched at the main computer unit and on the monitor (other electrical connections were hidden from view); there was no master switch controlling the power to all computers. Occasionally, the need to have two switches turned on caused difficulties for both staff and students.

Once turned on, any computer in this laboratory, would go through a startup sequence and then the screen shown in Figure 7 would be presented to the user:

![Figure 7 - Login Menu in Computer Room 2](image)

A technical fault would be readily identified, as this would result in the menu not being present. If the words “server not found” (repeated many times across the screen), were presented, this indicated a network fault and rendered the computer unusable. It was highly likely that any network fault would affect at least half the classroom and not single, isolated computers. Any other message (or the failure of the computer to start) would indicate a fault specific to that computer. In these cases the teacher or student would not use the particular computer, leaving it for a technical repair at a later time.
In Figure 7, all options except number two ("login as your own ID") were special-purpose options which do not need to be considered in this review of normal operations. Upon pressing number two, the prompt to key in a login name and password shown in Figure 8 would be presented to the user.

![Login Prompt in Computer Room 2](image)

Each user was assigned their own login name and password, and without this students were unable to use any computer. Only system administrators were able to resolve problems with login names and passwords, and so students in Howard’s and Arlene’s classes who experienced problems logging in would be unable to use the computer until they spoke to the system administrator at a later time (they would not normally be given permission to leave class to do so).

One of the characteristics of a diskless network was that the login process could take some considerable time. If the entire room of computers, were to be to turned on or logged in simultaneously, the process might have taken five minutes or more. This was an important consideration for teachers’ structuring of their lessons in the computer rooms.

A successful login would result in a range of diagnostic messages and system information being presented to the user, followed by the user being presented with the Program Manager for Windows 3.11, as is shown in Figure 9.
Both Howard and Arlene’s classes made particular use of Microsoft Word, which was accessed by opening the Microsoft Office group. The screen shown in Figure 10 would then be presented to the user. Microsoft Word would be started by double-clicking on the respective icon.

Figure 9 - The Opening Windows Screen in Computer Room 2

Figure 10 - Menu for Access to Word Processing and Related Software in Computer Room 2
Once using Word, there were two common difficulties which could beset the user. The first would be a fault with either the disk drive or the disk, rendering it impossible to save. This could mean that users could potentially lose a significant amount of work. To overcome that, users were encouraged to save their work early in their work session, thereby testing their ability to save. The most likely course of action would be for the user to move to a different computer. The second major difficulty would be a network failure, and in such circumstances, the computer might appear to keep working normally for a period of time, but the user would ultimately be unable to print or save his or her work. Again, the recommended safeguard was to save early and often.

Printing in Computer Room 2 was a straightforward operation. From any computer in the room, users would issue the print command in the software they were using, and their document would be printed on the common network printer; it was not possible for students to ‘select’ any other printer. Occasionally, aspects of the printing system invisible to the user would fail, requiring attention by the technical support staff before printouts could be obtained.

A variety of other programs were available to classes using the computer rooms, accessed through the various group icons, shown in Figure 11. Also installed were components of LANSchool (Lan Fan Technologies, 2001) which is an application designed to give a teacher full control of all computers in a training lab. Using this package, it was possible for a teacher to broadcast his/her computer screen to all student computers within the laboratory, which can be a very useful way of showing students how to use computer applications and tools from one. This feature was available as a separate icon which was only available at the workstation at which a teacher was logged in, and only required double-clicking the icon to broadcast a demonstration to the whole room. It was a function which Howard investigated on a few occasions. Only a very few of the packages shown in Figure 11 were actually used extensively by either Howard’s or Arlene’s classes (indeed, it could be argued that very few of these, except
Figure 11 - Illustrations of the Software Available in Computer Room 2
those shown in Figure 10 would have any appeal to the teacher of
English).

The routine for quitting and shutting down the computers in the
Computer Room 2 was firstly to quit from the software package being used
(e.g. Microsoft Word). This would take the user back to the screen shown
in Figure 10, and the user’s disk could be ejected. From then, the user
could select ‘Exit’ from the ‘File’ Menu, and this would return the
computer to the opening menu (Figure 7). At this point, the computer
could either be left for the next user, or could be shut down and turned off.
Unlike the Macintosh systems, turning the computer off rather than
following the recommended procedure would not result in any damage,
but the correct procedure was still encouraged.
APPENDIX 2:

INTERVIEW QUESTIONS

A list of the questions used to promote discussion at interviews throughout the year is presented in this Appendix.

Interview One

The discussion in the first interview was based around the following prompts, aimed at revealing: prior experiences and professional journey, understandings of self-as-teacher, understandings of self-as-learner, understanding of students’ learning. A copy of these questions was given to each participant several days before the first interview.

- Describe your background and professional journey.
- Think about your years as a student (school, university, college, etc) and your years as a teacher (incl. school teaching, tutoring, this school, other schools). What are some of the important things which happened to shape you into the sort of teacher you are today?
- What sort of teacher are you? What sort of teacher do you try to be? What sort of teacher would you like to be?
- These events which you have mentioned ... why were they important to you?
- Have there been any times in your career when memories of these events have been more important to you than at others?
- If someone was to walk into your classroom, what evidence would they see of the sort of teacher you are (or try to be, or like to be)?
- We have considered the sort of teacher you are and try to be. Are there any sorts of teacher you try not to be?
- Have there been any times when the sort of teacher that you try to be has seemed out of place? How did you come to terms with that?
• Do you think that the sort of teacher you are changes from lesson to lesson? Is there any fundamental difference between you teaching a particular subject (or year level or group) compared with teaching another subject/year level/group?
• Has the sort of teacher that you are changed over your career? Why might that be?
• What do you believe your role is in the classroom?
• Think of all the situations in which you have been a learner over the last year (e.g. workshops, conferences, lectures, reading, TV, radio, etc). For you which of these situations is “good learning”?
• Think of all the circumstances in which students learn. In which of these do students learn best?
• Could you use a metaphor (e.g. preacher, policeman, supervisor) to describe your role?
• How do you think this metaphor is related to (a) your beliefs about how students learn? and (b) those important events in your learning to be a teacher?
• As a teacher, what do you perceive as some of your limitations? Your strengths? Your needs and concerns?
• It is my hope that through our discussions, your reflections and the use of the video, your teaching will improve. In what areas would you like it to improve?

Subsequent Interviews

In the subsequent interviews, the use of videotape of a recent lesson was the major prompt for discussion. The initial questions which I used to begin the conversation were:

• What has been happening with your class, and how computers have been used, since our last discussion? How have things been going?
• Could you please give a running commentary on what was going on during the lesson? You could include the activities the students were
engaged in, what you are doing during the lesson, what the desired learning outcomes were, and of course, any particular features. If you want, you can use fast forward. So I’ll let you take the controls of the video, and describe your lesson.

The ensuing discussion was based on listening to what is said, using a recursive style, reflecting terminology used by participants, encouraging elaboration and seeking clarification and exemplification of the material presented (Marland, Kennedy, Forlin & Sturman, 1997). As such, the content of each interview was rather different, but over the course of the year, I ensured that the following topics were explored:

- Where there any highlights in the lesson?
- Where there any surprises in the lesson?
- What were the major positives, if any, in the lesson?
- What were the major negatives, if any, in the lesson?
- Were there any problems during the lessons? How did you go about addressing them? Did you find a satisfactory solution?
- Was the lesson enjoyable to teach? Do you like teaching with computers?
- Did you (the teacher) feel confident during the lesson?
- How would you describe the students’ work ethic and classroom demeanour?
- How would you describe the students’ skill in using computers?
- What is the impact of the room layout on pedagogy and students’ work and interpersonal interaction?
- What particular pedagogical or disciplinary strategies did you employ during the lesson?
- What particular instances of instruction did you use during the lesson (either to the whole class or to individual students)?
- What particular classroom routines were used during the lesson? (Particularly those for the beginning and end of each lesson, and where clear changes of activity during the lesson were involved.)
• What is the value of computer use in your subject area?
• How are the particular ways in which computers are used in the lesson related to the content being studied?
• What is your (the teacher’s) role in the classroom?
• Your planning - is the observed classroom activity the result of careful planning or is it spontaneous?
• What is your approach to the care for the physical environment (keeping the room neat, reporting faults)?
• Is it difficult to capitalise on the computer as a learning resource? What is the source of any difficulties?
• What are the differences and similarities in the teaching/learning in the computer laboratory compared with the ‘regular’ classroom?
• Would you say that computers have changed your teaching? In what ways?
• Is the teaching/learning in the computer laboratory consistent with your understanding of good teaching and learning?
APPENDIX 3:

PERSONAL MANIFESTO FOR WORKING WITH SELF-TAUGHT COMPUTER USING TEACHERS: A WORK-IN-PROGRESS

In Chapter Eight, I stated that by conducting the study, I have been able to formulate a theoretical knowledge base for my work in the professional development of teachers who are learning to use computers in their teaching, a knowledge base which is continuing to emerge but has been constructed by me as a result of my having conducted this study. The major product of my reflection on this study and its findings is a personal manifesto for how I will try to work with self-taught computer-using teachers. This manifesto is as follows. A major feature of this manifesto is a commitment to continue to engage in systematic enquiry and to periodically revise the manifesto itself, which I regard as a work-in-progress.

I will aim to

- provide teachers with a frequent, rewarding and recurring classroom experience, because that will build confidence and assist in the development of pedagogical content knowledge.
- encourage teachers to be sufficiently engaged with the technology to present challenges to the prevailing concepts of the scope and content of the technology.
- provide opportunities for teachers to increase their knowledge of the technology, because it will help them improve their confidence with the technology, increase the appreciation of the value of computers for teaching of their subject area (pedagogical content knowledge), and help them experience success when working with the technology.
- provide adequate technical support for teachers because that will assist in presenting a rewarding and classroom experience.
• create strategies to influence self-efficacy beliefs (Albion, 1999b) which includes enabling other colleagues to demonstrate that they have extended and rewarding experiences using computers, and providing examples in verbal or written form of other teachers having extended and rewarding experiences using computers.

• create strategies to improve pedagogical content knowledge which include developing knowledge of the technology, reflection on case study material, immersion in the field, and opportunities for reflection (Hollingsworth & Clarke, 1998; Shulman, 1986; Wilson, 1989).

• acknowledge that some teachers are not personally and psychologically disposed to adopt innovations, and I will not expect that new ideas must invariably succeed.

• encourage teachers to be reflective practitioners, identifying their practical theories of teaching, and to consider the implications of these on teaching with computers.

and, most importantly,

• continue to investigate the influences on the pedagogy of computer-using teachers.
REFERENCES


Spender, D. (1994). *Teaching and the new information technology (or teaching what we have not been taught)*. Paper and keynote address presented at the Victorian Information Technology Teachers’ conference, Latrobe University, Australia.


Wiseman, R. (1993). The interpretive approach (section 3). In H. Connole, B. Smith, & R. Wiseman (Eds.), *Master of education - issues and methods in research study guide* (pp. 103-177). Adelaide, Australia: University of South Australia Distance Education Centre.


