UNIVERSITY OF SOUTHERN QUEENSLAND

THE RELATIONAL NATURE OF MENTORING GIFTED CHILDREN USING DESKTOP VIDEOCONFERENCING

A Dissertation submitted by

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In partial fulfilment of the award of

Doctor of Education

2004

Abstract

The integration of technology into classrooms, the education of gifted learners, and the challenge this presents to classroom relationships as a result of engaging with computer technology are significant issues for teachers in this decade. The evolving paradigm of technology use, the deep learning of computer skills that students will require for future employment and how this can be incorporated into appropriate pedagogies for gifted learners also poses challenges for teachers. This thesis reports on a unique mentoring program that was developed to utilise desktop videoconferencing (DVC) technology and designed to specifically address these challenges.

The study was undertaken in a large independent school (K-12) in New South Wales, Australia and involved six students and six teachers, none of whom had any previous experience of DVC or mentoring. The aim of the study was to investigate learning outcomes for teachers and gifted students. This study employed DVC as a didactic strategy over a 10-week period. The mentoring sessions of the cohorts and their post-mentoring interviews were evaluated using grounded theory methods of data gathering and analysis over a 2-year period.

The findings demonstrated that the nature of learning during DVC could be constructed as an emergent theory, based on the teaching philosophies of the teachers and their goals for their students. Technical support, relational mentors and motivational tasks created supportive environments for DVC. Perseverance, enthusiasm and resilience enhanced the uniqueness of mentoring program**.** Several recommendations are also posited for further research.

CERTIFICATE OF DISSERTATION

I certify that the ideas, experimental work, results, analyses, software and conclusions reported in this dissertation are entirely my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Signature of Candidate	Date

ENDORSEMENT

Signature of Supervisor/s	Date
Signature of Supervisor/s	Date

Acknowledgments

I am deeply grateful to Dr Chris Forlin, my principal supervisor and mentor, who persisted in her support, advice and encouragement throughout the doctoral journey. I would also like to thank Dr Dorothy Andrews, my associate supervisor, for her wisdom and expertise. In addition, I will always remember Dr Tony Rickards, my first associate supervisor, for his kindness and enthusiasm.

I would also like to thank the principal, Dr Ted Boyce and the staff of the school community to which I belong.

Dedication

This thesis is dedicated to Mum, Dad, Matthew and Heather.

Table of Contents

List of Figures

List of Tables

Glossary

Desktop Videoconferencing

Desktop videoconferencing is a technique that uses a computer camera and microphone at one site to transmit video and audio to a computer at another site (Barron & Orwig, 1997).

Gifted

For the purposes of this research, the concept of gifted would be best understood as having significantly high ability relative to the peer group. The focus should be on needs and that giftedness in any field of endeavour should be accepted, valued and supported. The focus should be on what needs require what intervention (Senate Employment, Workplace Relations, Small Business and Education Reference Committee, 2001, p. 34).

Learning

For the purposes of this report, learning will be understood in the following context. Learning is about searching for meaning, developing understanding and relating that understanding to the world around us. As a consequence, the world is seen differently and student conceptions have undergone change (Willis, 1993).

Telecomputing

Telecomputing can be defined as the use of computers and electronic networks that have enabled people to communicate with each other and access information from each other, online databases and World Wide Web sites.

Telementoring

In the education of students, Clasen and Clasen (1997) defined mentoring as a process whereby someone assists the student in his or her intellectual, affective, social and career development in a specific area. The role of mentor involved being a teacher, expert, guide, adviser, friend and role model.

Chapter 1 – Introduction

1 Introduction

One of the great marvels of the previous century was the invention of the Internet and the availability of the World Wide Web. It has certainly changed how we work, rest and play. The mere mention that the computers are off-line can create havoc for many businesses and schools. Computer consumption is increasing and the use of telecommunications and online connections to the Internet, newsgroups, and electronic mail is continuing to expand in society (Dede, 1993). The Australian Bureau of Statistics (ABS) reported that by 2001, 60% of all Australian households would contain a personal computer with 50% predicted to access the Internet at least once during the week prior to the National 2001 Census (Australian Bureau of Statistics, 2003). No growth comparison can be made in Internet usage, as data were not collected in the 1996 Census. It is not surprising that there has been an increasing call upon schools to use technology, including telecommunications, to educate children. Educators cannot ignore what has happened in the outside world (Collins, 1996).

While educators acknowledge this call to connect with powerful technological tools (Ainsley, Banks & Fleming, 2002), there is also a need to ponder on the effects that computer consumption can have on relationships. Is the time spent interacting with the World Wide Web likely to have a direct bearing on the quality of relationships? Is society spending too long sitting in front of computer screens at the expense of time spent talking and listening to each other? It might be argued that computer "consumption" can be as problematic as human isolation, in that it cuts the person off from social relationships (Mackay, 2002).

The potential for computer technology to segregate people from social contact could pose a challenge for the educator. The educator needs to ensure the socialisation of the learner, the deep learning of computer skills, and the use of appropriate technology for the individual and the required task, usually simultaneously. Mackay (2002) contends that learning how to relate and using computer technology cannot be wholly addressed interconnecting via the World Wide Web. The challenge is to connect with each other and electronic technology.

Also, a number of studies (Cannings & Finkel, 1993; Mehlinger, 1995; Schlechty, 1997) have reported on the competencies for students to succeed in the workplace of

tomorrow. These authors argue that schools need to invest resources in the use of technological tools to facilitate their thinking, calculation, communication, and collaboration skills.

Many countries have envisaged a significant role for information and communication technologies (ICT) in their education system (Ainsley, Banks & Fleming, 2002). In Australia, one of the national goals for schooling in the declaration of the Ministerial Council on Education, Employment, Training, and Youth Affairs (MCEETYA) (1999) stated that students should become confident, creative, and productive users of new technologies in society. In addition, national action plans, as reported in, *Information and communication technologies in classrooms: Perspectives from an international study*, concerning information technology have addressed the issues of integrating on-line services with curriculum practice, providing effective teacher education and developing a high on-line content (Edna, 2000).

The national plan, as reported by Ainsley, Banks and Fleming (2002) has identified priority areas for information technology. These include the role of the student, the teacher and the education authority in the areas of equity of access and the effective use of ICT. With this use of ICT it is anticipated that there will be a greater understanding of the interdependence of conditions that facilitate success in improving both student and teacher learning outcomes. There is also an acknowledgement of the need to bridge the gap between the potential of ICT and its actual implementation in the classroom. In addition, there is the goal of nationally monitoring teacher and student competencies, resources, and learning outcomes.

Many millions of dollars have been poured into the information technology infrastructure and this does not necessarily reflect the actual implementation of technology in schools. As almost every school in Australia is connected to the Internet, the use of telecomputing tools in classrooms can be an important study resource in addressing the goal of the potential of ICT and its actual implementation in the classroom. Studying the use of telecomputing with students and teachers may be one way of assessing the implementation of some of these national goals. Fluck (2001) described the phases in the uptake and use of computers in education as:

- Phase 1: The provision of computers.
- Phase 2: The establishment of frameworks for student and teacher competencies in the use of ICT across the curriculum and content changes in all areas.

- Phase 3: The use of flexible school learning through ICT.

Fluck (2001) suggested that educators sometimes stagnate in Phase 2 and seldom reach Phase 3 where the use of computers can change the way in which education has been conducted. Fluck argues that time is needed for teachers and students to experiment and recreate with ICT. Release-time for teachers to experiment and recreate is not usually factored into a school's staff development budget, and can sometimes be viewed as a luxury rather than a necessity.

The educator seems, therefore, to be pulled in two directions. There has been the call to connect to each other relationally, as argued by Mackay (2002), and the call to become technologically astute by integrating technology into education (Ainsley, Banks & Fleming, 2002). This investigation is an attempt to discover whether telementoring and, in particular, desktop videoconferencing can achieve both aims. With this innovation, the student can be mentored by someone who can enhance their interpersonal skills, assist in high-level experiences and connect to the outside world (Clasen & Clasen, 1997)

Often, technological innovations do not live up to the claims of technology enthusiasts. Cuban (1997) warned that many hold unrealistic expectations of technological implementation without a clear strategy for its actual use in the classroom. Cuban noted that teachers inevitably and unfairly receive a significant portion of the blame for such failed attempts. However, educational innovations can only be meaningful if teachers can employ the innovation in their instructional practice. As Goodlad (1984) noted, one should ask how the innovation was implemented because it is in the implementation that it has meaning for teachers.

1.1 The Study's Purpose and Significance

The purpose of this research was to implement and evaluate a mentoring program for gifted primary school students using desktop videoconferencing. The particular focus was learning with, and through, information and communication technology.

My interest in this area stemmed from my involvement in the teaching of gifted students, consulting and collaborating with classroom teachers about effective teaching programs for gifted students and the results of my own pilot study (Whiting, 1999). The recommendations from that pilot study, which investigated the perceptions of teachers towards gifted education, supported the idea that mentoring was a viable strategy for gifted

students. Those teachers also strongly agreed that there was a need for more strategies to be developed for gifted children in the regular classroom. In this study, it was proposed to combine the strategy of mentoring with the technology of videoconferencing.

As new technology has impacted on education, there has been increasing pressure for teachers to keep up with the technological demands from their own school community and the wider community. Desktop videoconferencing has demonstrated that it is an alternative means of integrating successful teaching strategies with computer technology.

The findings of this study have the potential to contribute to the body of qualitative research regarding the actual experiences of teachers using telementoring with gifted students. Of particular interest were the experiences of the participants in learning content and the impact of telecommunications on that learning. Dede (1993) reflecting on learning with and through telecommunications, stated, "The process of developing visions that transcend how emerging capabilities (in educational technology) enhance conventional schooling to depict their implications for empowering new paradigms is vital for creating new possibilities for improved teaching and learning" (p. 2).

1.2 Research Problem

Although many societies have acknowledged that the education of gifted children (Senate Employment, Workplace Relations, Small Business and Education Reference Committee, 2001) is as necessary as that of other special population groupings, the associated practices do not appear to have always been informed by empirical research. The research base that does exist has focused very much on curriculum design, resources, teacher training, administrative arrangements and efficacy research. In addition, the research base has been largely characterised by the application of quantitative methodologies (Borland, 1989). In this regard, experiments and questionnaire surveys have been the norm. The findings of such quantitative research during the past 20 years have contributed significantly to this field of education and, more specifically, to the greater understanding of gifted education.

Over the last decade, many topics in the field of gifted education have been explored using qualitative methods of inquiry. These studies (Lundsteen, 1987) have included investigations into the perspectives and experiences of particular education programs and initiatives of students and teachers, as well as investigations aimed at evaluating programs. There has been a need for more Australian-based research, since

most of the literature has been American. The Australian Senate Committee into the Education of Gifted Children (2001) suggested that a priority could be a study of the ways giftedness has been handled in fields of endeavour outside the traditional academic curriculum.

The study reported in this dissertation is one contribution to the way giftedness has been handled outside the traditional academic curriculum. It was a qualitative study, concerned with the mentoring of gifted children, using desktop videoconferencing. In particular, the learning of students with and through, this technology was studied.

In framing the research focus in terms of what learning takes place with the use of information and communication technologies, a concept was adopted that has been articulated within the symbolic interaction tradition in social theory. Herbert Blumer (1969) first used the term *symbolic interaction* and argued that this theoretical approach is based on three principles:

- Human beings act towards things on the basis of the meanings the things have for them.
- The meaning of such things is derived from, or arises out of social interaction that one has with others.
- Meanings are handled and modified through an interpretive process used by the person in dealing with things encountered.

The selection of this position, as the theoretical approach, has underpinned the present research, and it will be argued that it was important to explore the understandings of participants in the mentoring process. In particular, how they acted towards it, how they acted towards each other, and how their understandings changed throughout the program. It is from an appreciation of these dimensions, that an understanding of the basic social processes, or other processes involved, can be achieved.

The focus of the study and its research question was: What learning takes place when mentoring is conducted through desktop videoconferencing with gifted primary school children? From this fundamental question guiding questions were developed.

1.3 Justification for the Research

One of the great challenges facing educators in the new millennium is to ensure that students are equipped with higher order thinking skills and understandings in order that they may be effective members of a digital society. The new digital society

> requires students to manage complexity, find and use resources and become lifelong learners who can frame problems, design tasks, plan, construct, evaluate outcomes and cooperate in finding innovative solutions. Online delivery of curriculum, whether by access to digital resources or to the provision of full courses will facilitate these requirements? (Kimber, 1999, p.1).

With a call such as this, for schools to be connected to the Internet and use technology in classrooms, it has become even more important to study how children learn and how teachers manage information technology. Universities have been offering teaching degrees in Learning Management rather than Diplomas in Teaching. The recognition by universities that teachers are now learning managers is a significant shift. How teachers manage student learning has involved a number of innovative strategies and mentoring programs may be one of those innovations.

Mentoring programs delivered by videoconferencing have been relatively new to educational research. Limited research has been completed in this area (Adam, 1999; Hedberg, 1996; McGinn, 1998; O'Neill, Wager, & Gomez, 1996; Van Horn, 1996).

Much of the success of mentorships has been due to the benefits that both the mentor and the mentee derive from the relationship (Wright & Borland, 1992). Benefits for the mentee have included a high-level of learning experiences, career development, an enhanced potential, an increase in interpersonal skills and confidence and connection to the larger world (Clasen & Clasen, 1997). For the mentor, there has been the satisfaction of passing a tradition on to a new generation. For the community there is the collaboration of schools (private and public), universities, community leaders, business and experts in the wider community working together on behalf of the future generation and in so doing, forging a bond between school and the community. "Success in learning is as much contingent upon how one learns as it is on what one learns" (Bowring-Carr & West-Burnham, 1997, p. 97). It is important, therefore, to the field of information and communication technology that further research is carried out concerning the way in which students learn technology, and how students learn using that technology.

Telementoring has been an online mentoring opportunity that can be part of a flexible delivery of programs for gifted children. It has involved e-mail and/or videoconferencing. This technology can be exciting and motivational and offers enormous potential for gifted students. Telementoring can be an innovative teaching strategy that enhances learning for all those who are involved in the process. Some educators believe that telementoring has been a promising technique for furthering education reforms, such

as project-based teaching (O'Neill et al., 1996). Other applications for schools have included curriculum enrichment programs, virtual field trips, networking with students from other cultures and staff development (Chute, Thompson, & Hancock, 1999).

1.4 Research Process

Emergent research design was used in this study (Weirsma, 1995). The emergent design enabled the researcher to understand the unfolding dynamics of the engagement of the participants, to incorporate the new emerging understandings of the mentoring process, and therefore enhance the credibility of the findings. This research design enabled the incorporation of many qualitative research methods, which are used to enhance the understanding of the central processes in which mentors and gifted children engaged. These methods gave a depth of understanding and uncovered patterns of responses by gifted children. Qualitative methods provided a way of knowing where to go, how to get there and when the task was complete (Lundsteen, 1987).

Since this qualitative research was mostly carried out in a natural setting, the researcher did not manipulate or intervene (except by being present) in the situation. The research design, therefore, required flexibility and a tolerance for adjusting the research as it progressed. Smith and Glass (1987) refer to this as a working design, similar to what Lincoln and Guba (1985) and McMillan and Schumaker (1984) call an emergent design.

Although the working design ran throughout the whole study, the components were separated. According to Lincoln and Guba (1985), the purpose of a qualitative study is to accumulate sufficient knowledge so as to lead to understanding. They recommend the use of emergent research design, whereby the data collection and data analysis are simultaneous and ongoing which allows for important understandings to be discovered along the way. In the emergent design, not all the specifics were outlined in advance. A theory did develop as the research was being conducted and the research design was changed, altered and refined as the research progressed. The developing theory was a result of the research data and is termed grounded theory because the theory was grounded in the data rather than on an idea, notion, or system. If no theory had developed then the research would be termed a-theoretical and retained for its descriptive value (Weirsma, 1995).

The procedure proposed by Weirsma (1995) has formed the foundation of the qualitative design for this research. Six primary school students were selected from a

composite class that catered for academically gifted children at Peace Community School (pseudonym). This composite class comprised students from Grades 3 and 4 only.

The method, known as the constant comparative method, shown in Figure 1.1, was used to analyse the data (Maykut & Morehouse, 1994). This was a non-mathematical procedure designed to identify themes and patterns in qualitative data. The research findings of this type of analysis can be presented in the form of propositions that summarise the salient themes and patterns within and across individual lives (Lincoln & Guba, 1985).

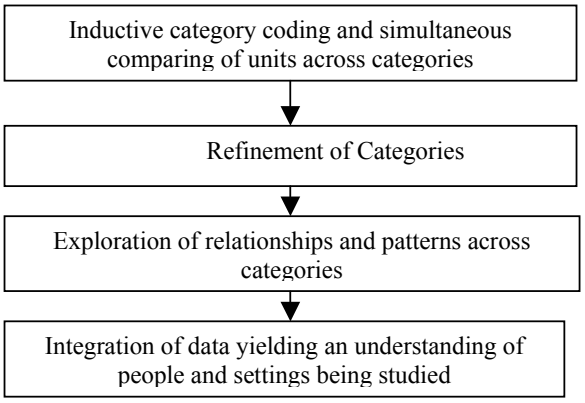

Figure 1.1: Constant comparative method of data analysis

The research findings are found in chapter 4 of this report. They are subsequently presented in the form of propositions that summarise the salient themes and patterns in chapter 5.

1.5 Delimitations of Scope and Key Assumptions

This case study focused on circumstantial uniqueness, as it pertained to one comprehensive K-12 School. Any generalisations should be reader-made inferences. The reader should decide as to what extent this case is similar to and likely to be instructive to their own experience or that of others. This case study aimed at enabling the use of reported material to increase understanding by way of naturalistic generalisations undertaken by the reader. The aim of the case study was to facilitate the reader's own analysis more than deliver statements of generalisation (Burns, 1998).

The key assumptions within this research were:

- Technology will continue to evolve and be an essential element in society.

- Providing teachers with the characteristics of desktop videoconferencing sessions will support their understanding of how students learn with and through information technology.
- Providing critical support strategies for desktop videoconferencing will assist educational leaders in planning for the implementation of technology in learning.
- Learning is socially constructed.
- People interpret (give meaning) to that which they encounter.
- Critical interpretation may increase understanding.
- The researcher is able to achieve empathetic understandings and represent feelings, motives and thoughts behind the actions of the participants in the study.

1.6 Overview of the Research

The following locates the subsequent chapters as they have contributed to the dissertation. The end of each chapter draws together the key ideas and themes with a section called Notes.

Chapter 1 is a description of the problem, purpose, significance, limitations and term definitions of this study.

Chapter 2 is a delineation of the central historical tenets for theorizing learning and defining gifted, from the perspectives of technology and its impact on the changing nature of education in the twenty first century. Within this framework of understanding, the chapter reviews the research and literature pertaining to the concept of gifted, mentoring, educational technology, instructional methodology and technologies for communication. Central to this discussion is an exploration of how learning and information communication technologies can be understood, shaped and regulated within the context of mentoring gifted primary school students.

Chapter 3 is a description of the research process, including the study's theoretical and methodological underpinnings and the procedural aspects of data collection and analysis. The procedural aspects of the research process are described, including information about the site and the participants. The data collection techniques are explained, including the specificities and procedures of interview and observation.

Chapter 4 is a presentation of the data and a description of the nine processes that emerged and allowed for the discovery of new understandings and conceptualisations

related to interactive desktop videoconferencing. These processes were a result of analysing the mentoring sessions of the six cohorts and interviews from the participants at the end of the data collection period. These processes were: clarifying, analysing, checking information, higher order thinking, making judgements, constructing knowledge, respecting, befriending and playfulness.

Chapter 5 reports on my examination of the research findings. Central to this examination is a set of propositions offered as a possible new way of learning through technology. An emergent theory is constructed to assist in the analysis. Through interaction with the research literature, the chapter draws together the study's principal contentions in understanding the diversity of learning through desktop videoconferencing (DVC). Learning seemed ubiquitous. Learning, using computer-driven media such as DVC, can lead to new processes in learning. Chapter 5 concludes by amplifying what this means for educators and those in leadership and makes recommendations for further research.

Chapter 6 contains references to the literature, further considerations and the researcher's conclusions.

Chapter 2 – Literature Review

2 Introduction

Chapter 2 is a review of the research literature pertaining to the concepts of gifted, mentoring, educational technology, instructional methodology and technologies for communication. This chapter describes the central historical views for theorising learning and defining gifted from the perspectives of technology and their impact on the changing nature of education. The discussion is centred on an exploration of how learning and information communication technologies have been understood, shaped and regulated within the context of mentoring gifted primary school students.

2.1 Gifted Primary School Children

Descriptions of giftedness vary from one culture to another. Gifted abilities are more likely to emerge when the individual's talents coincide with what is valued by the culture. Giftedness in cultures with no formal schooling will involve a different measure to those cultures that value formal schooling. Sousa (2003) contends, "giftedness is what people in society perceive to he higher or lower on some culturally embedded scale" (p.33).

Subsequently, gifted children are found in all socio-economic and cultural groups. These children have many special needs. For many, however, these needs are not being met, resulting in underachievement, frustration and psychological distress (Gross, 2001). Even the term, *gifted*, can cause distress due to the confusion surrounding it; confusion that often occurred because the word had become value-laden. Gifted can imply a false dichotomy with not gifted when, in fact, the individual variations of intellectual ability are in a continuum. The problem becomes more serious when a culture regards intelligence as a positive thing, closely associated with wisdom or high intellect. This can result in unwanted connotations of moral superiority for the gifted and inferiority for those not so gifted (Senate Employment, Workplace Relations, Small Business and Education Reference Committee, 2001). The problem of defining giftedness will be further pursued in the next section.

2.1.1. Problem of Defining Gifted Children

The concept of giftedness has changed with advances in psychological thought and educational ideology, resulting in a wide variety of definitions (Braggett, 1985). As early as 1926, Terman (1926) cited giftedness as the top 1% measure on a Stanford-Binet intelligence scale. The emphasis on superior intelligence continued to be the only attribute to giftedness until the United States Office of Education recognised the complexity of giftedness (Marland, 1972). The Marland Report (1972), *Education of the Gifted and Talented: Report to the Congress of the United States by the U.S. Commissioner of Education,* went beyond an intellectual measure and broadened the definition of giftedness to include potential or demonstrated achievement in five specific areas of endeavour, singly or in combination: creative or productive thinking, leadership ability, visual and performing arts, psychomotor and specific academic endeavour. The Marland Report included in the definition a minimum of 3% to 5% of the school population. Renzulli (1978) revisited the definition of giftedness and proposed that it should be based on a triad model that involved the interaction of three human traits: creativity, task commitment and above average general ability. His definition included up to 25% of the general population.

More recently, Gardner (1983) in his definition of giftedness promoted the concept of multiple intelligences. Gardner posited that there were seven intelligences including linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal and intrapersonal. His multiple-intelligence theory helped raise awareness that intelligence is more than a single construct. Tannenbaum (1983) also stated that there were multiple factors but he suggested five traits that interwove, namely, superior intellect, distinctive special aptitudes, a supportive array of non-intellective, challenging and facilitative environment and a smile of good fortune at the critical periods in life. Furthermore, the importance of the environment was strongly emphasised by Clark (1997) when she defined giftedness in terms of being able emerge from stimulating, environmental challenges in a manner that evinced innate capacities and processes.

Most educators and psychologists have agreed that a single numerical intelligence quotient is too narrow a description, as giftedness is much more complex. Hagen (1980) suggested:

> There is no universally accepted definition of giftedness nor is there complete agreement on the indicators of giftedness in any area. However, these should not be viewed as insurmountable barriers to anyone who thinks that potentially gifted

> individuals should be identified and that special educational interventions should be planned for those identified. (p. 4)

The single construct approach of former years had now been replaced with a different model, one that emphasised a broader range of gifts and talents and accommodated the input of the child's environment as well as the significant others within that environment.

The concept of gifted can be best understood as having significantly high ability relative to the peer group (Senate Employment, Workplace Relations, Small Business and Education Reference Committee, 2001, p. 34). The focus should be on needs and that giftedness in any field of endeavour should be accepted, valued and supported. The focus should be on what needs require what intervention.

The needs of gifted learners have been identified as the impetus that should drive educational intervention. A review of the characteristics of gifted learners can assist educators when designing educational programs. The next section focuses on the characteristics of gifted children.

2.1.2 Characteristics of Gifted Children

> In order for a child to become truly gifted, five factors have to interweave most elegantly: (1) Superior general intellect, (2) Distinctive special aptitudes, (3) A supportive array of non-intellective traits, (4) A challenging and facilitative environment and (5) the smile of good fortune at crucial periods of life. (Tannenbaum, 1991, p. 29)

A review of the characteristics of gifted children must begin with Terman's study of high intelligence children who were identified in the 1920s and traced and studied into the 1990s. Terman (1954), in his study of 1,528 high IQ children, cited findings of these students being better adjusted psychologically and socially than the average person. Success, he said, "was associated with well-balanced temperament and with freedom from excessive frustration" (Terman, 1954, p. 227). While high IQ was common to all his subjects, one important difference was adult productivity. During childhood, the most productive adults had been rated by parents and teachers, as higher in self-confidence, leadership, sensitivity to approval, perseverance, desire to excel and a exhibited a greater force of character than did their peer group. As a caution, Terman's study had a serious bias in his selection of students. These students were identified from a larger group of

students who were nominated by their teachers as gifted. The teachers would probably, in those times, have chosen students who were well behaved, high achievers, neat, popular and well spoken. He may not have included those who were inarticulate but creatively gifted, who were bright under-achievers, or who were intelligent but rebellious. Terman's list of characteristics of gifted learners was based on his experiences and his research during the 1950s.

Similarly, from their experiences and research into giftedness and temperament, Jones (1992) and Welte (1996) listed general traits that characterised gifted children as a group although the definition of gifted in the 21st century has a broader focus.

The traits listed were significantly different from those of Terman (1926) and included:

- A curiosity and desire to learn are the greatest allies in initially motivating and promoting sustained involvement in a wide variety of advanced studies.
- A long attention span and need to delve deeply into a subject suggest that class periods and duration of units should be of sufficient length such that satisfaction is felt at their culmination.
- A resistance to routine and drill indicates that creative strategies and fewer lessons with fewer application problems should be devoted to the mastery of such mundane but significant topics as multiplication facts or states and capitals.
- A desire to question, express ideas and receive a reaction should not be perceived as being motivated by argumentation, nor should lively and intense discussions where the adult is often not seen as the sole authority.
- An interest in exploring topics beyond the chronological age and maturity level results in the challenge of locating resources at an appropriate reading and comprehension level, as well as the need to provide time for guided independent study. Adherence to regular grade level requirements and materials is inappropriate and access to more advanced materials must be encouraged.
- An intense sensitivity to fair play, honour and truth makes it necessary to carefully think out actions and intentions so that a relationship of trust is maintained. Fostering the development of heroes and the pursuit of justice

should be balanced with the development of an understanding that neither life nor other individuals should be expected to be always fair or honest.

- An advanced sense of humour in employing this strategy in relationships with even young gifted students recognising, however, that this may also cause distractions in being used as a means of seeking attention.
- A need to interact with mental peers leads to relationships with age-peers through gifted programs, older-aged friends, teachers and other adults and often necessitates an arbitrary grouping in the school setting.
- A high level of verbal ability and language development may be evidenced in discussions between individuals, as well as with small and large groups but should not be misinterpreted as arrogance.
- To possess areas of great ability enables outstanding accomplishments and intense interests along with some of lesser strength, which can result in avoidance, frustration, or the need for appropriate reinforcement in learning the concepts.
- To disregard the need for social and physical development or exercise in favour of intellectual pursuits can result in health problems, obesity, or social difficulties if not adequately addressed in the educational program.
- To process ideas very rapidly, almost without being aware of the steps involved, can cause difficulty if demands are made for every step to be demonstrated in all cases; for example, in a number strand of mathematics.
- An ability to think at advanced levels of complexity dictates that the curriculum at those levels must include activities and discussions of cause-effect, alike-different and cross-curricular relationships that promote a fabric of integrated learning.
- Self-orientated perfectionism (Neumeister, 2002; Dixon, Lapsley & Hanchon, 2004)

This nearly perfect list of characteristics presents a rather one-sided picture of the gifted student. However, teachers and parents have noted some habits and dispositions that could be described as negative traits. These negative traits can cause personal or social adjustment problems as is evident in the list compiled by Torrance (1962, 1981, 1986) and Smith (1966):

- Indifference to common conventions and courtesies.

- Stubbornness and resistance to domination.
- Arguments that the rest of the parade is out of step.
- Non-participation in class activities.
- Uncooperativeness.
- Capriciousness and cynicism.
- Low interest in detail.
- Sloppiness and disorganization with unimportant matters.
- Tendency to question laws, rules, authority in general.
- Egocentrism.
- Temperamental and demanding.
- Emotional and withdrawn.
- Overactive physically or mentally.
- Forgetfulness, absentmindedness, mind wanders.
- Sometimes uncommunicative and watches windows.
- Will not join scouts.

As a general rule, gifted students have been reported as well or better adjusted than regular students and have better self-concepts (Chapman & McAlpine, 1988; Feldhusen, 1987). Marsh (1986) proposed that academic self-concept results from internal processes (comparing one's achievement in other areas) and external processes (comparing one's academic performance to that of peers). More recently, Gottfried and Gottfried (2004) have proposed that motivation is an area of giftedness in and of itself.

Conversely, research on self-concepts of gifted children has produced contradictory results; complicated by age differences, gender differences and the level of giftedness. Which self is the researcher looking at the academic self or the social self? Kelly and Colangelo (1984) found that gifted adolescent boys had better overall self-concepts that non-gifted boys, but there were no differences in self-concepts between gifted and non-gifted adolescent girls. In high school, however, girls may experience conflict over their role as a gifted, aggressive achiever versus an emerging identity as a woman and their self-concept suffers (Loeb & Jay, 1987; Rodenstein, Pfleger, & Colangelo, 1977). Self-concept and emotional stability has been an area where gifted adolescents have a greater struggle with than their non-gifted peers (Silverman, 1997).

Similarly, researchers Loeb and Jay (1987) reported self-esteem difficulties with gifted boys. Loeb and Jay found that the intellectual orientation of gifted boys was

disturbingly inconsistent with their ideal, male image of aggressiveness, self-reliance and individualism, leading naturally to a lowered self-esteem. They also reported that there seemed to be a reversal of attitudes in the high school where a masculine style of achievement is supported.

Further research in the affective domain has supported one problem peculiar to extremely bright students and that has been their emotional excitability and high sensitivity. Their emotional reactions were more intensely joyful, but more fearful and depressed. They develop steadfast values, with strong concerns for right and wrong (Piechowski, 1991). This trait was strongly linked to emotional stability and has ramifications for sustaining friendships. Researcher such as Erickson (1963), Fromm (1957) and Sullivan (1953) have noted that the gifted population, as a group, have a strong need for companionship, stimulation, affection, intimacy and social comparison. The emotional health of all students can be strongly affected by the friendships that they develop. In particular, gifted students do not always seem to make friends easily. Gross (2001), in her investigation of issues pertaining to friendships in students of primary school age, found that gifted students preferred older friends and that gender differences in friendships were most acute for students in Grade 3, if they only have access to age-peers. Gross' study further validated the study of Hollingworth (1942), who reported that difficulties in friendships were particularly acute for those students who were exceptionally gifted.

Researchers who have investigated the work habits of gifted learners have cited motivation and persistence as two common characteristics for this population (Davis & Rimm, 1994). In classroom settings gifted learners reportedly have stronger intrinsic motivational orientations to that of non gifted peers (Skollingsberg, 2003). This is further supported by Albert (1975) who stressed that a crucial trait of the geniuses he studied was the compulsion to be productive and the ability to work hard. Even with nursery school to second grade children, Burke (1980) found that persistence was both related to achievement and personal adjustment. In particular, the high motivation and curiosity of gifted students can lead to advanced interests (Davis & Rimm, 1994). Similarly, motivation and persistence has been reported as one of the most single recurrent traits of productive gifted students and eminent adults (Bryant, 1989; Dunn & Griggs, 1985; Franks & Dolan, 1982; Renzulli & Reis, 1991; Walberg & Herbig, 1991). In view of the high motivation, persistence, self-confidence, independence and high internal control of many

gifted students it may not be surprising to discover that their learning styles matched these characteristics.

2.1.3 Learning Styles of Gifted Children

Preferred learning styles have usually matched the characteristics of gifted students. Many researchers have concluded, that compared with non-gifted students, gifted students tend to be more independent self-motivated learners than teacher motivated. It has also been reported that gifted learners need and enjoy learning tasks that are unstructured and flexible, rather than the highly structured tasks needed by less able students. In addition gifted learners have preferred and active participant approaches to learning, rather than spectator approaches and they seem to learn through varied sensory channels, including auditory, visual, tactile and kinaesthetic. Gifted students also display a stronger preference for an imaginative learning style (Oakland, Joyce, Horton & Glutting, 2000). Further, they are more responsible, prefer a quiet learning environment and to learn alone or with true peers (ability similar), rather than with regular students (Dunn, Bruno, & Gardiner, 1984; Dunn & Dunn 1987; Dunn & Griggs, 1985).

Rica (1984) compared learning styles of gifted and regular upper-elementary students, using Dunn and Grigg's (1985) *Learning Styles Inventory* and Renzulli and Smith's (1978) *Learning Styles Inventory* and found that both groups of students had games as their preferred learning activity and, as the last choice, drill and recitation - as one would expect. Between these extremes, the gifted preferred independent study more than regular students, while the regular students preferred peer teaching and lecture more than the gifted. Furthermore, Rica added that preferences for flexibility and independence reflect the strong needs of gifted students to be presented with opportunities for self-selection of learning experiences.

Dunn and Griggs (1985) made two important points. First, within the gifted group there were large individual differences in preferred learning conditions and activities and educators should be aware of each student's preferred style. Second, there were significant improvements in academic achievement, school attitudes and behaviour when student's learning styles preferences were accommodated.

Welte (1996) argued that educators should incorporate psychological-type theory into their thinking so as to facilitate the preferred methods of learning, as well as exercise the modes the gifted students would rather avoid. The personality types developed by Myers and Myers (1980) have been useful in gaining insight into emerging personalities of

the child. Furthermore, information about the four major temperaments and qualities of gifted students can assist in curriculum planning.

According to Davis and Rimm (1994), teachers of the gifted should possess certain personal and teaching characteristics such as the ability to develop flexible programs and a respect for the individuality, creativity and innovativeness of those deemed gifted.

2.1.4 Characteristics of Teachers of the Gifted

One danger inherent in the promulgation of lists of desirable traits of teachers of the gifted has been the possible effect of these lists on prospective teachers. As Gallagher (1985) observed, they "can have a rather paralysing effect" on teachers and "can give the impression that no human being can live up to such a list of characteristics" (p.383). A major study concluded that successful teachers of the gifted could be characterised as:

- Highly intelligent.
- Cultural and intellectual interests.
- Mature and experienced.
- Striving for high achievement.
- Able to see things from the students' points of view.
- Well organised, orderly and systematic.
- Open to student opinions.
- Enthusiastic, stimulating and imaginative (Bishop, 1968).

Maker (1992) agreed with the above traits and added:

- Flexibility or openness to change.
- Sees the need to develop student's self concepts.

This was further expanded by Hultgren and Sealy (1982), who added a good sense of humour and broad general knowledge to the list. Whitlock and DuCette (1989) confirmed the above characteristics in their study of the ideal teacher for gifted students.

There is, however, one particular trait that has been mentioned on nearly every list: the teacher's own level of intellectual ability. This issue of high intelligence was cited by Ward (1961), who believed that teachers of the gifted should have the same intellectual qualities as those common to the gifted group. Newland (1976) agreed stating that the intellectual capabilities of the teachers should be the same as their pupils. Bishop (1968) study found that the most successful teachers of the gifted had intelligence scores significantly higher than the mean for teachers not identified as successful.

This need of high intellectual ability was also reported by Borland (1989), who stated that teachers of the gifted need to possess very high intellectual ability and has qualified this by adding that this quality alone will not ensure success. Borland cites behavioural features of effective teachers of the gifted as:

- Considerable amount of general intelligence.
- Strong educational background.
- A demonstrated hunger for learning.
- Capable of frequently saying, "I don't know".
- A solid sense of personal security.
- Tolerance of diversity, originality and off-beat responses to questions and assignments.
- Well organised and well structured in teaching.
- Effective counselling skills.
- Diplomacy, public relations and public speaking skills.
- Tough-mindedness and resistance to manipulation.
- Not afraid to teach.

Borland (1989) also added that there was no single profile of the effective teacher of the gifted but, rather, we should focus on the competencies. Competencies, such as the ability to think critically, were cited by Nelson and Prindle (1992) who surveyed teachers and administrators concerning the basic competencies needed by teachers of the gifted. They found that the promotion of thinking skills and the development of creative problem solving were two of the six basic competencies for teachers of the gifted. Silverman (1982), who studied experienced or master teachers, found that master teachers were able to induce more and higher level thinking among students and Starko and Schack (1989) found that the strongest needs of teachers for the gifted were higher level thinking skills. Other writers, while acknowledging high intelligence as a trait, have cited other traits as of equal importance. Gallagher (1985) believed enthusiasm and the search for new knowledge to be even more important.

Conversely, Clark (1997) asserted that the teacher does not need to be highly intelligent, but possess an understanding of high intelligence, its implications and how to nurture it. This ability to understand and nurture intelligence was also supported by Story (1985), who conducted an extensive observational study of teachers of the gifted, who had

training in the field of gifted education and were regarded as excellent teachers. She found that these teachers:

- Emphasised independent study and self direction.
- Used a multiplicity of resources in teaching.
- Modelled gifted behaviour.
- Stressed higher level thinking skills.
- Were flexible in classroom timetabling and activities.

In summation, teachers of the gifted have qualities that can be partly a function of intelligence, personality and teaching style. Other necessary aspects, as outlined previously, can be self-taught by participating in staff development opportunities, activities of professional organisations and universities supporting the gifted (Welte, 1996). Graduate training in gifted education can identify fundamental competencies that enable teachers to learn and use appropriate skills in teaching the gifted. Universities have designed teacher education programs to prepare all teachers in the basics of working with the gifted, and also offer postgraduate training and certificate courses for teachers to work with the gifted in special classes. The challenge, then, for the teacher of the gifted has been to find the appropriate curriculum for these gifted students, given their learning styles, personalities and other compulsory governmental directives in the area of educational competencies and outcomes.

2.1.5 Educating Gifted Children

The current trend emerging in Australian schools has been to have an eclectic approach to the education of gifted and talented students. Given that schools have a responsibility to provide appropriate programs that will enable all students to reach their potential, the needs of the gifted student must be addressed. Schools will vary in their philosophies and beliefs regarding the most appropriate education for gifted students. A school's total provision, however, should be broad enough to provide a range of options to cater for the diverse needs of students whilst taking into account the school organisation, structure, teaching staff, resources and school culture (Braggett, 1994).

Most schools have opted for either acceleration or enrichment/extension programs for their gifted and talented children. Acceleration has permitted students to learn material at a faster rate with a curriculum commensurate with the student's mental age. Enrichment/extension has allowed the student to have an intense involvement with ideas,

total absorption in tasks and commitments, a desire to be creative, imaginative and to enjoy activities within and beyond the classroom (Davis & Rimm, 1994). In the Australian state of Victoria, the Department of Education suggested that its schools might offer both options to cater for the individual needs of gifted students. Each option has its advantages and disadvantages, but when offered as alternatives, takes into consideration the diverse needs of the population. The range of school-based program options included acceleration, classroom enrichment/extension provisions, withdrawal programs within school hours and enrichment/extension classes out of school hours (Department of Education, 1996).

There have been many varied and diverse strategies employed by teachers to extend or enrich gifted and talented students in the classroom. Compacting the curriculum has allowed students to work at a faster rate based on condensing the required scope of work. Independent study has permitted students to work when they want on a negotiated area of set work. Self-paced learning has enabled students to work when they want on a negotiated area of set work and to progress through units of work that are usually criteria-based with pre- and post tests, at their own rate. In independent research, students have explored an interest area and been encouraged to proceed in an open-ended manner to produce a research project. Learning centres in classrooms have been set up containing stimulating materials and open-ended questions that have enhanced research over a range of topics. Individual instruction has provided a student with individual tutelage in a particular area. Using secondary and tertiary students as tutors has been another option for individualising instruction (Davis & Rimm, 1994). One option available to schools has been to set up a mentoring program as a vehicle to assist in the education of gifted and talented students, to provide appropriate opportunities for them to reach their potential and enhance specific talents.

The choice of curriculum should be appropriate. Appropriateness has been identified as one of the foremost aims in any program catering for gifted and talented students and can be achieved by addressing the specific nature of each child's talents. The characteristics that have made students exceptional (and thus created a need for the form of special education called the education of the gifted) also provided the basis for the differentiation of their curriculum. The students were characterised by unusually high intellectual capacity and interest and needed an appropriate and true curriculum (Borland, 1989). True curriculum has been referenced to what it was intended that students learn, not what it was intended that they do (Johnson, 1977).

A true, valid curriculum according to Borland (1989) would have the following requirements:

- A consensus with respect to what students would learn that they would not learn in the mainstream. Tannenbaum (1983) discussed this as an expansion of basic skills and knowledge that goes beyond the common core curriculum.
- A scope and sequence that provided a meaningful organisation for the knowledge and serve as a basis for designing instruction. Bloom's (1956) famous monograph that outlined his well-known taxonomy of the cognitive domain is one such framework. Bloom's structure was plausible because of this hierarchical sequence of each category. Bloom's six categories (knowledge, comprehension, application, analysis, synthesis and evaluation) represented just one level of the taxonomy.
- A knowledge category divided into three sub-categories and each of these would have finer divisions. These would be arranged hierarchically within the knowledge realm and together they would outline the epistemological structure, ranging from knowledge of terminology to knowledge of theories and structures, that would serve as a framework for sequencing a body of content within a discipline field.
- A planned articulation with a core curriculum. As Tannenbaum (1983) explained with the expansion of skills, it was part of the common core, which would be prescribed for all students.
- A focus on thinking skills. The development of thinking skills would have a framework of scope and sequence as suggested by Bloom (1956). Thinking skills would be part of the core curriculum with the expansion of those skills for gifted students. The expansion of knowledge would then allow gifted students to comprehend fully that to which their knowledge should be applied; to be able to analyse their knowledge; to synthesise new information from elements they have learned; and to think critically and evaluate what they know and have learned (Borland, 1989). The development of thinking skills then would be seen as a process, not an end (Renzulli, 1978). Opportunities would also be given to allow gifted students to think creatively and solve problems effectively, even elegantly, within the realms of the core curriculum.

- Appropriate meaningful content. It seemed important and the responsibility of educators, to make choices that affect what gifted students know and as Sawyer (1998) argues, "that every choice of curriculum … is essentially a moral choice" (p. 32). The choice of curricular content has been a decision to commit time and intellect to certain ideas. The moral nature of this choice has been acutely obvious to the best teachers of the gifted.
- Opportunities for independent study. Independent study has been an optional curriculum component, but only as a means to a higher end. What gave the independent study some of its motivational force was the fact that students could be involved in the exploration of their own interests. The value of independent study was that as an instructional strategy, it suited some gifted learners (Borland, 1989).
- Provisions for acceleration. The research on acceleration has been so uniformly positive that it is difficult to see how an educator could oppose it (Pollins, 1983; Stanley, 1981). The resistance to acceleration, according to Elkind (1981), has been that adult desires, not children's developmental needs, have driven the curriculum. This has resulted in miseducation and the potential for real harm to the child.
- Provisions for enrichment, learning and teaching. This was based on an inductive approach to the pursuit of real-world problems rather than on traditional, didactic modes of teaching. The purpose was to design learning environments that place a premium on the development of higher order thinking skills and the authentic application of these skills in creative and productive situations. The theory underlying this approach was based on constructivist theorists, such as Jean Piaget and on applications of constructivist theory to classroom practice. Enrichment clusters, non graded groups of students who share common interests and who come together during specially designed time blocks to pursue these interests, were excellent vehicles for promoting co-operativeness within the context of real-world problem solving (Renzulli & Reis, 1991). Studies in the effectiveness of school enrichment programs, conducted by Delisle (1981) and Olenchak (1991), have concluded that students in these programs have improved attitudes towards learning and improved self concept in high-ability students with learning abilities.

- Provisions for play. The importance of play as an aid to socialization has been well documented. The play interests of the gifted generally have centred on intellectual skills where the ideas and strategies are matched in competition (Hollingworth, 1926; Terman, 1926; Witty & Lehman, 1927). A significant number of intellectually gifted children created imaginary playmates or imaginary companions in an attempt to satisfy their need for companionship or social interaction at their own level and within their own interests (Hollingworth, 1926; Terman, 1926). Gifted children need companionship with peers or adults who are intellectually similar to themselves. Gross (2001) studied the friendship groups of children from Year 3 through to Year 7 and found that highly gifted children were more likely than other groups to say that they preferred to play alone and that their friends were older. In Years 3 and 4, gifted children had the concept of friendships, which characterised the average ability of children at least 2 years older.
- Appropriate provision for affective learning.

Definitions of giftedness have tended to stress the intellectual, academic, artistic and motivational characteristics of gifted children. This has sometimes resulted in little attention being given to affective considerations.

The affective domain has been one of the three domains determined by Bloom (1956) in his taxonomy of educational objectives (see Appendix L). The objectives in the taxonomy of affective domain, or domain of emotional response, run from least committed to most committed (Krathwohl, Bloom, & Masia, 1964). The five base objectives were receiving, responding, valuing, organising and characterisation by value. Affective learning has been concerned with helping students to better understand themselves and their values, to be more empathetic towards others and generally to acquire high-level values, ethics, achievement needs and humanistic attitudes.

The key to affective learning has been found in the teacher who has internalised humanistic values. Such a teacher has been able to communicate these values to the student, both in direct teaching and by serving as a good role model. Pine and Boy (1977) have listed the characteristics of such a self-actualised humanistic teacher. In summary, Pine and Boy used the following adjectives to describe that teacher: intuitive, risk-taker, learner, exploring, honest, genuine, empathetic, optimistic, self-controlled and energetic.

Ideally, the teachers who would develop the curricula would implement them. The curriculum itself, the specification of learning outcomes for gifted students, should be the product of the thinking of individuals who know the school and its students, who have a stake in the outcome of the special program and who will be responsible for the implementation of the curriculum. Good curricula for the gifted comes from teachers, not business managers (Borland, 1989).

The curriculum for the gifted student has to be defensibly differential and have rigour. Rigour has to do with worthiness of the abilities of the special students for whom it is developed, a challenging, consequential curriculum that "helps young people learn to love their books and learn to love learning" (Sawyer, 1998, p. 14). The curriculum also needs to address current technology literacy goals that are very compatible with many gifted and talented students' learning preferences (Siegle, 2004).

2.1.6 Special Programs for Gifted Children

One important question has been why special programs should exist for gifted learners. The answer, as discussed by Olszewski-Kubilius (1989), is that these programs have provided a level of challenge and a pace of learning that was more suitable to the intellectual capabilities of gifted students and very different from what they regularly encountered in school. There were more opportunities for independent inquiry, in-depth study and accelerated learning. Perhaps one of the most beneficial outcomes of special programs was that gifted children were more likely to foster friendships. This was because the classes were based on common interests and priorities. The friendships also provided a social support for educational pursuits and talent development (Grant & Seibert, 1993; Olszewski-Kubilius, 1989).

Cox, Daniel and Boston (1985) critiqued five program formats that, in their opinion, have demonstrated their effectiveness as a model for instructions to gifted learners. They were special schools, education with an international perspective, partnerships between secondary schools and colleges, summer programs and mentor programs.

Special schools for the gifted were characterised by enrolling only gifted students and the admission standards were quite high. In special schools, teachers of the gifted were responsible for instructions in the basic subject areas. A certain degree of covert or

overt acceleration was typical and enrichment was usually built into the core curriculum (Borland, 1989).

Education with an international perspective, such as the International Baccalaureate (IB) programs, has provided excellent opportunities for students to go beyond the regular high school requirements (Cox & Daniel, 1991). Academically, IB programs have drawn students from the 90th percentile and above. The IB curriculum requires a study of two languages, study of man, experimental sciences, mathematics, study of knowledge, participation in creative activities and a social service component. As a graduation requirement students are required to prepare an extended essay based on independent research. The IB program has clearly been a demanding, yet rewarding one for those students capable of completing it. In particular, the epistemological perspective afforded by the Theory of Knowledge course has, by its very nature, been especially appropriate for gifted students who were most likely to become producers, not merely consumers, of knowledge (Jacobs & Borland, 1986; Tannenbaum, 1983).

Partnerships between secondary schools and colleges have been available to those students who may need additional challenges. In Australia, in particular the state of New South Wales, the Board of Study has offered distinction courses for senior high school students who have completed their schooling one year early. Distinction courses have been developed as part of the Board of Studies' strategy to encourage excellence and to provide additional academic opportunities for gifted and talented students.

The attraction of these accelerated courses for gifted students has been the opportunity to study and socialise with like minded talented students and to experience study during residential schools in a university environment where advanced material was presented by university lecturers (Cummins, 1996).

Studies specifically conducted with children enrolled in holiday or Saturday programs showed varied results. Kolloff and Moore (1989) measured the self-concepts of fifth through to tenth graders attending three different 2 week summer residential programs. Their results indicated that self-concepts had improved, but suggested that this may have been the result of a more appropriate academic setting and greater peer acceptance. Van Tassel-Baska and Kulieke (1987) found an increase in seventh through ninth-grade students enrolled in a summer holiday program. Though these results were not replicated in a second semester. Cooley, Cornell and Lee (1991) reported that African American students who attended a predominantly White university summer school recorded improvements in self concepts and academic self esteem. Research results on

holiday or Saturday programs have been mixed and one could conclude that it all depends on the relationship between the student and the teacher.

Mentorships have placed students with well developed interests and high motivation in settings under the tutelage of established professionals with similar backgrounds in the fields of interest to the students. By their nature, mentorships and internships have been both promising and tricky. At their best, they have provided the sort of advanced, hands-on experiences that gifted students need but cannot readily find in the schools. At their worst, they have been unstructured extra curricular activities with little educational rationale (Borland, 1989). As it was a major focus in this research, mentoring has been further developed in the next section.

2.2 Mentoring

Mentoring is not a new concept. In Greek mythology (Homer's *Odyssey*), the character Mentor acted as a guide and counsellor to Odyssey's son, Telemachus. The word mentor today has been synonymous with instructor, guide, teacher, adviser and counsellor (Reilly, 1992). What has been of interest to the educator is that mentoring can often be a successful means of meeting the specific needs of students with gifts and talents whose skills and ability levels are beyond the scope of usual school resources. There have been some educators have believed that mentoring should be undertaken on a national level, so as not to squander the talent of a nation (Clasen & Clasen, 1997). This concept was highlighted within the context of educational reform in the U.S. Department of Education with the publication of the 1993 national report on the status of gifted education, *National Excellence: A Case for Developing America's Talent*. In this report American educators were reminded that there is a high cost to the nation if student talents were neglected as they constitute a loss of precious resources.

The benefits of mentoring can be far reaching yet the true value of mentoring can only be demonstrated in the long term. The challenge has been to determine if this can be a viable strategy, which all schools might embrace to enhance the education of students who are gifted and talented. What has happened to students during the mentoring process and how and what they learned can be of immense interest to educators as they contemplate the nature of teaching and learning in these changing and technological times.

2.2.1 The Concept of Mentoring

Definitions of mentoring have varied depending upon the workplace. Mentoring programs or mentorships can be found in many institutions, businesses and schools. Mentoring has been seen as a means of helping to develop an individual's cognitive and psycho-social potential, particularly the ability to function more effectively in society (Reilly, 1992).

In education, Clasen and Clasen (1997) defined mentoring as a process whereby someone has assisted the gifted student in his or her intellectual, affective, social and career development in a specific area. The role of mentor involved being a teacher, expert, guide, adviser, friend and role model. Reilly (1992) contended that mentoring was a supportive relationship between a child and an older more experienced person who offered to support, guide and assist the young person during a difficult period. During the mentoring, the mentee identified with, or formed a strong interpersonal attachment to their mentor and eventually was able to do for themselves what the mentor had set out to do for them. Haeger and Feldhusen (1991) described mentoring as an educational process in which students were teamed, usually one to one, with an older person who had some talent, knowledge, or expertise to share. Mentors differed from tutors in that tutors do not have the same level of commitment to the relationship, do not negotiate the breadth or depth of the program and do not have the time available to devote to the youngster. Most mentors gave voluntarily of their time, whereas tutors were paid by the hour. The role of the mentor was to help youngsters in a positive and productive way. Clasen and Clasen (1997) in their support for mentoring stated:

> Mentoring can be a powerful experience and frequently has a long-lasting impact on both partners in the relationship. It requires commitment, hard work and negotiation. In return it offers sharing mutual interests, confronting appropriate challenges and developing a keener understanding of life possibilities (p. 228).

2.2.2 Mentoring Programs or Mentorships

Increasingly, mentorships have been recommended as a means of helping students to realise their potential. Mentorship programs have involved mentees from as young as six, as noted by Haeger and Feldhusen (1991) in the Purdue University program. Students from any socio-economic environment can benefit from an appropriate mentoring relationship. Mentorships can provide support, encouragement and opportunities to a

greater degree than what may normally be possible at the school level. Mentoring relationships may have a positive impact on the attitudinal and self-concept factors of the mentee before a student's orientation toward education, achievement and success becomes limited (Clasen & Clasen, 1997).

According to Maker (1992), the educational experiences promoted for highly able children should be qualitatively different from those provided for other children and take into account student interests, preferred learning styles and motivational characteristics. Whilst most of a child's learning needs can be met in the regular classroom, the provision of individual opportunities to meet with others of similar interest and skills to work on challenging and meaningful projects were sometimes beyond the realm of the classroom teacher. One viable solution was to establish a mentor program that could provide high level, individualised, enriching experiences for students (Frampton, 1989).

Mentoring or mentoring programs have been just one of the many options open to schools as a service delivery to gifted and talented students in enabling them to reach their potential. Gagne (1992) recommended mentoring as a catalyst for the development of talent. He saw the combination of enthusiasm and receptivity in a relationship as a means of actualising potential.

Mentorships can be spontaneous, in that they happen naturally in the learning environment or they can be structured, usually organised by a third party (Clasen & Clasen, 1997). Regardless of how they develop mentorships have always involved a high level of commitment by both the mentor and mentee. The benefits of mentorships have included meeting specific needs, career exploration and development, potential development, psychosocial advancement, connections with the larger world, shared rewards, community and school collaboration (Clasen & Clasen, 1997).

Frampton (1989) described the beneficial nature of mentor-student relationship as a shared exchange built firmly on a student's interests and strengths with mutually satisfactory outcomes for both the mentor and the student.

Research demonstrates clearly that mentoring has been a very useful strategy for developing the potential of gifted and talented students. Mentor programs have the potential to provide for the special needs of gifted and talented students in ways not possible within the context of the school curriculum. Research studies in the United States will be reviewed first and then consideration will be given to the Australian context. In the United States mentor programs have been an important part of the programs for the gifted. Perhaps the most widely promoted has been the Purdue Mentor Program, Feldhusen and

Huffman (1988) described the program as a university-based mentorship for fourth to twelfth grade students possible within the context of the school curriculum. The purpose was to extend learning opportunities beyond the classroom for gifted youth that have previously performed well in Super Saturday or Super Summer classes. Super Saturday was a program for gifted children in grades K-12 on Saturday mornings at Purdue University. Super Summer was its counterpart that operated weekdays during the summer. The mentorships were intended to extend to these youngsters individualised, personal learning experiences with adult experts in personal interest areas or in career or professional fields. The ultimate goal was to help talented youth understand higher level adult occupations and to stimulate interest in and knowledge of these occupations (Haeger & Feldhusen, 1991).

Wright and Borland (1992) cited another type of mentoring program known as Project Synergy. This involved student-to-student mentorship and has made significant contributions to the lives of both parties in the partnership. It was a research project devised by Columbia University to test ways of identifying potentially gifted students who were economically disadvantaged. The mentees were urban kindergarten children. The project endeavoured to provide services to these children, their parents and their teachers. The aim was to develop the children's potential. The three phases of the mentorship were training, mentoring and evaluation. The project involved gifted adolescents serving as mentors to younger gifted children. During spring 1991, Project Synergy identified twelve potentially gifted kindergarten children from a disadvantaged public school in Harlem. The mentors were drawn from an academic middle school in Manhattan that serves gifted students. The mentors were trained before the program and mentoring in the classroom involved coaching in social skills. The only evaluations possible were informal and tentative, but very positive. Wright and Borland (1992) concluded that adolescent mentors could make contributions that are unique and quite significant, but they needed guidance, oversight and structure.

Davalos and Haensly (1997) investigated a year long independent study/mentorship research course for gifted high school students. Each student was paired with a community member who guided the research course. A gifted and talented teacher also mentored each student. The students were asked to make a public professional presentation of their research to colleagues, mentors, teachers, school personnel, parents and friends at the end of the program. A survey questionnaire was devised to determine the academic and personal implications of the program. Of the 354 students in the program, 90 responded to

the survey. Students were asked to consider the most significant aspect of the course for them. The study showed that 47% identified improvements in their self-esteem, 45% identified the personal significance of the mentor, 24% mentioned improvements in organisation, time management and responsibility and 23.5% believed that the program made a significant contribution to their life. In addition to paying tribute to their research mentors, several students identified their (gifted and talented) teacher as being more significant in their growth than their research mentor. The data have shown that this mentoring program resulted in developing the students' potential and was a viable strategy for these gifted and talented students. Davalos and Haensly (1997) concluded that mentoring programs were "a powerful, economically beneficial option for gifted youth, an option that has long lasting effects" (p. 208).

Not all mentorships involved one mentor and one mentee as Ambrose and Allan (1994), in an American study, discovered when describing the experiences of a young artist who had two mentors assisting him throughout his high school education. One mentor worked with him daily; the other mentor lived across the continent. Through interviews and questionnaires, the study investigated the mentors' influence on the young artist, particularly his cognitive and affective development. The results demonstrated that the mentorship validated the young artist's style of thinking, sharpened his metacognitive abilities, helped him develop a general sense of career direction and provided emotional support when it was needed. This triangular mentorship also demonstrated that the mentors gained as much as the mentees in that they all had their metacognitive abilities sharpened. The mentorship had a profound impact on the emotional and cognitive development of the young mentee. The mentee suggested that the ideal mentor is an insightful flexible person who guides without controlling. In concluding, the mentee reflected how one should not stress the product but rather the process of learning. One process of learning for him was his mentoring program. Mentoring was a strategy that enabled him to develop his potential beyond the school.

Reilly (1992) described a mentor program that operated in Minnesota and successfully allowed hundreds of high school students to prepare for and participate in, advanced level learning with professionals. Over 50 schools were involved in this Mentor Connection Program and the effectiveness of the program led to the development of the Mentor Program. In the Mentor Program a student may seek a mentor when they have exhausted their school's resources, when they need to move beyond what the school district can provide and when their pace of learning greatly exceeds the pace of the classroom.

Reilly (1992) suggested that the benefits for those who participated in the Mentor Program (both mentor and mentee) were increased self-esteem, better developed skills in the field of interest and honed thinking skills. The students were highly creative and had more clearly defined career options. They made better connections between work and school, had increased motivation to achieve and establish new friendships. There appeared to be inspiration generated by a role model, a matured sense of responsibility and direction, and the development of the mentee's potential. The key to this successful mentoring program involved the selection of appropriate mentors, a structure that allowed mutual sharing of interests, appropriate challenges and a support system that supported the mentor and the mentee.

Grybek (1997) referred to three different mentor programs that all reported excellent outcomes. The first program, the Alabama Executive Internship Program, allowed the students to shadow executives for 4 days per week, while the remaining day was spent in conference with the coordinator. Grades were awarded to participants. The results were excellent. The second program, the Florida Laboratory Experience Program, involved students studying science or maths to be matched with researchers in the community. The community sites included hospitals, accounting firms and research laboratories. In the anecdotal comments all participants reported excellent outcomes. The third program was a university-based summer program whereby the students attended the summer program and worked with the professors and graduate students. Again the participants expressed excellent results. Grybek (1997) did note that the risk factor was that the participants became too attached to their mentors and suffered a tremendous sense of loss at the end of the relationship. However, despite the risk, Grybek (1997) proposed:

> Mentorship is probably inevitable in the lives of bright students who relate best to older individuals. Formal mentorship programs rising out of' a student's interests and career plans are desirable introductions to the realities of the world of productive work for many student (p. 119).

2.2.3 Mentoring in Australia

Mentoring programs in Australia have not been as common as those in the United States. Perhaps the best known has been a statewide mentor program, which was developed in Victoria in 1983. The scheme, initiated by the Victorian Gifted Association

and the Victorian Education Department, provided significant numbers of gifted students with educational experiences in a variety of academic and non-academic areas. The mentor program provided access for short and long term placements in the city region. One program linked postgraduate primary school teachers from Victorian College with two bright primary school children. The enrichment program lasted 8 to 10 weeks and the students were mentored in story writing. Students reported an increased confidence in creativity and risk-taking within the supportive, non-threatening environment of the mentoring relationship (Frampton, 1989). Benefits to the mentee included a high level of learning experiences, enhancement of one's potential and an increase in interpersonal skills and confidence.

In 1991, the New South Wales Department of School Education, Metropolitan East Region, piloted a program called Mentor Links. This program developed to the point that it became operational statewide (Forster, 1993). Mentor Links connected a gifted student in the government school system that was aged 10 years or older with a community mentor who had expertise in the same area of interest as the child. The key to the success of the program was the voluntary nature of the mentor's participation and the tight security checks. The students benefited because of the tremendous enjoyment of working with someone else, the mentor, who was interested in the same things. Families benefited as their child's self esteem and interpersonal skills increased. The mentor also benefited in the challenge of sharing their knowledge and expertise with a young person.

Although non-government schools in New South Wales have not been involved in the Mentor Links program, several independent schools have initiated their own mentoring schemes. Christie (1993) described mentoring at an Anglican Girls' School in New South Wales, as a strategy that was born as a result of a situational analysis of the needs of the gifted at the school. It was decided that the principles of the Renzulli triad model would be instituted at the school to encourage the girls to take a greater responsibility for their own learning and therefore, have greater control over the outcomes of their experiences in school. The girls, from Year 8 to Year 12, embarked upon research projects and presented them at the conclusion of the program. All students admitted to liking the opportunity to think for themselves and the freedom to identify their own problems and to investigate those problems. By linking the students with experts in the community, educators were ensuring that these learners had opportunities to reach their potential and take control of their own learning.

Another similar mentoring program operated at an academically selective state secondary girls high school in New South Wales (Cummins, 1996). Girls from Year 8 to Year 11 were eligible to take part in the program and were selected by a Gifted and Talented Committee. Mentors could be teachers at the school or community members. The program was delivered in school or out-of-school. The girls were asked to work on a research project or a major piece of work, which was to be presented at the final school assembly and/or published in the school newspaper. Cummins (1996) summed up the benefits in these words: "The mentor scheme has encouraged and challenged many girls to take risks, to extend themselves out of their comfort zones and to develop to their full potential" (p. 232).

A slightly different mentoring program has been developing in a primary school in Sydney, New South Wales. This mentor/buddy program for the gifted relied on challenging both mentees and mentors (Valich, 1998). It was a three phase mentorship-type scheme in which older students were mentors for younger students in Phases 1 and 2, with adults becoming mentors for students in Phase 3. Phase 1 involved six, Year 4 students who mentored students in Years 1 and 2. Phase 2 involved six Year 5 students, who mentored the Year 4 students and Phase 3 involved a mentorship program between retired people in the local community and Year 6 students. The older students, who were mentoring the younger students, were challenged academically in trying to find an appropriate level of tasks for their buddies. All students were challenged socially as mentors built a relationship of friendship and respect so their buddies would be encouraged to learn. All students were also challenged emotionally as pairs of different personalities worked together. The field test evaluation form pinpointed the strength of the program as the students feeling they had learnt a lot academically, socially and emotionally and that they considered the program had been a success. The weakness was that there was insufficient time to complete all the required activities. The students were, however, positive overall about their experiences.

2.2.4 Mentoring: A Viable Strategy

The reviewed research has confirmed that mentoring appears to be a viable strategy for some gifted and talented students in the development of their potential and well suited to the individual needs of gifted and talented students. Mentoring has involved any area of giftedness or intelligence, as identified by Gardner (1983) in his theory of multiple

intelligences. Mentoring has also been proposed by Tannenbaum (1983) and Clark (1997) as an important strategy in the provision of a challenging and facilitating environment for the development of giftedness.

One of the great strengths of mentoring has been its flexibility. Mentoring strategies can be tailored to suit the specific needs of both the mentee and the mentor. Mentorships can go beyond the scope of the normal school resources and have the potential of being a unique and rewarding learning experience in the education of gifted and talented children (Horn, 1996). Mentoring can involve young children through to university students and has been predominantly enrichment based as in the Purdue Mentor Program (Haeger and Feldhusen, 1986). Mentoring can operate in schools with larger numbers of students, such as those described by Wright and Borland (1992) involving only high school and primary school children as mentors and mentees in academic extension. Other mentorships have involved school personnel and community personnel (Christie, 1993; Cummins, 1996; Frampton, 1989; Freney, 1989; Reilly, 1992).

In conclusion, mentoring as an educational process has been documented as very beneficial for both the mentee and the mentor. And yet there appears to be reluctance on the part of most schools to develop mentorship programs. A concern may be that it has been too difficult, too costly, or too time consuming. Haeger and Feldhusen (1991) affirmed that in their experience mentorships are no more difficult to plan or implement than any other program option for the gifted. The benefits far outweighed the costs and unnecessary effort can be avoided by using a well documented text such as *Developing a Mentor Program* (Haeger & Feldhusen, 1989).

Perhaps the difficulty has been with the sense of need. A school community must have a desire for mentoring; they must see it as a viable strategy for assisting gifted students to develop their potential and they must want it to happen. Mentoring needs to be communicated to the school community as a positive and productive way to ensure the talent in a school is not squandered, but enhanced (Forster, 1993). Further information on how the mentoring relationship develops may also assist the school community in choosing this strategy for their gifted population.

2.3 Educational Technology

Educational technology is a process rather than a product. It is the process of applying tools for educational purposes. The most modern of these tools, the electronic

computer has presented as a difficulty for some teachers in learning how to integrate it into their teaching (Roblyer, Edwards, & Havriluk, 1997). With the integration of computers into the curriculum, a need has arisen to investigate what learning takes place with and through computers. Information about how children learn with educational technology can also be a benefit to the teacher and affect the integration process.

2.3.1 History of Educational Technology

In the first half of the last century, experts such as Thomas Edison predicted that the new technologies of radio, film and television would revolutionise education (Cuban, 1986). Many people felt that the new technologies, such as radio and film, would become substitutes for direct instruction. Some experts deemed that students would be able to acquire more information with less teacher effort (Cuban, 1986; Tyack & Cuban, 1995). This was not the case and Cuban (1986) summarised the reasons for limited use of early technologies in the classroom. Cuban found that non-use, or infrequent use was due to equipment cost and inaccessibility, curriculum fit, training and resources

With the implementation of technology into the school environment, teaching in the 1980s environment took on a new role of interactive environments for active learning (Pea, Endelson, & Gomez, 1995). Researchers found that drill-and-practice software was effective in improving test scores for students (Means, Olson, & Singh, 1995). Some teachers became fearful that computers would replace their roles and only a few teachers adopted their ongoing use (Cuban, 1986, Office of Technology Assessment, 1995; Tyack & Cuban, 1995).

Early computer classrooms, in the United States and Australia, had the traditional computer in the corner of the primary classroom or designated laboratory in high schools. Activities mimicked existing tasks for students in the traditional classroom. Word processors replaced typewriters and math software was more like a plug-in workbook with fancy graphics for correct answers (Means, 1994; Schlechty, 1997; Tyack & Cuban, 1995).

At the beginning of the 21st century, teachers were uncertain as to the best use of computers in teaching environments. External influences, such as parents and businesses, were the reason more computers had been forced into classrooms. This pressure, coupled with calls to connect to the Internet and use technology in classrooms, resulted in teachers changing their practice and integrating technology into their teaching. Traditionally, it has been the work of a teacher to impart knowledge. This role is also changing through the

influence of recent technology developments as we see teachers becoming learning managers.

2.3.2 Teachers and Educational Technology

Understanding why teachers have resisted the introduction of technology into classrooms can assist in future innovations. According to Andres (1991) teacher attitudes and lack of awareness has lead to a resistance to technology application in classrooms. Others have cited lack of time and limited support for technology implementation (Means et al., 1995). Cuban (1986) stated that the reasons for non-use of technology were brought about by insufficient access to technologies, insufficient time to plan the curriculum and insufficient training and resources.

Schofield (1995) found that teachers who find it difficult to see how computers will fit with their traditional practices do not adopt them. This was consistent with one of Roger's (1995) conditions that sustained use of innovations must fit with the values and beliefs of adopters and their ways of doing their work. Roger argued that teachers would only use technology if it was their perception that it would assist the students in their learning. He added that if the teacher's paradigm included covering the content and use of technology as an add-on activity, then the technology would be used in ways that matched that mode. According to Rogers, the level of perception that was beneficial would affect the adoption of the innovation. If teachers perceived that this innovation was "instrumental to student growth and development" (Rosenholtz, 1991, p. 106), then there may be support for teacher perseverance in using an innovation such as desktop videoconferencing.

Resistance by teachers to computers and computer technology has shifted. Gallo and Horton (1994) found that teacher reluctance to use computers was overcome by the use of the Internet. Other researchers have cited that teachers adopt technology when it satisfies some need, according to perspectives of usage and gratification (Kuehn, 1994). This involved cognitive satisfaction such as gathering information, interpersonal utility as the need to establish relationships and diversion as an escape from routine or boredom (Anderson & Harris, 1997; Kuehn, 1994). Anderson and Harris (1997) found several types of gratification reported by their telecomputing teacher respondents. Some benefits were cognitive, such as obtaining information, curriculum materials and news. Eighty-seven percent of the respondents in Anderson and Harris' (1997) survey of users of a statewide network agreed that the network brought them information they would not otherwise

obtain, or allowed them to reach people they wanted to contact, indicating a high level of relative advantage of the network for the sample. Other types of gratification found by Anderson and Harris (1997) were interpersonal, relational, such as keeping in touch with friends and family, although users found telecomputing less helpful for planning meetings. They also found that telecomputing provided a diversion, a pleasant break, an opportunity to participate in entertaining activities for some users of the network. Most of the respondents reported more than one category of gratification from their use of telecomputing.

Using the computer as a tool was the most often cited incentive for using computers in the classroom (Sheingold & Hadley, 1990). Other incentives cited were that computers increased student enthusiasm, helped make a subject more interesting and gave the teacher more personal gratification because they were learning new skills. In this case, teachers seemed to be receiving cognitive gratification. Incentives for using telecomputing reported by participants in Honey and Henriquez's (1993) study may also fall into the categories of uses and gratifications. The opportunity to communicate with other educators and reduction of isolation were cited as incentives by respondents to these researchers. An additional incentive cited was the ability to access information otherwise difficult to obtain, a cognitive gratification.

Teachers have reported that they adopted telecommunications because it was "exciting" or variations of that term (Gallo & Horton, 1994). Firestone and Rosenblum (1988) found that teacher and student commitment were mutually reinforcing. Teachers' commitment was influenced by the response they received from students and in the changes in student learning that resulted from a change in their practice (Guskey, 1986). Guskey (1986) suggested that changes in teachers' beliefs and thus practices, were made as a result of "that which they have seen work in their own classrooms with their students" (p.7). If their students were achieving more, were more motivated, or were demonstrating higher self-esteem as a result of some new practice, "then and perhaps only then, … [was] a significant change in [teachers'] beliefs and attitudes likely to occur" (Guskey, 1986, p. 7). Teachers did not employ innovations developed elsewhere without critical examination and adaptation, which calls into play the practical intelligence developed through their experiences as teachers.

Technology and innovations have to be compatible with the beliefs and practices of the teacher (Rogers, 1995). According to Cuban (1997), the questions that need to be asked in the 21st century relate to the beliefs teachers have about learning and teaching,

about the use of technology in learning and about how to judge where, when and under what conditions technology should be used in the classroom. Zhao (1998) believed that the challenge of technology is the design and development of educational technology products to meet the goals of promoting adoption and instructional change.

Furthermore, the learning of new technology can be quite demanding. This learning of the technology can take precedence over curriculum content in a classroom. It is only after several rounds of integrating technology with content that content emerged as a strength. This dilemma has important implications for the willingness of teachers to adopt technology. Throughout the technology adoption process Goldman, Cole and Syer (2000) proposed that teachers respond to the dilemma in three ways. Some teachers diminished or stopped using technology, some stuck to the tried and true technology, while others plunged head first together with students in learning the technology. Technology can be a long road from promise to reality.

2.3.3 Students and Educational Technology

Technology, in today's culture, is not a fad. According to the Australian Bureau of Statistics (ABS), in the 2001 Census, 42% of Australian homes have computers. The number of computers in schools in Australia has increased markedly since the 1980s and has continued to grow.

The use of technology according to Roblyer et al. (1997) was based on common sense rationale recognising two major points. Technology was everywhere and technology had been shown to be effective. The case for justifying technology was based on motivation.

Technology-based methods have successfully promoted several kinds of motivational strategies that may be used individually or in combination; gaining learner attention, engaging the learner through production work and increasing perceptions of control. Gaining learner attention was achieved due to the visual and interactive features of many technology resources (Pask-McCartney, 1989; Summers, 1990-1991). Engaging the learner through production work has been achieved by engaging in the creation of student designed technology-based products. This strategy has been used effectively with word processing, hypermedia, computer generated art and telecommunication. Roblyer et al. (1997) reported that such uses revealed how students liked the activities because they promoted creativity, self-expression and feelings of self-efficacy and because they resulted

in professional looking products that students could view with pride. The increasing perception of being in control of their own learning has been cited by some students who were successful users of technology-based material. Learner control seemed to have been especially important for students at risk who may have otherwise have experienced academic failure (Roblyer et al., 1997).

Technology may also have satisfied some need that Kuehn (1994) referred to as the use and gratification theoretical perspective. Just as teachers have used computer-mediated communication because it satisfies cognitive, interpersonal utility and diversionary needs, too, were similar reasons for students choosing telecomputing. Most primary school children have chosen to use computers because they were fun (Cobb, 1997).

2.3.4 Motivation and Educational Technology

Several constructs of motivation have been proposed. Intrinsic motivation, attention theory and self-efficacy theories seemed to have elements that may be related to perseverance or motivation to continue.

According to Lepper and Hodell (1989), intrinsic motivation increased when a task provided a challenge, stimulated curiosity, allowed the learner a measure of control and contained an element of fantasy. To provide challenge, a task must have clear goals and have an uncertain attainment. Dowson and McInerney (2003) have suggested in their research with middle schoolers and motivational goals that students hold multiple social and academic goals in school settings. These goals interacted to differentially influence students' academic motivation performance. It was found that students' multiple goals may either conflict with, converge upon, or compensate for, each other with respect to students' engagement in learning.

Tasks that stimulated curiosity were also motivating. Lepper and Hodell (1989) described these activities as those that offered surprises or ideas that were discrepant from current beliefs.

A third factor in intrinsic motivation was an element of fantasy. The near anonymity provided by technological innovations, where one is known only through the information one decided to share, provided users the ability to create a personal identity, or mediated personal presence (Ferneding-Lenert & Harris, 1994).

A final factor in intrinsic motivation was the sense that learners have control over their learning. When a learner perceived the outcomes of accomplishing a task that is a

direct function of his or her responses, motivation increased. Deci, Vallerand, Pelletier and Ryan (1991) concurred in that learner are more motivated to perform the task when they have more choice and initiate a task as well as feeling greater personal responsibility.

Another motivation construct that has played a role in perseverance has been the amount of attention teachers have available to devote to technological innovations. Cognitive theorists believed that individuals have a limited amount of attention that may be devoted to all the tasks in which the person is involved in any given moment in time. First, one must decide to pay attention or selectively attend to the task (Kahneman, 1973).

In addition to attending to the task, one must decide how much attention will be allocated to the new information (Kahneman, 1973). The workplace of teachers demand that they carefully use their time and energy to cope with conflicting demands (Cuban, 1986). Attention available to innovations may be competing with other educational activities.

Finally, the perceived level of difficulty of the task influenced how much attention the learner gave to the task. If a task was perceived to be difficult, attention and arousal increased. If the task was perceived as too difficult, fear of failure set in and anxiety occurred (Kahneman, 1973).

Marcinkiewicz (1993) and Kellenberger (1996) studied the classroom use of computers through the lens of another motivational construct, expectancy theory. This perspective proposed that behaviour was predicated upon perceptions about the success of the actions a person might take. Past success was linked to expectancy of future success by the increasing of confidence. When one was confident about trying something based on previous success, motivation to try again was increased (Kellenberger, 1996). Although neither study was focused on desktop videoconferencing (DVC), they do provide insight into the motivation to use an essential component of DVC computers.

Marcinkiewicz (1993) examined the factors influencing computer use in the classroom. Self-report data regarding levels of computer use, innovativeness, focus of control, perceived relevance of computers to teaching and self-confidence in the use of computers were collected. Age, gender and years of computer experience were also examined. Results indicated that level of use was correlated most closely with teachers' perception of their competence using computers and innovativeness. Although innovativeness was not typically considered in motivational research, Marcinkiewicz (1993) defined it as "willingness to change" (p.233) and stated that it is, therefore, a motivational construct.

Educators have often cited higher level thinking as a characteristic of gifted learners. Bloom (1956) who developed his taxonomy for educational goals and objectives categorised higher level thinking as analysis, synthesis and evaluation. Vochell and Van Deusen (1989) whose book is based on using computers to teach higher order thinking have categorised this higher order thinking as recognitive skills, critical and creative thinking, problem solving and core thinking skills. This view has also been shared by Roblyer et al., (1997) who advocated that engaging in technology such as videoconferencing allowed teachers to set complex long-term goals that called for basic skills, thus motivating students to learn both lower level and higher level skills. Similarly, McLoughlin (2000) in her research with technology found that higher order thinking among gifted students can by fostered by utilising audiographic conferencing. Her results indicated that the interactive features of the technology provided the possibilities for collaboration, discussion and evaluation of concepts thereby leading to higher order thinking.

McKinnan, Nolan and Sinclair (2000) reported in their 3 year study of computer usage in New Zealand schools that students who elected to be involved in the computer integrated studies program had more positive attitudes to computer use than those in the traditional school program. They also reported that students showed more enjoyment towards out-of-class activities.

Beliefs about competence in the use of computers may contribute to a teacher's pursuit or avoidance of computer use (Marcinkiewicz, 1993; Schofield, 1995; Stuhlmann, 1994). Self-competence was related to self-efficacy, with the shared element between them being the "person's expectations of competence in controlling the behaviour" (Marcinkiewicz, 1994, p. 232). A teacher's perception of self-efficacy, defined as having the belief that of personal effectiveness as a teacher, was also related to student achievement and to aspects of student motivation (Kellenberger, 1996).

Some students were more advanced than the teacher when it came to using computers and teachers felt they were less able to help students having trouble with computers. This may have negatively influenced teachers' self-efficacy (Kellenberger, 1996), especially when it came to DVC. Possessing less knowledge than students about computers also lead some teachers to reject DVC due to a perception that their authority may have been eroded (Schofield, 1995).

These motivational theories may help us to understand teachers' perspectives about their perseverance. The setting in which a technological innovation was used may

contribute to perseverance. If teachers self-initiate use, have some measure of control over that use and see it as a challenge - but not to the extent that they are overwhelmed - then they may persevere.

2.3.5 Frustration and Educational Technology

Frustration with technology had little emphasis in the research studies on computer-mediated communications. The research literature on the use of the World Wide Web was short of analytical studies as well as qualitative studies (Burge, 1994; McIsaac & Gunawardena, 1996).

The literature about computers in education emphasised only one aspect, usually the good points, but occasionally the bad, to the exclusion of other points of view (Ragsdale, 1988).

A few authors identified the issue of frustration in computer-mediated communication (Dede, 1996) but did not indicate the problems in social contexts. Hara and Kling (1999) cited four possible reasons why this phenomenon of students' frustration has not been seriously studied until now. They were:

- The researchers may be biased towards technology, since they may work in an educational technology setting.
- The lack of qualitative research studies.
- Students may not have had the opportunities to express their frustrations with web-based distance education.
- Post studies have been conducted with experienced technology users and hence may be better at handling students' frustrations, technological problems and ambiguous instructions.

Bryson and de Castell (1998) urged that attention should be given to failures of educational innovation because it will tell us why success stories are arbitrary.

In this kind of learning environment where students are away from traditional classrooms, frustration can be a major obstacle for distance learning.

Hara and Kling (1999) in their study of frustrations with web-based distance education courses, indicated that students' frustration originated from three sources:

- Technological problems.
- Minimal and untimely feedback from the instructor.
- Ambiguous instructions on the website as well as via e-mail.

A Canadian study in distance education focused on the feasibility of authentic problem-based collaboration at a distance and found that the most severe frustrations were centred on problems that occurred when technology failed them. One of the important findings of this study was that all participants felt that face-to-face interaction was preferable and critical (Carr-Chellman, Dyer, & Breman, 1999).

Goldman et al. (2000), in their research into teacher's adoption of technology in classrooms, cited glitches galore as one of the obstacles to overcome. Frustration with the technology was not the only frustration cited. Teachers were frustrated with the time taken to learn technologies and consequently academic content was being sacrificed in the process.

2.4 Instructional Methodology

The mere presence of technology is not an automatic guarantee for improved learning. Rather than viewing computer technology in terms of achievement gains, researchers such as Kozma (1991, 1994) proposed that technology should be viewed in the context of the learner actively collaborating with the medium to construct knowledge.

Teaching to allow students to construct meaning in new ways was the emphasis of many school reforms (Koschmann, Newman, Woodruff, Pea, & Rowley, 1993; Means et al., 1995). Directing students to knowledge acquisition through facilitation rather than direct instruction has become the role of teachers in the 21st century (Brooks & Brooks, 1993). Students were gaining competencies for future roles as knowledge makers as computers and technology become tools of authentic learning (Dwyer, 1994; Schlechty, 1997).

The process of learning has emphasised learner-centred activities, inquiry and relationships with mentors, peers and experts. Learning has also been part of the socialisation process and encouraged through communication and opportunities of self-expression.

Learning is a process through which experiences cause permanent change in knowledge or behaviour (Woolfolk, 2001). Learning can also be viewed as an individualised and active search for meaning. Dowson (2000) explained that the learner is active in "constructing knowledge rather than passively receiving it and shaping knowledge as well as being shaped by experiences" (p. 5).

There are two different views on teaching and learning. Direct instruction, grounded on behaviourist learning theory and the information processing branch of the cognitive learning theories, is one such view. The other view, constructivist, evolved from other branches of thinking in cognitive learning (Roblyer et al., 1997).

It is important to realise that both direct instruction and constructivist approaches attempted what Gagne (1995) called the "conditions of learning or the sets of circumstances that obtain when learning occurs" (p. 2). Although both approaches have taken different perspectives on improving current educational practice, indications have suggested that both kinds of strategies may be useful to teachers in addressing commonly recognised instructional and educational problems.

2.4.1 Relational Learning: An Instructional Approach

Relational learning proposed by Otero (2001) has been a radical new look at how new relationships make learning possible. Relational learning has not seen the student as a computer to be programmed, but as a marvellous blend of mind, body and spirit with whom dialogue is to be engaged. It has been that place where dialogue has connected and reconnected and built, stored and changed relationships.

Relational learning has embraced the human connection; connection of self to self, self to others and self to content. Relational learning has enabled the learner to relate to ideas and feelings. Relational learning has developed the process of critical thinking, conveyed knowledge of self in society and established a common base of understanding. According to Otero (2001), relational learning has been a process of recognition, understanding, valuing and relating. Relational learning has promoted a new way of seeing the learning process. First, it established a frame of reference, which has been based on relationship, not on facts to be learnt. Second, through specific focus on the process of learning, learning structures have been developed which changed the learning culture to emphasise the human basis of all learning. Third, it focused the learning outcomes on learning for positive action. Throughout the process, it provided a caring nurturing environment for the learner, which transcended personal fears about the learning process. It created a community.

Relational learning proposed a learning model, which has been designed to refocus education upon the human elements of the learning process. The relational learning model comprised a six step sequence focusing on relationships. These steps characterised the

dynamics of interdependent relationships, the ultimate goal of relational learning. The role of the teacher was to support these dynamics in planning instructional activities.

The processes were:

- Survey: The exploration of the student's environment.
- Test: The assessment of the student's beliefs, values and understandings.
- Sharing: Students have communicated what they know with others.
- Incorporation: Students have seen learning as its own reward.
- Reconciliation: Students have seen what still has to be learnt.
- Change: The student has full involvement of self in the process.

Relational learning has provided pedagogy where relationships have been both the means and the ends. Learning has been internalised and integrated in useful ways. Relational learning developed authentic relationships that sought a new order of harmony in the global context. The commitment to a global curriculum has appeared. And that global curriculum has been independence. This approach according to Otero (2001) has restored a sense of community in classrooms and schools that has been equitable, inclusive and humane.

2.4.2 Direct Instruction

Direct instruction has been teacher directed. Learning happened when knowledge was transmitted to the learner. Direct instructional models have tended to focus on teaching sequences of skills that began with lower-level skills and built to higher-level skills.

Direct instruction has been preferred by many teachers for the delivery of information to students (Cuban, 1986). There has been an emphasis on traditional teaching and assessment methods such as lectures, skill worksheets, activities and test with specific expected responses. It has been a transmission of knowledge. As Copely (1992) stated:

> Information transmission, views teachers a masters of particular knowledge domains, whose job it is to transmit expertise to students primarily by lectures and recitation. Students memorise facts and concepts of the domain, practice skills until they have mastered them and demonstrate mastery on appropriate tests (p. 617).

Direct instruction has been responsible for the preparation of instructional materials using systems approaches and instructional design. It has affected K-12 curriculum for the

past 50 years. Teachers have found powerful tools in traditional methods if it was perceived that certain students needed more structured learning than others, or that certain required skills can best be learned through direct instruction.

Direct instruction, based on behaviourist principles, has some current applications that have been improving student achievement. Some examples have included:

- Fluency practice in precision teaching of basic reading and maths skills to young learners (Spence & Hirely, 1993).
- Performance management contingencies that have improved the study habits and achievement of college students (Mallot, 1993).
- Structured, teacher-directed techniques that have been utilised to teach problem solving and higher order thinking skills to at-risk students (Carnine, 1993).
- The application of behavioural techniques that have been employed to teach the required behaviours leading to creativity (Epstein, 1993).

According to Roblyer et al. (1997), one of the greatest criticisms of direct instruction is its irrelevance to the needs of today's students. Critics frequently cited several problems:

- Students could not do problem solving.
- Students found directed instruction activities demotivating and irrelevant.
- Students could not work cooperatively.

Consequently, educational reformists have moved away from direct instruction and sought other instructional methods that embraced motivation and relevant activities that have some degree of problem solving. Current educational reform efforts have suggested that constructivist learning experiences are desirable for K-12 classrooms (Means, 1994). Constructivism, underpinned by the teachings of Piaget, has been recommended by educational organisations as a way of helping students construct meaning from moral and intellectual autonomy (Kamii, 1985).

2.4.3 Cognitive Constructivist Learning

Constructivism has called for teachers to rethink traditional views on both objectives and methods of instruction and to experiment with new ways of facilitating students' learning. Originally constructivism focused on strategies derived from branches of cognitive science and has sometimes been referred to as cognitive constructivism. Cognitive constructivism emphasised students' motivation to learn and their ability to learn

from their environment. The internationally famous developmental psychologist, Piaget has generally been regarded as a major contributor of the theoretical principles for cognitive constructivist thinking. More recently, the term social constructivism has emerged based on the work of Vygotsky (1978) whose ideas about language, culture and cognitive development have become major influences in psychology and education and have provided alternatives to many of Piaget's theories (John-Steiner & Mahn, 1997). Social constructivism has put more emphasis on the interaction between teacher and student (and between students) than did cognitive construction. In this section, the discussion is centred on cognitive constructivist learning while social constructivist learning is discussed in 2.4.4. The cognitive constructivist model, one of facilitating learning, viewed teachers as:

> Facilitators whose main function is to help students become active participants in their learning and make meaningful connections between prior knowledge, new knowledge and the process involved in learning. The role of students from this perspective is to construct their own understandings and capabilities in carrying out challenging tasks (Copely, 1992, p. 681).

The advanced skills of comprehension, reasoning, experimentation and composition have been acquired not through transmission of facts but through the learner's interaction with content.

A curriculum offered by a constructivist would be filled with a variety of activities involving students as active participants in their learning. Emphasis would be placed on action and production. Ideally, the students would understand what they were doing, why they were doing it and where they were headed (Boomer, Lester, Onore, & Cook, 1992).

In reviewing the descriptions of constructivist teaching and learning, Jonassen (1994) offered eight characteristics that differentiated constructivist-learning environments.

1. They provided multiple representations of reality
2. Multiple representations avoided oversimplification and represented the complexity of the real world.
3. There was an emphasis of knowledge construction instead of knowledge reproduction.
4. There was an emphasis on authentic tasks in a meaningful context rather than abstract instruction out of context.
5. The provision of learning environments such as real world settings or core-based learning instead of a predetermined sequence of instruction.

6. There was an encouragement of thoughtful reflection on experience.
7. There was an enabling of context and content-dependent knowledge construction.
8. There was support for collaborative construction of knowledge through social negotiation, not competition among learners for recognition.

All these characteristics applied to all constructivist approaches since children would construct or build their own reality. To accomplish this they needed multiple representations, or views, of a concept or issue. Some of these characteristics applied especially to social constructivism, which is discussed in the next section.

As students engaged in constructivist activities, they frequently interacted with others in their quest for deep understanding of concepts (Brooks & Brooks, 1993; McNabb, 1997; Strommen & Lincoln, 1992). The desire to communicate with others and to exchange points of view were important elements in the constructivist approach that was encouraged by Piaget (Kamii, 1985). Participant to participant interactions were evident as meaningful engagement that involved discussions between partners, trios, groups and experts in order to construct meaning and understanding of content (Garmston & Wellman, 1994). Many available communication technologies have been used as tools for the exchange of viewpoints and social interaction between groups (Bates, 1995), thus supporting education reform and constructivist methodology. With the emphasis in education on social interaction, the need to focus on social constructivism has become increasingly relevant to teachers and students. Social constructivism is addressed in the next section.

2.4.4 Social Constructivist Learning

Social constructivism has put more emphasis on interaction between teacher and student (and between students) than did cognitive construction.

Vygotsky (1978) was a major proponent of socio-cultural theory. His ideas about language, culture and cognitive development have become major influences in psychology and education and have provided alternatives to many of Piaget's theories (John-Steiner & Mahn, 1997).

While both Piaget and Vygotsky emphasised the importance of social interactions, they saw a different role for interaction. Piaget believed that the most helpful interactions were between peers because peers can challenge each other's thinking on the basis of

equality. Vygotsky, however, suggested that children's cognitive development was fostered by interactions with people who were more capable or advanced in their thinking, people such as parents and teachers (Moshman, 1997; Palincsar, 1998).

Vygotsky emphasised the tools provided by culture to support thinking. These cultural tools have been categorised as real tools (computer, scales, etc) and symbol systems (numbers, language, graphs) that allowed people in a society to communicate, think, solve problems and create knowledge. Vygotsky stated that children cannot and should not be expected to reinvent or rediscover knowledge already available in their cultures. Rather, they should be guided and assisted in their learning. Vygotsky therefore, perceived teachers, parents and other adults as central to the child's learning and development (Woolfolk, 2001).

This means that children would need assisted learning or guided participation in classrooms via scaffolding. Scaffolding has supported learning and problem solving by clues, reminders, encouragement, or anything else that allowed the student to grow in independence as a learner (Rosenshine & Meister, 1992).

Vygotsky coined the phrase, zone of proximal development, the area where instruction can succeed, because real learning has been possible. He explained that, sometimes, problems were beyond the child's capabilities and a child entered a state called, zone of proximal development, in which a child could master a task if given appropriate help and support (Wertsch, 1991). This support has included prompts and hints to see how a student learnt, adapted and used such guidance. These prompts have been systematically increased to see how much support was needed and how the student responded. With regard to teaching, this has meant that a student would be best placed in situations where they have to reach to understand, but where support was available from other students or the teacher. Sometimes the best teacher has been another learner who has recently mastered the skill or problem because that learner was operating in the student's zone of proximal development. In addition, students have been encouraged to use language to organise their thinking and to discuss what they have been trying to accomplish. Vygotsky explained that this zone of proximal development was where instruction can succeed because authentic learning is possible. He further explained the major role language played in learning inside and outside the classroom. The giving of appropriate help and support has altered the teaching and learning process from teacher-directed to child-centred. Furthermore, Seely, Braun, Collins and Duguid (1989) has described knowledge in terms of being socially constructed, based on situated learning,

whereby knowledge was situated and partly a product of activity, context and culture. Additional support for the theory of situated learning has been reported by Collins, Brown and Newman (1989) who recognised that, ultimately, learning could only be established, by, rather than for, the learner.

Computer use in the classroom has been slowly transforming traditional classrooms into child-centred places (Sandholtz, Ringstaff, & Dwyer, 1997; Sivin-Kachala & Bialo, 1996). Technology has supported constructivist learning activities when it has been integrated effectively into classroom projects. Furthermore, communication technologies such as telecomputing, have been often used in a constructivist setting, "allowing access to information, communication with experts, more possibilities for collaboration and a creative medium for thought and expression" (Dwyer, 1994, p. 19). In technology rich classrooms children have not just learned technology. Technology merely provided a tool for the task to be used for authentic learning. It has been a means, not an end (Schrum, 2000). The capabilities of these new technology tools are identified in the next section.

2.5 Technology for Communication

The infusion of technology into our lives has expanded the boundaries of educational systems. Those who have never traditionally been involved in education have now participated in educational experiences and there has been greater access for educational opportunities (Kozma & Quellmalz, 1995). The online experiences, afforded by the use of the Internet, has reflected a shift in orientation from instructionist models of teaching through lecture, text and worksheets, to a more student-centred (constructivist) approach designed to support individual construction of understanding (Koschmann et al., 1993).

Through the Internet, students have connected with remote sites to view, discuss and construct knowledge. An important consideration, according to Riel (1996), has been the construction of online communities. The size and structure of the online community; the balance between defined structure and participant creativity and the reflection and evaluation of work are aspects to be considered. An example cited by Reil has been the project, Lives from Antarctica. Students across the world joined scientists who were involved in real world work. Operated by remote control, a robot was placed under water, creating a virtual sense of presence (telepresence) as the students collaborated with the

scientists. This project involved the students in social construction and collaboration to build a community of practice (Reil, 1996).

This section has addressed the communication technologies available to educators for teaching and learning. Of all the computer applications that have been adapted to educational purposes, telecommunications hold the greatest potential for revolutionising the teaching and learning process. Molnar (1990) had this to say:

> The creation and evolution of new, knowledge-based tools and information and communication technologies are increasing the potential for expanding human capacity and productivity both in the classroom and in the workplace. It is clear that the future will see a major restructuring of our social, industrial and educational institutions and an increased reliance on computers and telecommunications for both work and education (p. 62).

The digital age has changed the nature of our tools and different forms of computer interaction, such as audio and videoconferencing, make synchronous and asynchronous multi-person collaboration possible (Reil, 1996). Telecommunication tools such as, telecomputing, telementoring, videoconferencing, room videoconferencing and desktop videoconferencing are addressed in the following sub-sections.

2.5.1 Telecomputing

Telecomputing has been a tool used for communicating at any time, in any place, between one person and another person, between one person and a number of other persons, or among a group of persons. Telecomputing is thus a unique medium because it can be interactive and not limited by time or space (Harasim, 1989). Writing about the potential of telecomputing in schools, Maddox, Johnson and Harlow (1995) stated:

> It can empower students and improve problem-solving ability by bringing about a new relationship between children and information. It can expand the horizons of students everywhere and make quality information equally accessible to students in both rural and urban settings (p. 581).

Teachers have been using telecomputing in classrooms in a variety of ways since the early 1980s. Practices have included enhancement of traditional courses; primary teaching medium for a portion of, or an entire course; or a forum for knowledge networking, participation in discussion groups, or information with peers and/or access to online resources (Harasim, Hiltz, Teles, & Turoff, 1996).

As growing numbers of schools and classrooms have gained access to network connections, numerous approaches to using telecomputing in the classroom have been employed by innovative teachers. Harris (1998), who has done extensive work in documenting teachers' practices with telecomputing, found a variety of ways teachers were using telecomputing in the classroom. She categorised these uses into three broad categories:

1. Interpersonal exchanges, which included keypads, global classrooms, electronic appearances, telementoring, impersonations and question and answer activities
2. Information collection and analysis, which included information exchanges about a variety of topics, database creation, electronic publishing, telefield trips and pooled data analysis
3. Problem solving, which included information searches, peer feedback activities, parallel problem solving, sequential creations, telepresent problem solving, simulations and social action projects

In addition, Harasim et al. (1996) classified models of telecomputing in the classroom as mentorship, access to key information, or collaborative projects. The research described a number of learning networks where participants created online learning communities around curriculum topics and activities.

Technologies, such as telecomputing, have been unequalled in potential as educational tools because they have encompassed most other computer applications. Telecomputing is not represented be a single application but, instead, has opened up a worldwide network of applications. By bringing the world to the classroom, educators have been given vast new opportunities to enrich instruction and enhance teaching and learning (Maddux, 1994). Researchers have also been given opportunities to investigate how technology has affected the teaching paradigms.

Accordingly, Romiszowski and Mason (1996) viewed telecomputing as a medium that can fit either of two teaching paradigms, which they label instruction and conversation depending on how "telecomputing is employed in the teaching and learning process" (p.449). The instruction paradigm has been focused on specific objectives, a one-to-many flow of information from teachers to students, in a single layer of complexity. The conversation paradigm has been characterised by more general objectives, a many-to-many flow of information and multiple, interwoven layers of complexity (Romiszowski & Mason, 1996). These two paradigms were significant to the teaching and learning process, and may have altered the way learning through and with technology have been perceived.

2.5.2 Telementoring

Telementoring has been the use of electronic communication, such as electronic mail or computer conferencing, to facilitate the creation of such a relationship when it has not been possible to do so in person, due to either distance or time constraints. It has not been necessary for the mentor and the mentee to be in the same place at the same time. As a relationship between mentor and mentee, telementoring has fitted Romiszowski and Mason's (1996) conversation paradigm of teaching, a forum for knowledge networking (Harasim et al., 1996) and interpersonal exchange structure (Harris, 1998).

In the school setting, telementoring has provided the opportunity for students to develop a caring and supportive relationship with an adult, which has been often missing from the lives of many students (Murfin, 1994). Some researchers, however, advised that the primary focus of exchanges between telementors and their telementees should not be only relationship building, but on curricular goals. Focusing on an issue, problem, or some content and communicating about that curriculum, would likely result in the development of a personal relationship (Ferneding-Lenert & Harris, 1994; Sanchez & Harris, 1996).

A number of research studies have investigated the attitudes of participants who have engaged in telementoring. For example, using K-12 students and mentors to connect using telementoring has been a relatively new phenomenon in the field of educational innovation. Ross, Morrison, Smith and Cleveland (1990) conducted an evaluation of a telementoring project where 51 sixth grade students were paired with education students from a local university who volunteered to serve as telementors. Attitudes of participants and the frequency and content of the exchanges were analysed in the evaluations. They recommended that others who operated telementoring projects increase personal contacts between telementors and students in order to strengthen the learning benefits of the experience.

Similarly, Murfin (1994) investigated the possibility that computer mediated communications might be an effective way of bringing African American and female students into contact with adult scientist role models. The number of messages increased over time with positive tones. Murfin believed the result of the study indicated that telementoring had potential for promoting social and communication skill development.

In addition, O'Neill et al. (1996) studied a project that matched high school students with volunteer mentors to provide assistance in open-ended research projects.

These researchers found that more successful matches had higher message traffic and were those in which telementors used a variety of mentoring strategies. The students' level of trust and respect for the mentor, assessment of the mentor's friendliness and impression of the respect the mentor held for them, were also related to success. Reasons given by students as to why relationships failed were that the mentors did not understand their needs, were too slow to respond, were too busy, did not know about the topic, were insulting, or never answered mail. When creating telementoring relationships, these authors recommended that one should make sure students know what the role of the mentor is and that the mentor knows what is expected. They further recommended that a mentor orientation program to help mentors understand how to communicate to students may be helpful and some attention should also be given to providing incentives for mentors.

In another project matching high school students with professionals in a high tech corporation, Willinsky (2000) found that most students and telementors quickly established a connection that had a tone of equality and immediacy. Willinsky characterised these relationships as conversations between screen equals. The online conversations included not only the collection of information regarding the workplace of the professions and the feedback provided about students' writing, but also explored aspects of each other's interests and lives. Having an authentic audience for their work made the students aware that it is not only English teachers who care about correct grammar and punctuation. The professionals learned about the teaching process and the need to explain why their students should make changes in their writing. Students reported that they enjoyed this type of writing assignment more than traditional assignments, but were hindered at times by technical problems.

Furthermore, Ferneding-Lenert and Harris (1994) investigated the matching of teachers and students with subject matter experts through computer mediated communication. Interviews were conducted with thirteen informants including teachers, subject matter experts and students and triangulated with electronic mail messages exchanged among the informants. Two themes emerged from data analysis and "the influence of the structure of the computer mediated communication learning environment itself and the type of social or mediated personal presence developed by the subject matter expert" (Ferneding-Lenert & Harris, 1994, p. 132). The researchers concluded that through the sharing of personal background information, subject matter experts could establish a favourable mediated personal presence with students that builds trusts and

creates a successful online educational partnership. This partnership seemed to be important for continuation of the communication among the players in the match. Teachers noted that building these relationships was one of the greatest benefits of telementoring. Teachers also reported increased self-esteem for students. Students felt the privacy of electronic communication increased their willingness to communicate more than face to face interaction in their classrooms.

In another study, Jones (2001) examined the message flow in his study on communication between individual students and subject matter experts in on-to-one telementoring exchanges. His purpose was to better understand this communication. He found that open-ended projects had richer discourse that engendered mentor relationships, while the discourse in deadline-based projects tended to be more restricted, following a question and answer pattern. Participants in the open-ended project were more positive about the experience and seemed to get more out of telementoring. Younger students were more likely to be involved in open-ended projects due to fewer demands on their time than the high school students.

Young children have also been involved in the Hewlett Packard E-mail Mentor Program that was started in 1995. In 1998, the program was expanded and renamed the International Telementor Program. The program establishes one-to-one mentoring relationships for students grade five through twelve. In an evaluation of this program conducted by Cobbs (1997), students reported the benefits of participation were the relationships with their telementors and that the project was "fun". They also noted that they had increased their skills in using computers, the Internet and e-mail. Some students reported the project had no impact and that they had not developed a positive relationship with the mentor. Struggles to establish a positive relationship, according to the mentors, were due to lack of interest on the student's part, technology difficulties, lack of support from the school structure and time limitations on the part of the mentors. A difference between the perceptions of students and the perceptions of mentors about the impact of the program was also reported.

Reports of benefits for students that result from the use of telementoring in the classroom have emerged. Access to increased store of resources, increased motivation, improved self-concept, improved academic achievement and improved critical thinking have been cited as some of the benefits telecomputing has provided for students when used in the classroom. A review of studies that have suggested these benefits follows.

Irving (1991) conducted a 2-year study in six schools (one primary and five secondary) in which students were given access to online information services. The aim of the project was to stimulate students' use of a variety of information resources and the study of contemporary topics. The researcher concluded that online services provided immediate, on-demand and up to date material not available in or near the school and access to specific information topics for which books either did not exist or were not in the school resource collection.

Using the Internet and other technology had positively influenced the students' overall achievement. The motivation factor alone increased engagement, a goal of most classroom teachers (Brownlee-Conyers & Kraber, 1996, p.34). A number of researchers found that student motivation increased when they engaged in telecomputing activities in the classroom (Ferneding-Lenert & Harris, 1994; Harasim, 1989). Students were found to be more motivated to participate in learning activities that involved computer-mediated communication than traditional activities. In addition, students who used online resources began to view computers as tools for acquiring and managing information rather than for simply word processing or playing games (Williams, 1995).

Studies of telementoring have found that another benefit of computer-mediated communication was the ability to match students with mentors, even though great geographical distances might separate them (Ferneding-Lenert & Harris, 1994; Murfin, 1994; O'Neill et al., 1996; Ross et al., 1990). Through telementoring, experts have communicated with students without travelling to the school campus to provide needed assistance. Improved self-esteem and relationship building was cited as a benefit in most of these studies (Ferneding-Lenert & Harris, 1994; Murfin, 1994; O'Neill et al., 1996).

In addition, researchers have found that students in K-12 classrooms improved their academic skills when participating in telecomputing activities. In their study of telecomputing on writing performance and attitudes of 50 fifth graders, Moore and Karabenick (1992) found student's writing to be more complete and elaborate when using e-mail. The fifth grade students communicated with adult mentors via electronic writing partners and the students writing skills improved compared to other students who participated in journal writing and used drill and practice software, but who did not communicate by electronic means.

Hiltz (1997) also found that students who were involved in group learning using online communication tools achieved higher grades, felt more motivated and rated courses as more desirable than traditional courses.

Similarly, in a project to increase social interaction that employed computer mediated communication, Naiman's (1988) study of students with mental and physical disabilities was found to improve the student's reading and writing abilities. Frequent use of computer-mediated communication contributed to the improvement of these skills. Students who exchanged e-mail with mature writers improved more than those who corresponded with peers. Writing is not the only area in which improved student achievement has been noted. Honey and Henriquez (1996) studied the role of computer-mediated communication in a school reform. The project provided computers at school and at the homes of all 135 seventh graders and their teachers in Christopher Columbus School. In addition, a revised curriculum was adopted and supported by integrated technologies. Standardised test scores rose in language arts and mathematics and writing skills improved. The researchers did not claim that it was only the use of computer-mediated communication that caused these gains. They did, however, point out that students who attended technology-enriched schools have consistently outperformed their peers in other schools in the district on achievement tests and attendance rates. In addition, there have been an increasing number of requests for transfers to this particular school.

Another potential benefit of using telecomputing cited by researchers is improved critical thinking (Centre for Applied Special Technology, 1996; Irving, 1991; Newman, 1994). These researchers also found that a combination of computer-mediated communication stimulated the production of more unique ideas and better solutions to problems.

Similarly, improvement in critical thinking has been documented for adult learners. Focusing on teachers, McGee (1997) examined the nature of professional development for teachers that might have occurred during telementoring exchange. She described the unintentional professional development that occurs for teachers through the collaboration and reflection that are inherent in telementoring matches. For the teachers in this study the most telling shared attribute in their professional growth was that it was unintentional. There was not a school or administrator mandate that initiated their involvement. In fact, there was no motive to do anything more than to enhance student learning. They expressed a conscious connection between student comprehension and their instructional goals or perceptions of content. This was evidenced by their shift in method, re-sequencing of instructional events and revised approaches to teaching.

In another study of adult learners, Bennett, Hupert, Tsikalas, Meade and Honey (1998), noted online telementoring via the Internet had proliferated since the

Telementoring Young Women in Science, Engineering and Computing project began in 1994. Their evaluations indicated that it was highly successful in connecting students with telementors, but did not always achieve the expectations of the participants. They learned that the strong relationships created in the project were the result of several key mentor strategies: paying attention to personal details supplied by the students, giving direct affirmation to students, establishing a personal presence, avoiding silences, negotiating what is off-limits in the discussion and experience and comfort with communicating off-line.

The research to date has demonstrated that telementoring offers a means for teachers to employ technology in the classroom in ways that support the curriculum and the social and emotional growth of their children. Some services have supported curriculum-based applications to telementoring, while others focused on the development of career awareness. The use of telementoring as a strategy for assisting gifted learners has validity.

2.5.3 Videoconferencing

The use of this fast emerging communication has yet to become common in business and universities around the world. Some educational communities have started to investigate how videoconferencing, sometimes known as digital video, fits into enriched learning experiences for school aged students (Fetterman, 1996). Recently in the United Kingdom, a report into digital video found that digital video had the potential to enhance learning by increasing student involvement in the curriculum, developing a range of learning styles and motivating a wider range of students than the traditional curriculum (Becta, 2002). The report added that the potential of digital video was significant in that it had the capacity to enable students to transform both their own identities and their views of the world. The report also affirmed the technology when it also acknowledged that "Digital video in many ways bridges different worlds for pupils – interior and exterior, the subjective and objective, private and public, school and home, peer and tutor, solitary and communal" (http://beta.org.uk/research/reports/digitalvideo/index.html p. 7).

Videoconferencing, or digital video, can be classified as room videoconferencing and desktop videoconferencing. What follows is a discussion of room videoconferencing followed by desktop videoconferencing.

2.5.4 Room Videoconferencing

> If a picture is worth a thousand words, then videoconferencing is worth ten thousand words. (Newcombe, 1997, p. 1.)

Room videoconferencing has been used for large group gatherings to communicate with remote individuals and/or groups. Usually cameras have allowed multiple views with zoom capability on individuals and documents. Room videoconferencing was a combination of audio, video and communications networking technology for real-time interaction. Interactive white boards have been sometimes used to support the seminar (Korhonen, 1997). Cost has usually been high due to the need for dedicated lines, specialty rooms and high-end equipment.

The key points of room videoconferencing as defined by Hyman (1996) were:

- Typically a one to many interaction.
- Distinct and unequal participation.
- Lecturer retained control.
- Used more formal communication methods (raising hand to speak).

Room videoconferencing has become a great tool for teachers. Schutte (1998) described how it allowed teachers to expand the teaching horizons beyond the classroom and local community. Some educators have also invited local business volunteers to talk about careers and broadcast to other schools and other sites. Other sites have shared guests. Teachers have arranged virtual visits to museums to view exhibits and dialogue with museum personnel. Other virtual visits have toured hospitals. Students have shared information with other schools as they have worked collaboratively on projects. Science experts have been used to help students plan and work on science projects or reports. Conferences with students from other countries have been possible. It is an incredible experience for students to learn from and understand another culture. Students have started e-mailing exchanges with educators from other countries and helped locate Internet capability and the willingness to participate in such projects. E-mail has allowed students to plan and set up conference agenda before their meetings. The possibilities have been exciting (Schutte, 1998).

Learning has been found to be more enjoyable and exciting using videoconferencing and the Internet. Teachers such as Florence McGinn, teacher at Hunterdon Central School, Flemington, New Jersey, have turned to videoconferencing in establishing mentors for her high school English writing class. She now has 50 mentors

from across the country at Rider University, New Jersey. The mentors were honours college students who mentored the high school students in writing and literature studies. Using a combination of video, voice and Internet tools, the mentors talked with students as they sat at their computers. Students could see and hear their college student mentor as they worked collaboratively to revise a writing project on screen (McGinn, 1998). Similarly in Los Angeles, primary school students from Hacienda school district, sitting at their computers could see and hear lessons from the state zoo or museum and watch educational films via the Internet, all through the use of videoconferencing (Litt, 1996).

Other examples of classroom videoconferencing projects were supported by the Education First initiative, developed by Pacific Bell. The goal of this initiative was to help schools establish the telecommunications infrastructure needed to access the Internet and/or participate in videoconferencing with other sites to help develop the skills to effectively exploit the value of interactive data and video applications (Woodruff & Mosby, 1996). Through Eduction First, educators who were considering videoconferencing were provided suggestions and strategies such as remote site connection, sharing expertise, tutoring, remediation and partnerships with the business community.

One major drawback has been the expense of satellite videoconferencing. Alternatively, microwave transmission has provided a cost-effective method for educational applications of videoconferencing in more localised areas that were no more than 40 km apart. Community colleges and universities have used this technology to distribute courses throughout the community. The drawback with this technology has been the number of channels in one area which has limited its expansion (Barron & Orwig, 1997).

2.5.5 Desktop Videoconferencing

More recently, desktop videoconferencing (DVC) has emerged as a preferred option in schools, colleges and universities (McGinn, 1998). Desktop videoconferencing is a technique that has used a computer camera and microphone at one site to transmit video and audio to a computer at another site (Barron & Orwig, 1997). There have been many benefits and advantages of using this technology.

One major advantage of this technology has been economy (Barron & Orwig, 1995). For a few hundred dollars it has been possible to set up this technology in a

classroom, library or at home. A miniature video camera attached to the USB (Universal Serial Bus) port of the computer and a modem connected to an Internet provider is all that is required. This technology has allowed people to literally meet people from other cultures, to become members of cooperative learning groups and to have video-mentors (Van Horn, 1996). The low cost of this technology has made it attractive to schools.

Additional benefits for schools have been in the area of relationship enhancement making teaching more relational. Desktop videoconferencing has made distance education more relational. A project conducted in South Australia, in 1994, trialled videoconferencing between teachers at the Open Access College with a family of three primary school age children living in a remote area and two medically disabled students living in metropolitan Adelaide. Results showed that the students in the remote area believed they had better contact with their teachers. The medically disabled students exceeded all expectations for improvement. The teachers involved in the trial had little or no experience at its commencement but became competent and literate with the technology. In addition, the parents and teachers developed a much closer relationship with each other (Hedberg, 1996). Hedberg (1996) concluded that, desktop videoconferencing:

- Enhanced the learning experiences of the students disadvantaged by their geographical location or medical ability.
- Increased the effective delivery of the teacher's lesson material.
- Offered excellent opportunities for sharing visual concepts and receiving immediate responses.
- Provided a tool for modelling work.
- Interactive, easy, enjoyable and fun to use.

Furthermore, Ramsey, Barabesi and Preece (1996) studied the informal communications produced by participants in desktop videoconferencing sessions. The results indicated that participants wanted to share an activity or objects. Secondly, the participants engaged in some form of mediated coupling or sharing. This study further supported the evidence that strong relationships were formed when participants engaged in DVC.

Similarly, Fetterman (1996) cited the relational benefits of electronic communication when he explained, "Electronic communication is a little more personal and a lot more effective when you can hear the nuances of tone and non-verbal language

such as gestures and expressions, ones you normally depend on face-to-face interactions" (p. 23).

More recently, Forlin, Keller and Thygesen (2003) employed DVC and the software program iVisit to promote the advancement of international comparisons in three different countries in the area of special education among tertiary students. This medium supported the constructive principles of cooperative learning, simultaneously providing motivation through real-time communication. The use of DVC technology allowed for the development of international partnerships that provided the opportunity for immediate access to educational practices across the globe. Desktop videoconferencing enabled the learner to become immediately familiar with current international practices and issues.

In summary Hyman (1996) stated that the key benefits of desktop videoconferencing were the interaction of many sites, equal participation, more relaxed method of control and informal communication among the participants

Conversely, there have been problems where technology has been used to support educational programs (Fishman, 1997; Jerram, 1995; Johnson, 1996; Ramsey et al., 1996). Many of the problems have stemmed from the failure of technology to deliver when needed. Adequate video/audio quality has been an issue in education as well as business. Images have been small, jerky, fuzzy and grainy and audio quality has ranged from good to bad to unusable. Thygesen, Forlin, Keller and Bachmann (2000) found that delays in audio transmissions decreased communication quality and they recommended that there should be many opportunities to practice this technology. They concluded that although the video was sometimes stilted, it was still possible to see and converse with international parties.

Subsequently, some interactions have been inferior (Halhed, 1996). Good lighting and a suitable camera were necessary to enhance the quality of the image (Rhodes, 1997). Similarly, the purchase of a good microphone was required to limit background noise. As Allen (1997) pointed out, desktop videoconferencing is not for everyone but is rapidly finding its place in the business world and at home. The number of DVC units sold in 1996 in the United States was 200,000 and the expected sales in the 21st century were in excess of 6 million in the business market and 14 million in the home market.

According to Pea et al. (1995), videoconferencing to desktops in K-12 classrooms has been rare, although many examples of distance learning with classroom-based videoconferencing exist. Learners and teachers needed highly interactive conversational involvements that provided common grounds for fostering learning communications and

"designs must be involved for how teachers and children will make use of these events for classroom purposes" (Pea et al., 1995, p .7).

Despite its problems, DVC has proved to be a popular way of communicating over the Internet. Teachers have seen the potential for their students and, in particular, for gifted students. This technology can be used to implement mentoring programs with students and mentors across classrooms, across states and across the world.

2.6 Technology: Where to Now?

The literature regarding educational technology has been full of glowing promises of dramatic and meaningful improvements to classroom activities and outcomes. Benefits have included higher order thinking, critical thinking, problem solving skills, relational learning and increased computer literacy for participants. But the mere presence of technology does not guarantee improved educational outcomes.

As previously discussed, Vygotsky contributed this idea that tools shape our understanding of the world around us. Computers, along with multimedia software and hardware, have helped us to express our ideas in virtual environments (Reilly, 1996) and these new technologies foster the active, collaborative learning advocated by constructivists (Collins, 1996).

Nevertheless, certain factors can profoundly affect whether technology is giving education a leap forward or creating a pitfall. According to Cuban (1986), teachers hold the key to its success or failure. Cuban advised that success depended upon teacher beliefs about teaching and learning and teachers being included in the decision-making relating to technology.

The following section reviews the issues that need to be considered when planning for a new innovation in the classroom. Firstly, access to the technology resources; secondly, training and support and finally, teacher leadership.

2.6.1 Accessibility

The provision of technology in schools has been very much a budgetary consideration of the principal or school business manager. Schools have faced a dual challenge that seems likely to remain the only constant amid changing educational technology; how to acquire technology resources adequate for today's needs while keeping

up to date with emerging trends that could affect future purchases and training (Roblyer et al., 1997).

As budget consciousness heightened and the expense of keeping up with the technological change increased, teachers experience difficulties when proposing expensive technology programs or resources that appear to be beneficial and hypothetical rather than proven (Roblyer et al., 1997). Although hardware costs have been high, they are rapidly decreasing. Such costs reductions, however, will be offset by the ongoing need to constantly update hardware.

Consequently, with any innovation, a school would need a technology plan that incorporated the creation of a merged vision, accessed the current status, stated goals and developed activities. Any implementation of the plan would need evaluation and revision (Brody, 1995). Dyrli and Kinnaman (1994) emphasised that the most important characteristic of a good technology plan was to have teacher training as a top priority. Dyrli and Kinnaman also added that successful technology programs hinged on well trained, motivated teachers.

2.6.2 Training and Support

Researchers generally agreed that properly trained teachers made all the difference to success or failure of an integration effort (Little & McLaughlin, 1993; Munday, Windham, & Stamper, 1991; Reibel & Wood, 1994; Sheingold, 1991). Carey (2003) emphasised that:

> It is important for school leaders to provide the time and support necessary for teachers to explore and experiment with the range of ways the technologies can be woven into the school environment and curriculum because the computer as a tool for students and teachers is not going to disappear (p. 13).

Most educators recognised the importance of teacher training in technology, however, what was rarely acknowledged was that "teachers will have to confront squarely the difficult problem of creating a school environment that is fundamentally different from the one they, themselves, experienced" (Sheingold, 1991, p. 23).

When technology has been integrated into the curriculum, Collins, Brown and Holum (1991) explained that these new teaching and learning environments have differed from those in the past. Collins (1996) added that staff development programs have to be concentrated on teachers as learners with more tasks being authentic and collaborative.

Collins (1996) concluded that when schools have begun using technology, which is fully integrated into the curriculum, there will be an emphasis on exploration and reflection of technology. This view has also been supported by Sandholtz et al. (1997): "When teachers are learning to integrate technology into their classrooms, staff development features include opportunities to explore, reflect, collaborate with peers, work on authentic learning tasks and engage in hands-on, active learning" (p. 142).

Similarly, other researchers have stated that teachers should not only view themselves as learners, but also take time to observe students using technology (Lieberman, 1995; Papert, 1993). Time will also be needed for educators to engage in opportunities to learn how to operate and integrate the new technology tools, to implement radically different curricular approaches and associated classroom management strategies and become facilitators of learning for students (Roblyer et al., 1997). Time taken to learn and observe technology will have a significant paradigm shift in teaching. This will significantly impact the school teaching allocation budget.

Similarly, time will needed for professional development. Professional development in technology applications to reform the learning environment has never kept pace with the purchase and distribution of equipment (Hawkins & Macmillan, 1993). Professional development needs to combine learning about technology with instruction in how to realise new learning conditions through the new teaching practices (Roblyer et al., 1997).

Although technology can serve as a catalyst for change, teachers need opportunities to reflect on their experiences. They need supportive school environments and the freedom to experiment. Both pre-service and in-service teacher training should be constructivist based and include teaching practices that mediate students' construction of their own understandings (Brooks & Brooks, 1993).

In summation, Brooks and Kopp (1989) and Roblyer (1994) have suggested ways of modelling technology by using it in regular activities of teacher education and in-service training. Suggestions included:

- Using cooperative learning activities, telecommunications-based projects and other non-traditional/non-lecture methods to carry out training.
- Using presentation software to teach groups and requiring its use for learner presentations to classes and other groups.

- Requiring use of technology products (e.g. software and video discs) in trainees' research projects or demonstrations for other courses or training workshops.
- Requiring learners to do research for class projects using online, CD-ROM, or disc-based databases.
- Having each learner develop and maintain a personal database of recommended teaching resources that includes technology products and projects.

It was also noted that effective training required exposure to new ideas. Resources should be placed so that teachers can apply what they learned immediately after the training experience.

It has become apparent that the traditional teacher role is being restructured. That is not to say that computers are replacing teachers but, rather, that the teacher has become a facilitator of educational technology. This will remain an important focus as schools continue to undergo curricular reform. Schools will increasingly use technology as a tool to support student and teacher inquiry rather than as a substitute lecturer or workbook (Means, 1994).

2.6.3 Teacher, the Leader

As the 21st century begins to unfold, a restructuring of the teaching profession seems imminent. The role of the teacher is now seen as the role of a leader or learning manager. The federal government of Australia has now endorsed university undergraduate degrees emphasizing the changing nature of the teaching profession. In some universities, such as the University of Central Queensland, a Bachelor of Learning Management has replaced the undergraduate teaching degrees. In addition, teacher leaderships, as a concept, may guide the development of the profession.

Crowther, Kaagan, Ferguson and Hann (2002) have proposed five premises that may direct the general education community as the post-industrial era has unfolded. These premises include the following understandings regarding teacher leadership. Teacher leadership:

- Is real.
- Is grounded in authoritative theory.
- Is distinctive.
- Is diverse.

- Can be nurtured.

Crowther et al. (2002) contended that when teacher leadership is seen as an entity in its own right and becomes widespread, there will be implications for school reform and the role of the teacher in a knowledge-based society will be profound.

Added to this is the existence of parallel leadership, as administrators and teacher-leaders exercise leadership simultaneously. Parallel leadership, as defined by Crowther et al. (2002), is a process whereby teacher leaders and their principals engage in collective action to build the school capacity. It has the capacity to embody mutual respect, shared purpose and allowance for individual expression.

Thus, the power of parallel leadership, according to King and Newman (2000), has residence in its connection to organisational capacity. The potential of this can be most appropriate to schools, where the creation of meaning from teaching and learning has constituted the core business. Consequently, teacher leaders can exercise influence well beyond their individual classrooms. Crowther et al. (2002) suggested that teacher leaders demonstrate how knowledge can be created and what new knowledge would look like. This has given further support to the writings of Drucker (1994), who stated that teachers are core knowledge workers, who will give the emerging knowledge society its character, its leadership and its social profile.

As teachers are seen as leaders and important stakeholders in the process of integrating educational technology into the curriculum, it becomes imperative that administrators listen to their voices. History has shown that early technologies using a top-down method did not lead to successful adoption by teachers (Cuban, 1986).

2.7 Notes

Teachers of gifted children have been acutely aware of the characteristics of gifted learners. These teachers have also been willing to invest time and energy into providing an appropriate curriculum to meet those diverse needs. The strategy of mentoring has been cited as a viable educational activity for gifted learners. Teachers have often gone to great lengths to find a suitable mentor for a gifted student. From the perspective of a technology that has rapidly changed the way people think, learn and live, a need has developed to provide an education that is both challenging and relevant. This has resulted in electronic mentoring; integrating technology into the curriculum while keeping in mind the individual needs of each learner has become a challenge for the teaching profession. Educational

technology has become a tool that can deliver instruction. It will not, however, ever replace the teacher. The teacher will always be at the heart of teaching and the relational attribute of the teacher will always be the catalyst for authentic learning.

In this technological era, schools with limited resources have to be creative and constructive given their budgetary restraints. Learning has to be authentic and relevant. Children have to be engaged in meaningful tasks that promote learning. Consequently, if teachers and children engaged in innovative practices, such as electronic mentoring and desktop videoconferencing, then authentic learning could be anticipated. The educator cannot assume but may only speculate. This, then, should be investigated; what kind of learning takes place when mentoring is conducted through desktop videoconferencing? The investigational practice of teachers has been cited as crucial to teacher involvement.

In the process of integration of educational technology teacher involvement has identified the best practices for success. Together, teacher-leaders and administrators or school principals, will make decisions and make a difference to the lives of many individuals. It would be wonderful for all teachers to empathise with this teacher, involved in a Queensland primary school, who wrote:

> We have learned to listen to each other, talk to each other and learn from each other, all because we have come to believe that as teachers, we are real leaders who can create new ideas. We know how to move mountains (Crowther et al., 2002, p. 19).

Chapter 3 – The Research Process

3 Introduction

This chapter is a description of the research process of the study being reported in this dissertation. The aim of this study was to investigate what kind of learning takes place when mentoring is conducted through desktop videoconferencing (DVC). By using emergent research design, the researcher was able to better understand the central processes in which mentors and gifted children were engaged. The research question was:

> What learning takes place when mentoring is conducted through desktop videoconferencing with gifted primary school children?

Qualitative researchers mostly research in natural settings. This required a research design that was flexible and easily adjusted as the research progressed. Smith and Glass (1987) have referred to this as a working design (p. 259), whereas McMillan and Schumaker (1984) referred to this as an emergent design (p. 179). Both terms are synonymous. What this design allowed for was a variety of data collection methods to better understand the engagement of the participants and an increase in the credibility of the findings. By using emergent research design, other ways of understanding a process could be included as the process unfolded (Weirsma, 1995). The components of emergent research design are summarised below in Figure 3.1

Working Design	**Working Hypothesis**	**Data Collection**	**Data Analysis & Interpretation**
Subjects to be studied Site Selection Length of study	Foreshadowed Problems Research Questions Generating Grounded Theory	Interview Oral Histories Specimen records Document Collection And Review	Data reduction Coding Data

Figure 3.1: Emergent Design

This procedure as proposed by Weirsma (1995) formed the foundation of the qualitative design for this research.

According to Lincoln and Guba (1985), the process of simultaneously collecting and analysing data allowed for important understandings to be discovered along the way. The specific purpose of the research was to understand the central processes of mentoring. If a theory did develop, then it is said to be grounded theory because the theory is grounded in the data rather than on an idea, notion, or system (Weirsma, 1995). For a theory to develop the context would have a level of conceptual density and would be grounded in the reactions and interactions of teachers, students and parents. The researcher endeavoured to reach a point of theoretical saturation (Strauss & Corbin, 1998), whereby each of the categories that comprised the substantive theory was fully developed and no new knowledge was forthcoming to change either the nature of the categories or the relationships between them.

The aim of the study was to observe and, if appropriate, develop a theory about the nature of learning in a mentoring context conducted through the use of computer technology. From the main research question, guiding questions were developed to initiate the data gathering process. These questions were then used as a basis for a semi-structured interview guide for mentor and mentee interviews. Further guiding questions were developed as the study enfolded. Finally, grounded theory methods of data gathering and analysis were used to ascertain whether a substantive theory had emerged from the study.

The remainder of this chapter is an outline of the methodology of the study in detail. There were six main areas. Firstly, the final research question within social and learning theory; secondly, the description of the participants; thirdly, an outline of the data gathering methods and data analysis; fourthly, the description of the methods of recording and data storage; fifthly, an explanation of the trustworthiness of the grounded theory and finally, the addressing of ethical issues which were associated with the study.

3.1 Theoretical Stance

In framing the research focus in terms of what learning took place, information and communication technology concepts were adopted and articulated within the symbolic interaction tradition of social and learning theory.

3.1.1 Social Theory (Symbolic Interaction)

Herbert Blumer (1969) first used the term symbolic interaction and argued that this theoretical approach was based on three principles:

- Human beings act towards things on the basis of the meanings the things have for them.
- The meaning of such things is derived from, or arises out of social interaction that one has with others.
- Meanings were handled and modified through an interpretive process used by the person in dealing with things encountered.

In selecting this position, as the theoretical approach underpinning the present research, the researcher will argue that it is important to explore the participant's understandings in the mentoring process. In particular, how they acted towards the technology, how they acted towards each other and how their understandings changed through the mentoring process. It is from an understanding of these dimensions that an understanding of the basic social processes or other processes involved can be developed.

3.1.2 Learning Theories

Learning theories have two chief values. One is that they have provided a vocabulary and conceptual framework for interpreting the observable examples of learning. The other has been in suggesting where to look for solutions to practical problems. The theories did not provide solutions, but they directed attention to those variables that were crucial in finding solutions (Hill, 1985).

The major theories of learning and teaching (behaviourism, cognitive constructivism, social constructivism and critical theory) have guided both the development of educational technology and its use in schools. These theories have lead to different approaches to instruction and differences in emphasis.

Firstly, behavioural approaches have tended to emphasise the need to break down complex subject matter into smaller segments that were taught one by one. Then they were combined to bring the student to an understanding of the larger, more complex concept.

Secondly, cognitive constructivists have argued that breaking down the content into smaller segments destroys the meaning and removes the material (to be taught) from its natural context. Cognitive constructivism was founded on the Piagetian premise that a child's knowledge of the world has been constructed through assimilation and accommodation. This has led the constructivist to believe that learning occurs best when it happens within a meaningful context. Constructivists have preferred situated instruction approaches such as problem-based learning, anchored instruction and cognitive

apprenticeships and their uses of technology have become more common in classrooms (Maddux, Johnson, & Willis, 1997). Constructivist applications have involved much more than merely assigning students computer time and have required considerable planning to ensure that resources were available when needed. They cannot, however, be fully pre-planned so that the teacher knows what to do at any particular moment. Constructivist teaching has called for flexibility, on-the-spot analysis and decision making and a comfortable confidence that students can learn and achieve with constant teacher-centred instruction and direction (Maddux et al., 1997).

Thirdly, social constructivism has derived as the other strand of constructivism. Social constructivism, proposed by Vygotsky (1978), emphasised the critical importance of interaction with people (other children, parents and teachers) in cognitive development.

Finally, critical theory has focused on political and power relationships in culture and the interaction of different groups in society. Critical theorists have argued that information technology, or technology in general, is not value free (Maddux et al., 1997). Critical theory has served as a framework for many critics of current practices.

All four theories have contributed to how technology should be used in schools and can lead to different approaches to instruction. The main research question was based on the four major theories of learning and teaching (behaviourism, cognitive constructivism, social constructivism and critical theory). In addition, a set of guiding questions was used. The intention of the guiding questions was to gain meaning as to the nature of learning that may be happening during the mentoring sessions. These guiding questions were to influence the development of the post-mentoring interview questions.

The guiding questions were:

1. Is the learning sequential or hierarchical?
2. Is the learning relational; that is, is it social and collaborative?
3. Are the teacher and student interactive in the learning process?
4. Are the teacher and student well motivated and challenged?
5. Is there equal access to technology resources for all students regardless of gender, culture and financial resources?
6. Are the student and teacher having fun?

By using concepts from social theory and learning theory, I was able to investigate learning within the context of the mentoring program with a particular focus of how the learning is affected and perceived by the participants. This then allowed me to better understand the characteristics of gifted learners, the teaching and learning of gifted

learners, information technology as an educative tool and teachers as leaders and learning managers.

3.2 Ethnographic Case Study

This study has drawn on ethnographic principles and methods that have allowed for a close inspection of the interactions of the participants. This approach allowed an exploration of how the participants constructed their knowledge and made sense of their learning. Attention was also made to any other behaviours that may have happened and assisted in the understanding of desktop videoconferencing (DVC) as a learning strategy.

The intimate understandings of the specificities of a case study approach, however, only allowed for generalisations of the particular case from which they derived. They were then extended in developing subsequent case generalisations (Stake, 1996). In this regard, the case study approach was established as the basis for naturalistic generalisation (Stake, 1996). This then allowed the reader to respond to and harmonise with the case study descriptions by engaging in similarities, likenesses and relevancies and by relating these to personal experiences and understandings.

One prominent aspect of case study research was the careful specificity delimiting its boundaries; that is, what was and what was not the case (Stake, 1996). This did not mean that this case stood in isolation. To the contrary, the specificities of the case were moulded by the wider society (Burns, 1998), which determined the possibilities and scope available to the individual within a given case.

Using an ethnographic approach, it was possible to recognise the larger social discourses and contexts which shaped the values, expectations and understandings of the participants. While the study's central focus was delimited to a thorough and detailed exploration of six mentoring cohorts, attempts were made to relate the impact of broader educational structures to the development of learning with technology. Specifically, the study sought to identify the learning that happened within the participants, which shaped and regulated the understanding of how people learn with and through technology.

3.3 The Site

Peace Community School (pseudonym) is situated in a predominantly middle class socio-economic area in an outer suburb of larger metropolitan city in New South Wales, Australia, with an enrolment ceiling of 1,300 students from a diverse range of familial

structures and socio-economic backgrounds. The student population was largely of Anglo-Saxon descent.

The school was positioned within a bush setting and accommodated a junior school (ages 4 to 8), middle school (ages 9 to 13) and senior school (ages 14 to 18) on the one campus. The junior school had three classes per grade that incorporated a streamed class of advanced learners in Year 3 and Year 4. Similarly, the middle school had advanced learner's classes in Years 5, 6, 7 and 8. The senior school (Years 9 to 12) streamed its core subjects and did not have a specific advanced learners' class.

The school was selected for a number of reasons. First, my association as a teacher allowed me open access to all the available technology hardware and support; second, the school selected children with special aptitudes and tried to address their needs with appropriate strategies; third, the school's philosophy was aligned to my own and fourth, the school - as a community of learners - had some prior knowledge of mentoring and no previous direct experience with desktop videoconferencing.

3.4 The Participants

At the beginning of Term 2 in 2000, a total of 33 students in the composite gifted class 3/4 were invited to join in the study and comprised 17 boys and 16 girls ranging in ages from 8 to 10. A letter detailing the study's justifications and research processes was sent home to parents/guardians seeking their permission for their child to be part of the study (see Appendix A). Following the return of this letter and follow up phone calls, 10 of the parents agreed for their child to participate in this study.

Similarly, teachers at the school were sent a letter to establish their interest in participating in this research (see Appendix B). Initially, no teachers responded to the letter of invitation. Subsequently, I visited staff meetings in each of the junior, middle and senior schools to further invite teachers to participate. It was at this point that eight teachers responded to the invitation.

What follows is an explanation of the process of selecting the mentoring cohorts and a description of the students and teachers and the implementation phases. For clarity, the students will be referred to as mentees and the teachers will be referred to as mentors.

3.4.1 The Students

The mentees in the study were aged 8, 9 and 10 and were in Grades 3, 4 and 5. With regard to the students, there was considerable diversity amongst them even though they were all categorised by the school as gifted learners. Regarding their gender, there was one female and five males. Males outnumbered females because more males than females volunteered to be part of the study. There was a significant variation amongst the students in their areas of interest and prior use of a computer. Two mentees had very limited computer knowledge, two mentees were confident on the computer and the other two mentees were highly knowledgeable about computers. They nominated themselves as being interested in taking part in the study and completed the application forms.

3.4.1.1 Simon

Simon was 10 years old and was in Year 4 at the beginning of the data collection period. Simon's parents were keenly interested in Simon's education. His father was a chief executive officer in the insurance field and his mother had her own business and worked from home. He was the youngest in a family of three boys. Simon was very much a homebody. His favourite holiday pastime was staying at home. He was involved in many extra-curricula activities outside the home, such as playing cricket in the summer and soccer in the winter. He learned Mandarin on Saturdays and piano lessons on Thursday afternoons. He enjoyed playing his violin but he equally enjoyed playing cricket and computer games. He had a quiet personality with highly developed verbal skills. He excelled academically, particularly in the area of mathematics.

3.4.1.2 Mark

Mark was 10 years old and was in Year 4 at the beginning of the data collection period. Mark's parents were very interested in Mark's academic development. Mark's father had his own computer consultancy business and was keenly interested in computers in schools. Mark's mother worked in the family business taking phone calls and assisting in the clerical duties of the business. Mark had an older sister who attended a private girls school. Mark shared his father's enthusiasm for computers. Mark was also interested in biblical issues since his father and mother had recently returned to Australia after serving in the field on a mission in Papua New Guinea. Mark was a bright, bubbly and active boy. He had highly developed verbal skills and his mathematical ability was outstanding.

3.4.1.3 Nick

Nick was 10 years old and was in Year 4 at the beginning of the data collection period. Nick lived at home with his mother, father and brother and two stepsisters. Nick was eager to join this project, as he did not have a computer at home at the beginning of the project. He was the second youngest boy in his family and had older sisters. His mother was a full-time nurse and his father was an electrical engineer. Nick was a keen cricket player and very excitable, to the point of giggling when he was happy. Nick was highly competent in all academic areas.

3.4.1.4 Sally

Sally was 10 years old and in Year 5 at the beginning of the data collection period and she turned 11 during the course of the project. Sally was the only female student in the study. She was the eldest child in her family. Both parents were older than most parents of 10-year-olds and in their late 40s. Sally had a younger brother who also attended the school. Sally's father worked in a managerial capacity in the telecommunications industry and her mother worked as an after school care coordinator. Sally was fanatical about dogs and craft. She was an avid reader and highly competent in all academic areas. Sally had never been seriously interested in computers before the study. Sally was highly excitable, to the point of being loud. Sally's teacher described her as a passionate and headstrong young lady, not unlike Anne in the classic novel, *Anne of Green Gables*.

3.4.1.5 Rhys

Rhys was 8 years old and in Year 3 during the study and was the youngest to participate in the mentoring project. Rhys lived at home with his mother, a businesswoman, who commuted regularly between Melbourne and Sydney. Rhys had a younger sister who also attended the school. The children had a nanny living at home. Their parents were divorced, however the children visited their dad regularly. Rhys loved to collect things and had an extensive general knowledge. He was keenly interested in his environment and enjoyed constructing with Lego. Rhys had a computer at home. Rhys was highly competent in all academic areas, with a very high verbal ability. Rhys's teacher described him as a gentle boy with an amazing general knowledge.

3.4.1.6 Sam

Sam was 10 years old and in Year 4 at the beginning of the data collection period. Sam's parents were keenly interested in Sam's education. His father was a minister of religion and his mother was a casual teacher but mainly stayed at home. Sam was the youngest and the only boy in a family with two older sisters. He was involved in many extra curricula activities outside the home, such as playing cricket in the summer and soccer in the winter. He played sport on Saturdays and guitar lessons on Thursday afternoons. He enjoyed playing his guitar but he preferred playing cricket and computer games. He particularly enjoyed chess. He had a quiet personality with highly developed verbal skills. He excelled academically, particularly in mathematics.

3.4.2 The Teachers

There were six teachers in this study with considerable diversity in their age, years of experience, subjects taught and personality types. Three of the teachers were male and three were female and all but one taught at the school. The other teacher worked outside the school in a commonwealth department. All the teachers were considered by their peers to be experts in their field, which included mathematics, biology, physics, computing, fine arts and theology. The youngest teacher was 21 years of age and the most senior was 54 years of age. Most of the teachers were familiar with computers. However, none of them had previously been involved with mentoring, videoconferencing, telementoring, or desktop videoconferencing.

3.4.2.1 Albert

Albert was in his early 40s at the beginning of the data collection period. He had taught in the social sciences for 20 years and was an expert in his field. Albert was fond of computers, science fiction and passionate about the stock exchange. Albert was a quietly spoken man who was well liked by his peers and the students whom he taught. Albert liked tinkering with computers and particularly enjoyed photography and graphics. He was married with three young boys who also attended Peace Community School. Albert had been at the school for eight years. He was very interested in the mentoring project, but did not initially respond to the first invitation. However, he did approach me privately and asked to be involved. His reason for holding back was that he wanted to give other teachers the opportunity to be involved.

3.4.2.2 Stefan

Stefan was in his early 40s at the beginning of the data collection period. His interesting career included spending time as a registered psychologist, a remedial teacher, university lecturer and a pastoral care worker. He had taught theology. Stefan had taught for over 15 years, 8 of those years having been at the Peace Community School. Stefan was an energetic man, with a passion for Christian service. In his additional role as mission coordinator, Stefan frequently took students and staff on mission trips inside and outside Australia. He was married with teenage children, one of whom attended Peace Community School. His interests were wide and seemly unconnected. He enjoyed participating in musicals, playing the drums, writing books and growing roses. Initially, Stefan did not respond to my invitation as he was away on a mission and thought he might not be available. After some discussions, Stefan saw possibilities for desktop videoconferencing in global situations, especially where he wanted to send mission trips. Stefan was interested in the possibilities of desktop videoconferencing for connecting with other Christian schools, especially in Africa.

3.4.2.3 Bryce

Bryce was in his early 30s at the beginning of the data collection period. He had only been at Peace Community College for 2 years, after leaving an exclusive girls school, to take up a promotion to become the College Director of Teaching and Learning. In this capacity, he was passionately interested in how children learn and how teachers teach. Bryce was married with a young family of three boys and one girl, all of primary school age. Trained as a science and physical education teacher, Bryce had been teaching senior school science and higher school certificate physics and chemistry for the past 2 years. He also taught general science to Grades 7 and 8. Bryce had been teaching for 14 years and enjoyed his work. Bryce was passionate about anything scientific and enjoyed computer technology. His other interests included playing, watching and coaching cricket. He was also involved in Little Athletics and loved reading and playing the piano. He was involved in the work of his church, where he taught Sunday school. Bryce did not initially respond to the invitation to be part of this project as he was relatively new to the school and did not get around to it. He saw the researcher privately to ask how the project was going and at the end of the discussion, asked if he could be included.

3.4.2.4 Alice

Alice was the most senior of the teachers and had been teaching at Peace Community School for 19 years. She was currently involved in a senior management position and had been for the past 10 years. Alice had been in the business/corporate sector prior to commencing teaching at Peace Community School as a corporate manager of human resources. She was well skilled in relating to people of any age in any circumstance of life; one of her many talents. Alice's interests were varied and diverse. She was also enthusiastic about Christian service and had led mission teams to Eastern Europe. Her other interests were antiques, craft, photography, dogs and music. As a young person Alice grew up in a vaudeville family who toured Australia competing in jazz and tap competitions. She was very attractive in her appearance, manner and personality. People were naturally drawn to her. Initially Alice did not respond by writing to be part of the project as she wanted to discuss it with the researcher first. She became keen to be involved in this project, because of her desire to be aware of what may shape the future of learning.

3.4.2.5 Gloria

Gloria was in her early 40s at the beginning of the research project. She was married and had two children who attended Peace Community School. Gloria was a biologist and worked in her field as a researcher. Gloria was very interested in insects and plants and was a fine musician. She played three musical instruments and was very supportive of the needs of her children. Gloria was a straight-talking person, very task oriented and very articulate in talking through any issues that were of a concern to her. She was highly intelligent, achieved well in all areas of endeavour and had a doctorate. She had high expectations for herself and others. She approached the researcher and asked if she could be part of the study. Initially she found out about the study because she had a son in the gifted 3/4 composite class and received a parent letter. Although her son did not want to be involved, the researcher was highly delighted that she was interested. Gloria was competent with computers and related well to young children, being the mother of two young primary school aged boys. It was also advantageous for Gloria to take part as she was a school parent and would be able to communicate a parent's perspective in the project.

3.4.2.6 Rosie

Rosie was 21 at the beginning of the data gathering process. She was a graduate teacher and very enthusiastic. This was her 1st year as a teacher of mathematics and her 1st year in a community school. Rosie wanted to do everything well and was keen to learn this new technology. She approached the researcher after delivery of the project at the senior school staff meeting. Rosie asked many questions and, after an initial overnight think about it, she was ready to begin. Rosie was also newly married and had the combined pressures of a new job and a new marriage. Despite this, however, she was keen to learn new technology. Her interests included chess, mathematics and music. Rosie was passionate about ancient history and cooking. Her husband was involved in repairing computers and this had given Rosie an additional interest in computers. Rosie and her husband were very involved in the youth work at their local church. They were planning to go into full-time church work in the future.

3.4.3 The Research Director

The author's role was that of research director who coordinated the participants, organised the mentoring sessions and trained the participants in the technology. If participants were not able to make their sessions and could not contact each other then the researcher assisted in communication and was also available for technical support should it be needed.

3.5 The Apparatus

Desktop videoconferencing required very little apparatus. With the availability of integrated services digital network (ISDN) and higher-bandwidth services, desktop videoconferencing could be used in most metropolitan areas. To participate in desktop videoconferencing each participant required a personal computer, a desktop video camera and a software program downloaded onto the personal computer. A microphone was needed for speech input with most applications. The researcher also used a mini-cassette recorder to record the interactions between the participants. Each of the participants was provided with all the necessary equipment.

3.5.1 Desktop Video Camera

The Logitech Quick Cam Express Web cam was used to connect the two participants in the mentoring sessions. The Quick Cam Express Web Cam shown in Figure 3.1 was a plug-and-play device. After plugging in the Web Cam it was then necessary to install the software that came with it. This took a few minutes and the participant was then able to capture photos and videos, make live video calls and participate in online discussions.

The rate of video frames went up to 30 frames per second at 320 x 240 pixels. Exposure and colour contrast could be set manually or automatically by the camera and the lens had a manual focus. With this camera, it was necessary to purchase a microphone. The Quick Cam Express Web cam was compatible with computers that run Windows 98, 2000, me or XP and have a USB.

Figure 3.1: The Logitech Quick Cam Express

Each of the participants was given a Web Cam to take home and install it on their home computer. After successful installation, they were invited to experiment by sending live emails to their family and friends until the researcher was ready to set up their mentoring sessions.

3.5.2 Microphone

Along with the Web Cam, each participant was issued with a microphone. The microphone needed to be of the highest sound quality available and as least intrusive as possible since children were not comfortable with such devices. The microphone used in the mentoring sessions was a Logitech. It was designed to screen out ambient noise by

having a highly directional pick-up pattern and was aimed directly at the participant's mouth. This microphone was worn close to the mouth by means of a crook. After plugging in the Web Cam, the participant also needed to plug in the microphone into the microphone sound ports usually located to the side of a laptop or to the back of a desktop computer. The microphone, as shown in Figure 3.2, was then ready for use.

Figure 3.2: The Microphone

3.5.3 Sony Voice Activated Mini-cassette Recorder

The Sanyo handheld mini-cassette TRC-3680 was used to record the mentoring sessions. The recorder was set up near the mentors only. It had a slide control for easy recording and playback. The unit was very small and unobtrusive. It took two AA batteries and there was a LED (Light Emitting Diode) indicator showing the battery level. It had a quick record and quick review feature. At the end of the tape there was a signal in the record mode. This unit did not fail in delivering what was required and is shown in Figure 3.3.

Figure 3.3*: The mini-cassette recorder*

3.5.4 iVisit Software Program

Most desktop video software applications had a feature called share application, which permitted instructors to share with remote students a whiteboard contained in the software package and residing on a desktop personal computer (PC). Software applications for presentations, word processing and spreadsheets were commonly shared resources.

Most share applications have enabled students to collaborate with the teacher as they viewed and/or revised presentations, reports, graphs and other types of documents. Students then have entered and revised data on these documents. When used to support instructional methods such as case studies, brainstorming and group discussions, desktop video, share applications have enhanced specific learning goals in distance learning environments.

At the time of the research study, however, most of these share applications could be quite threatening to young users. When conducting a conference there could be no guarantee that any other user, online, would not intrude on the conference. Participants could experience unknown persons intruding on an enlightening discussion. This intruder could be perverted and an inexperienced young person could unknowingly welcome an undesirable person into a discussion. To ensure the protection and safety of the children the researcher decided to use iVisit as the software program because it was possible to ensure privacy for the entire period of desktop videoconferencing. Since that time, a shareware software program called Yahoo Messenger has become available from http://messenger.yahoo.com/. It can be downloaded from the Internet, enabling two parties, who have exchanged a Yahoo identity to initiate and conduct a private conference.

During the research study, iVisit was the software program that enabled people to interact “live” simultaneously over the Internet. This software enabled the participants to see each other, through a small Web Cam connected to the computer. They could hear each other, using the external microphone and the computer’s speakers and could see text typed in a chat window. iVisit was marketed as a better option than e-mail or the telephone. iVisit had enabled people to communicate with each other over long distances at no cost or just the cost of a local phone call, even when they were on opposite sides of the world. Not only could participants hear each other but if each person had a video camera connected to their computer, they were also able to see each other as shown in Figure 3.4.

Figure 3.4: The participant

It was not necessary to have video capacity to use iVisit. The casual user may see the main advantage of iVisit as being able to talk globally and inexpensively.

When connection problems arose, especially when first learning how to use iVisit, there was a helping device called the chat window as shown in Figure 3.5. If the video or sound connection was distorted or unrecognisable, real-time communication was still possible by typing in a message.

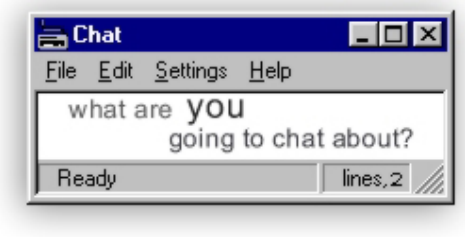

Figure 3.5*: The Chat Window*

One of the other advantages of using iVisit was its capacity to be a cross platform program working on both Mac and Windows machines. Different users could have different kinds of computers and yet all communicate in the same discussion at the same time.

Unlike other software programs that allowed other people to join in online discussion, iVisit participants could talk to others through public rooms within the iVisit forum, or create a private room for use by invitation only. Each private room was password protected and the participant who created the room emailed the password to the

invited guests. Guests had to confirm the password before access was granted. The iVisit software could be downloaded in either a Mac or Windows version, free from the iVisit Web site. No registration was required.

Each participant in the research study, downloaded iVisit to their computer. The researcher then set up a conference to enable them to practice with the software.

3.6 Implementing the Program in Two Phases

3.6.1 Phase One.

At the commencement of the study, the researcher introduced the mentoring program to the students and the teacher of the gifted class from which the students were drawn. The program was also explained to all teaching staff of the school during a regular weekly staff meeting. It was thought that by using on-site school mentors, the researcher would be able to sort out any technical problems should they arise. Students and staff were invited to join the mentoring program and prospective mentees and mentors were encouraged to read a *Modified Mentoring Handbook* (Appendix C). This is a modification of the existing *Peace Community College Mentoring Handbook*, as the original handbook did not include the provision for telementoring. Most teachers were not aware of the original mentoring handbook. The *Modified Mentoring Handbook* explained the program and contained the mentor application form, the commitment needed by the participants and the permission notes to by signed by the parents of the students.

When the returned application forms and permission notes were processed, a list was compiled of mentees and mentors outlining their areas of interest and expertise and interests. The mentors were then matched according to their mutual interests and preference for a male or female counterpart. The cohorts were matched according to their interests, as detailed in their application form, to become a mentor or mentee. A profile of teachers and children is displayed in Table 3.1.

Table 3.1

Information regarding children and teachers in the study

Cohort	Name	Age	Gender	Interests	Agreed Topic	Years Teaching
1	Albert	42	Male	Computing, Bible	Bridges	21
	Simon	9	Male	Chess, Bible, Computing		
2	Stefan	43	Male	Bible, Singing, Research	King David	12
	Mark	9	Male	Bible, Computing		
3	Bryce	35	Male	Science, Maths, Computing	Heart &	14
	Nick	10	Male	Biology, Computing	Astronomy	
4	Alice	54	Female	Craft, Music	Dogs &	10
	Sally	10	Female	Dogs, Craft	Craft	
5	Gloria	35	Female	Biology, Research, Computers	Insects &	10
	Rhys	8	Male	Games, Lego, Biology	Lego	
6	Rosie	21	Female	Ancient History, Computing	Ancient Rome &	1
	Sam	9	Male	Music, Cricket, Chess, Maths	Chess	

In August 2000, the first two cohorts were matched and given their desktop videoconferencing (DVC) workbooks (Appendix D). The DVC workbooks outlined how to connect with each other via iVisit (the Internet videoconferencing software program). This allowed the cohorts to set up a private room where the videoconference would take place. Included in the DVC workbook was an outline of the format for a suggested mentoring session and response sheets to evaluate each mentoring session.

Preliminary online practice sessions with the researcher were completed so that parents, mentors and mentees were familiar with the technology. The 10 weekly sessions were then scheduled. This proved to be somewhat difficult as, for a variety of reasons, there were interruptions. The 10 sessions were planned for one school term. In actuality, the 10 lessons spanned 6 months. Each of the sessions was audio-taped and then transcribed. Although parents were able to monitor each session, they were requested not to take an active part in the mentoring.

The participants (mentors, mentees and parents) were interviewed after their final mentoring session and the interviews were taped and transcribed. A semi-structured interview protocol or schedule was used with the participants. This included a short list of

set questions and a list of general issues that the researcher wanted to cover (Appendix M). The data being sought were reflections, evaluations and information that had not been previously thought of by the researcher. From the discussions with the participants, sound quality proved to be the most frustrating component. One of the mentors, Albert, found himself using the cordless telephone to establish a connection. He suggested that for the next phase, the lessons would flow better if a cordless phone were used. Consequently, in phase two, the participants were able to use a cordless phone if quality sound could not be established.

3.6.2 Phase Two

In March 2001, the second set of cohorts commenced their mentoring sessions. The methods of training participants, taping and transcribing sessions used in phase two were identical to phase one. The only difference was the option of a cordless phone for sound quality. The second set of cohorts completed their sessions at the end of 2001.

3.7 Tools of Analysis and Interpretation

This study utilised grounded theory methods of data analysis as outlined in the work of Strauss and Corbin (1998). The use of these methods involved "an intricate process of reducing raw data into concepts" (Corbin, 1986, p. 102) which was then developed into categories and related sub-categories as the basis of a theory. This, in turn, involved the use of explicit coding and analytic procedures, which were then designed to generate a theory, that was plausible (Glaser & Strauss, 1967, p. 105).

Consequently, the researcher was looking for common ground in social theory and the major learning theories and was aware that another theory may be emerging. That theory may be one that supported one learning theory and added to it. It therefore seemed appropriate to use grounded theory methods to investigate the learning that was taking place during mentoring sessions conducted through desktop videoconferencing.

When using grounded theory methods, data needed to be collected from several cases, sites and situations that had the potential to yield a richness of data pertinent to the study. These data were then analysed to commence the process of building a pattern of relationships that evolved into a theory (Glaser & Strauss, 1967).

The importance of density in a substantive grounded theory helped to relate very abstract levels of data (Glaser & Strauss, 1967) and was one of the essential criteria upon

which to judge the adequacy of a substantive theory that was inductively developed from empirical data (Strauss & Corbin, 1998).

In this study of "learning" the researcher used three types of coding. The coding procedures were applied flexibly in accordance with the changing circumstances over the 18-month period of data gathering, analysis and theory formulation. What follows is an explanation of three types of coding and how they were used in the study.

The analysis of data in this study involved coding, namely, open, axial and selective (Strauss & Corbin, 1998). Coding has been described by Charmaz (1983) as the process of categorizing and sorting data while codes were described as serving to summarise, synthesise and sort many observations made out of the data. As such, the coding provided the link between data and the conceptualisation (Bryman & Burgess, 1994). Throughout the coding process, questions were asked about the emerging data and comparisons made between the data, concepts and categories. Code notes and memos were prepared to represent the questions asked of the data, the comparisons and the relationships between concepts and categories as they emerged from the data.

Code notes and theoretical memos were written throughout the data analysis and theory development phases of the study. The intention of the code note was to describe and explain the conceptual label that emerged from the data (Strauss & Corbin, 1998). Whereas theoretical memos were developed to track the coding results and further stimulate coding (Strauss & Corbin, 1998). This thinking gave rise to relevant categories of concepts (Strauss & Corbin, 1998).

All data were examined and re-examined throughout, oscillating between collecting data, coding and writing memos. An example of a code note written in the early stages of data analysis is found in Appendix H.

3.7.1 Open Coding

Open coding was the process whereby concepts, drawn from the data, were identified, developed and categorised (Strauss & Corbin, 1990). During open coding the data was broken down examined, compared, conceptualised and categorised. Coding represented the gradual building up of categories out of the data. Simultaneously, the researcher was asking questions about the category or the property of a category to ascertain the meaning behind the incidents. Analysis, explanation and questions of the phenomenon can lead the researcher to new discoveries (Strauss & Corbin, 1998).

In this study, open coding commenced during the first cohort, August to December 2000 and continued throughout the 2001 school year. Each of the transcripts from all the mentoring sessions was coded on a line-by-line basis. Code words were written in the right hand margins of the interview transcript sheets (Strauss & Corbin, 1990) as illustrated from the third transcribed session from the first cohort and found in Appendix E.

Similarly, open coding was used in analysing the interviews. An example of open coding from interview transcripts, following the completion of the mentoring program, can also be found in Appendix F.

Evaluation forms submitted by parents, teachers and students was also the subject of open coding procedures. An example of open coding of evaluation forms provided by parents, teachers and students can be found in the Appendix G.

3.7.2 Axial Coding

While the primary purpose of open coding was to identify categories of data and their related properties and dimensions, in axial coding the aim was to fit pieces of the data puzzle together and make connections between each of the identified categories and its sub-categories. According to Strauss and Corbin (1998), the purpose in axial coding was to:

> Begin the process of reassembling data that was fractured during open coding….categories are related to their subcategories to form more precise and complete explanations about phenomena …… phenomenon, that is, a problem, an issue and event, or a happening that is defined as being significant to respondents. (p.124)

In this study, axial coding was employed by constantly moving between inductive and deductive analysis in an attempt to build up a dense texture of relationships around the axis of categories, which were generated from the data analysed through open coding (Strauss & Corbin, 1998). Hypotheses were made about the relationships between each category and its sub-categories. These were then tested by re-examining data previously gathered or by analysing new data about the phenomena represented by the categories and sub-categories.

Throughout the process of axial coding, code notes and memos were prepared to represent the relationships between categories and their subcategories. An example of an

axial coding memo that pertained to the categories "relating" which developed as a major process in the emerging theory is found in Appendix I.

3.7.3 Selective Coding

The aim of selective coding was to integrate categories along the dimensional level to form a theory, validate the statements of relationship among concepts and fill in any categories in need of further refinement (Strauss & Corbin, 1998). During the latter months of 2001, the researcher commenced integrating the categories generated and developed through open and axial coding into a possible theory about how learning took place through the strategy of mentoring and technology. This process of integrating categories was *selective coding* (Glaser & Strauss, 1967; Strauss & Corbin, 1998).

The process of selective coding began by developing a general descriptive overview of the story that represented the emerging theory (Strauss & Corbin, 1998). Throughout the process of selective coding theoretical coding notes were prepared. The aim was to ensure that the integrity of the theoretical framework would withstand close scrutiny and at the same time provide a high level of conceptual density and conceptual specificity. An example of a theoretical coding note written at the selective coding level is found in Appendix J.

Such theoretical memos were developed throughout the study to synthesise the data, concepts, codes and categories. In this way, the researcher arrived at a substantive theory about the research question. According to Glaser and Strauss (1967), "Substantive theory is a theory developed for a substantive, or empirical, area of sociological inquiry, such as patient care, race relations, professional education, delinquency or research organization" (p.32).

This contrasts with formal theory, which can be developed for a conceptual area of inquiry such as stigma, socialisation, or social mobility (Strauss & Corbin, 1998). Theories, however, do more than provide understanding or paint vivid pictures. They can enable the user to explain and predict events, thereby providing a guide to action (Strauss & Corbin, 1998). Substantive theory, can lead to the development of formal theory. According to Woods (1992), by making comparisons between the hypothesis developed from a substantive area of study and the analytic concepts developed in other fields it is possible to initiate formal theory which will, in turn, permit greater generalisation. A good substantive theory can provide an excellent stepping stone for attaining a powerful formal

theory; but even a good substantive theory can only provide the initial stimulus that moves the theorist toward necessary comparative work (Strauss & Corbin, 1998).

3.8 Recording and Storage of Data

All data were stored in hard copy and computer files. Interview recordings were transcribed, coded and filed. Evaluation forms were also coded and filed. Lists of conceptual labels and categories were generated and filed separately from the data. Code notes and memos were referenced and filed making retrieval easy for sorting and cross-referencing.

The systematic coding of transcripts, documents and observation notes and the methodical storage of code notes, categories and memos led to the development of a theory in which the categories, sub-categories and concepts could be traced back to the data. This was considered extremely important as a key component of credibility and dependability was demonstrated by the 'audit trail' (Lincoln & Guba, 1985).

The findings from the study are presented in chapter 4 of this dissertation. Throughout chapter 4, passages from the data are used to describe and exemplify the properties and dimensions of the theoretical categories. The passages were either direct quotations from interviews, or extracts from document.

3.9 Trustworthiness of the Developing Theory

The trustworthiness criteria were credibility, transferability, dependability and confirmability. These were articulated by Lincoln and Guba (1985), as they were concerned with determining the extent to which confidence can be placed in the outcome of a study. Since this was an interpretivist study, it was deemed appropriate to use the criteria of the interpretivist to evaluate the study in terms of trustworthiness, rather than use the more positivist criteria of validity and reliability.

3.9.1 Credibility

Credibility referred to the truthfulness of the data (Lincoln & Guba, 1985). Credibility was enhanced when strategies were put in place to check on the inquiry process and allowed the direct testing of findings and interpretations by the human sources from which they have come. The credibility of this study was enhanced by the period of data

gathering, the prolonged engagement of the researcher with the participants in the study and the data gathering methods.

3.9.2 Transferability

Although Lincoln and Guba (1985) posited that transferability was impossible in a qualitative study, it can be possible for researchers to develop theories that incorporate working hypotheses together with descriptions of the time and context to which they were found to hold true.

According to Geertz (1973) and Denzin (1978), when a study incorporated thick description then judgements could be made about the possibility of transferability to another situation. Strategies used in this study enabled judgements to be made about the transferability of the findings to other contexts, included the detailed analysis of interview transcripts and documents, the use of theoretical and purposive sampling and the logical and concise presentation of theoretical propositions accompanied by relevant examples from the data.

3.9.3 Dependability

Dependability referred to the criterion of rigour related to the consistency of findings (Guba, 1981). The development of an audit trail has become an accepted strategy for demonstrating the stability and trackability of data and the development of theory in qualitative studies (Guba, 1981). The permanent audit trail created in this study allowed the researcher, when required, to work from the beginning to the end to understand the path taken and the trustworthiness of the outcomes.

3.9.4 Confirmability

Confirmability referred to the extent to which the data and interpretations of the study are grounded in events rather than the inquirer's personal constructions (Lincoln & Guba, 1985). In this study, the audit trail enabled the study to be evaluated in relation to the following questions: Were the findings grounded in data? Were the inferences, which were based on the data, logical? Did the category structure have explanatory power and did it fit the data? Furthermore, throughout the research process and, particularly during the writing of the dissertation, the researcher was guided by a series of seven questions

developed by Strauss and Corbin (1998) that could be used to assess the extent to which grounded theory studies were empirically grounded:

1. Were concepts generated?
2. Were the concepts systematically related?
3. Were there many conceptual linkages and were the categories well developed and did they have conceptual density?
4. Was much variation built into the theory?
5. Were the broader conditions that affected the phenomenon under study built into its explanation?
6. Had process been taken into account?
7. Did the theoretical findings seem significant and to what extent?

3.10 Ethical Considerations

Ethics clearance was obtained from the University of Southern Queensland and the approval of the principal of Peace Community School to interview teachers, students and parents. Teachers and parents signed a consent form before participating in the study (Appendix K). The consent form contained a description of the purpose of the study, details of the data gathering methods, a description of the potential benefits of the research and an assurance that participants could withdraw from the study at any time.

All data were treated in a way that protected the confidentiality and anonymity of the teachers involved in the study as well as the students and their parents. Coding was used during the gathering and processing of interview notes, tapes and transcripts. Teachers were informed that their identity would remain confidential and would not be disclosed either verbally or in publications based on the study.

3.11 Notes

This chapter has summarised the methodology of the study reported in this dissertation. The aim of the study was to develop a theory about what learning took place when mentoring and was conducted through the use of computer technology. The study was restricted to a K-12 Independent School in a north-western suburb in a large metropolitan city in New South Wales, with a community of learners who had some prior knowledge of mentoring and had no previous direct experience with desktop videoconferencing.

In focusing the research in terms of what learning takes place, the decision was taken to utilise qualitative methods of data gathering and analysis proposed by grounded

theorists, such as Strauss and Corbin (1998). These methods were consistent with the study of human behaviour.

Data gathering took place using three major approaches of qualitative research, namely, recording the mentoring interactions, interviewing and document study. Data were based on six teachers, six students and six parents.

Grounded theory methods of data analysis were utilised in the study. Open, axial and selective coding techniques were used to reduce raw data into concepts that were, in turn, developed into categories and related sub-categories as the basis of the developing theory. Code notes and observational, methodological and theoretical memos were written throughout the data analysis and theory development phases of the study. Through the systematic coding of transcripts, documents and observation notes and the methodical storage of code notes, categories and memos, the researcher developed a substantive theory in which the categories, subcategories and concepts could be traced back to the data.

Categories and sub-categories of codes were developed during the data analysis. The codes were conceptually based and related to the research question. The first set of codes (technology, knowledge and relating) was so named, as they were the closest to the concept being described. Each unit of analysis, a sentence or phrase, was given a name and a suffix for distinguishing meaning within the category. For example, Technology was a concept code for computer hardware and software, Technology-SD referred to sound difficulty, Technology-VD referred to video difficulty, Technology-ID referred to Internet difficulty and Technology-GM referred to Garbled Message.

Once a code was assigned to a unit of data, the unit was read and a code assigned to it. If the new unit addressed the same topic as the previous unit, it was assigned the same code. If not, it was assigned a code that more closely matched the topic of that unit. This process continued until all the data had been coded.

The next step was to begin the process of selective coding each category. For example, a general descriptive overview of the story was written by way of theoretical memoing throughout the study. This enabled the researcher to capture the concepts and themes in the data, such as motivation and perseverance. In addition, as the theoretical memoing continued to a point of theoretical abstraction, the researcher was able to observe the emergence of the subcategories of each category and the processes embedded in the emergent theory. These findings are described in Table 5.1

The next chapter is a detailed exposition of the data analysis of this study.

Chapter 4 – Data Analysis

4 Introduction

This chapter is a description of the data analysis of the study being reported in this dissertation. The aim of the study was to theorise about the nature of learning in a mentoring context as conducted through the medium of computer technology. The study utilised qualitative methods of data analysis as outlined in chapter 3. During the data collection and analysis nine sub-categories emerged that allowed for the discovery of new understandings and conceptualisations related to interactive desktop videoconferencing. These sub-categories were the result of analysing the mentoring sessions of the six cohorts and interviews from the participants at the end of the data collection period. These nine sub-categories (clarifying, analysing, checking information, making judgements, higher order thinking, constructing knowledge, respecting, befriending and playfulness) form three categories (technology domain, knowledge domain and affective domain). These are shown diagrammatically in Figure 4.1

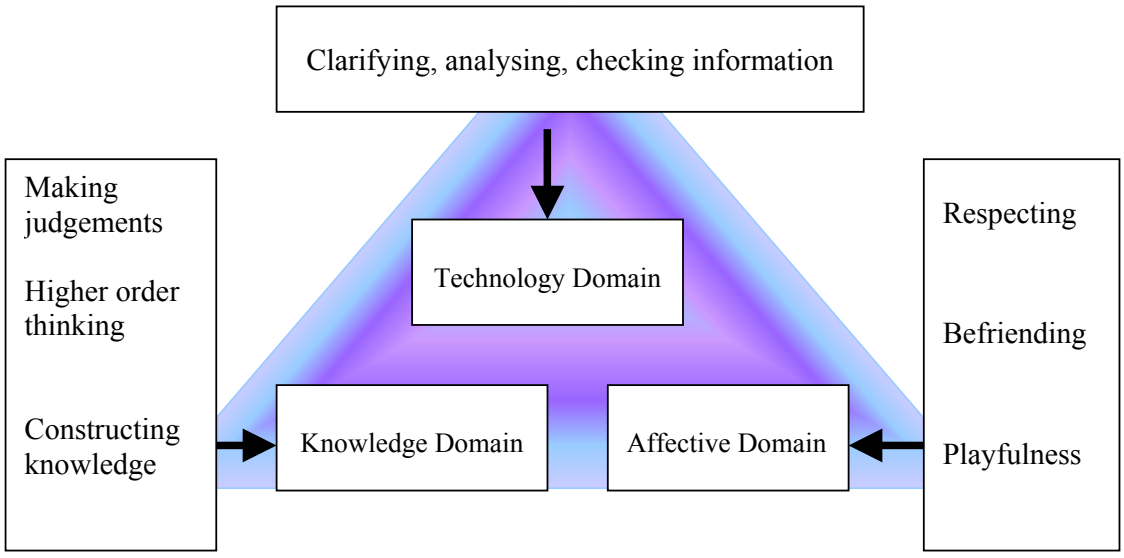

Figure 4.1: Categories and Sub-categories

In writing up the data, the researcher will explain these sub-categories and categories and then give examples from the data. The terms used to name the categories, Technology Domain, Knowledge Domain and Affective Domain are similar to those described by Bloom (1956) in his taxonomy of educational objectives.

4.1 Technology Domain

The Technology Domain was so named because it involved the computer hardware and software. The Technology Domain consisted of three sub-categories: clarifying, analysing and checking information. What follows is an explanation of each sub-category.

4.1.1 Clarifying

Clarifying was the term given to students and teachers as they learned about the specific computer technology and its capabilities. As such, it represented the range of strategies that mentors and mentees used to gain knowledge, prior to making decisions about how they will cope with it. It commenced at the time of their initial engagement with the technology and continued throughout the period of the mentoring relationship.

Mentors and mentees used a wide range of strategies when clarifying. The more formal of these strategies were the meetings with the researcher and information technology (IT) teacher. Informal strategies for mentors included discussions with colleagues and other school leaders and casual conversations with friends and family members. Similarly, informal strategies for mentees included discussions with the researcher and their peers, who were also involved in the mentoring program and casual conversations with their parents and family members.

While the combination of strategies used to gain information varied amongst mentors, the overall outcome was that during the mentoring period each of the teachers received a substantial amount of information about all aspects of desktop videoconferencing (DVC). Mentors used this information as the basis for making decisions about how they would respond to the new conditions encountered as they progressed with the online DVC. In particular, the information was used to guide their decision making in relation to what they deemed the important components of a mentoring session: teaching strategies, thinking skills and acquisition of knowledge.

The mentors in the study spent considerable amounts of their time clarifying. This was particularly the case at the beginning of the mentoring period when their experience with DVC was limited. Albert made these comments to the researcher:

> "I don't know if you've ever noticed but because you've given me a loan of the camera, I started to get interested in web cameras; type in web cameras, there's a whole directory, a whole wall there. It's just quite amazing, there are people that

are, a bit voyeuristic in that they have cameras in their homes and I didn't go into any of those, in fact there's a camera set up looking at Times Square, or looking at the surf at California; the beach at California."

Most teachers in this study found clarifying a novel experience. It represented the first occasion on which they had sought information to assist with the implementation of an innovative educational program without sharing that professional experience on equal terms with other faculty colleagues. The ongoing professional collaboration that often characterises the introduction of a new educational program was limited because DVC did not include any of the other teachers in the faculty. This experience of having to clarify issues associated with DVC, without faculty support, was not viewed in a negative light by the teachers in the study. To the contrary, the experience of being the only teacher in the faculty having some expertise and direct access to DVC was a positive experience. Rosie made the following comments in her post-mentoring interview:

Researcher - Did it bother you that no one else in your faculty was familiar with web cameras and DVC?

Rosie – no not really, it was great that I was the youngest faculty member and knew something that the others did not.

Researcher - Did you discuss it?

Rosie - Yes, they did ask me questions about it, especially Bert; he was really inquisitive, he likes fun things.

4.1.2 Analysing

Analysing was the process through which mentors and mentees closely examined all aspects of DVC. In particular, it was the process through which teachers and students analyse individual pieces of information and then reconciled them with their current understanding of computer technology. It was a process by which mentors and mentees built on to what they already knew.

Through the process of analysing, the focus shifted between understanding broad concepts of computer software and the small details of fine-tuning the software to suit the mentoring sessions.

As a direct result of engaging in the process of analysing DVC as a teaching medium, the overall understanding of mentors and mentees changed significantly during the mentoring period. The process of closely examining information about a wide range of

specific issues associated with educational computer technology as applied to DVC tended to have a cumulative influence on the overall understanding that mentors and mentees.

4.1.3 Checking Information

Checking was the process used by mentors and mentees to compare and contrast the information they received from different sources about DVC and educational technology.

As with clarifying and analysing, the intensity with which mentors and mentees in the present study engaged in the process of checking was greatest at the beginning of the mentoring period. At that time there was no definitive source of information to their many questions about DVC other than the researcher. As a result, mentors tended to seek out and compare the views and opinions of school administrators, experts, colleagues and friends about matters related to computer technology. The advice and opinions of these experts appeared to be an important element of the checking process.

Mentors also engaged in checking to reassure themselves about their work practices in relation to teaching strategies, higher order thinking skills and the selection of lesson content. They were eager to ensure that the school leadership team supported the work practices. In this regard, checking was used as a safety-first strategy to increase teacher confidence in managing particular aspects of DVC.

It also became clear that mentors and mentees could use checking as a means of satisfying their general curiosity about the validity of educational technology. In particular, mentors and mentees were very interested to gain the views of colleagues, peers and others about this educational technology.

Clarifying, analysing and checking information were mostly concerned with the educational technology. The technology component of the program was both exciting and frustrating for all the cohorts as from the moment they commenced mentoring there were difficulties with technology.

Cohorts 1 and 2 had the most difficulty with audio. Speech would sometimes be distorted and garbled at the beginning of the interaction and then become quite clear at the conclusion. The video would appear jerky or the frames would freeze. This unreliability of both video and audio persisted for each cohort throughout the study. Problems with sound appeared the most frustrating, with interruptions to the flow of communication, as recorded in Albert's mentoring session and Bryce's post interview:

> Albert - I seem to be spending all my time trying to get voice contact with him; very, very frustrating
>
> Bryce - The reliability of the technology is an ongoing issue that creates just enough interruption to the flow of learning to prevent getting a big enough block of accomplishment in any single activity period.

Mentors, Albert, Bryce and Rosie set about gathering information to help clarify these technology difficulties. Each of these mentors investigated the software program, iVisit, to further assist in the problem solving. Throughout the sessions, the mentors were independently analysing each situation and Albert's comment is an example of this:

> I think the problem has arisen; he's either forgotten what room we said we'd set up our chat room in, or he doesn't seem to recognise them

Similarly, mentees Simon, Mark, Nick and Sam were equally motivated in analysing the technology difficulties. The mentors encouraged their mentees and this is an example:

> Nick - Maybe if I do connect it into this computer we can use the chat. I've got the chat box up on here. Have you got the chat box up?
>
> Albert continually clarified and analysed information and predicted bandwidth and peak time with phone usage as the major problems:
>
> Albert - One thing I suspect will be a problem, there's going to be, because of the bandwidth those little cameras use up. I suspect that during the day, say for example at 5 o'clock to say 5:30, because that's a peak time with phones, it's going to drop out a lot easier, so it might be better to make it 8 o'clock to 8:30 and you know the phone traffic's going to drop off so you have less chance of it dropping out.

By the end of the 10 sessions, Albert was asked if he found the computer technology frustrating. His final comments, after checking through all the events, led him to conclude that he didn't find it frustrating, instead he found it interesting:

> Albert - No, I don't find it frustrating. I find it interesting because I'm learning how to use the Internet again and to better use iVisit. I have so much to learn.

For Albert and Bryce, the overall outcome of clarifying, analysing and checking was that the technology had potential. Acknowledgement was made that the technology had its frustrations. However, Albert and Bryce persisted because they believed it had potential for learning. This is shown below:

> Albert - The only thing is that the technology is not quite up to the potential, but its getting there, fast lines, the camera is certainly good enough; just look at the picture of that guy and us, it was great and the sound was fine for a while, I suspect in a couple of year's time it will really be red hot.
>
> Bryce - The technology? That's what we've got. I would see the benefits of it would outweigh whatever limitations there might be from time to time. We should be making use of it right now.

These mentors were making a reference to learning styles. For some students and teachers learning appeared enhanced if associated with technology. In these cases the frustration with technology problems did not hamper the willingness to learn.

Stefan also found the technology frustrating as he didn't achieve the interesting objectives he had set for himself and his mentee. The technology hindered the flow of the lessons and this was his major concern:

> Stefan - It was frustrating and it meant that we didn't actually achieve through what Mark's interest was, which was disappointing to him I suspect; he's a lovely hearted kid and that was good fun.

Simon and Nick also shared Albert's frustration with the technology. When asked, during his post-mentoring interview, what frustrated him the most, Simon replied that it was the technology that wouldn't do anything:

> Simon - When you are trying to talk or trying to listen and it just won't do anything, it won't cooperate with you.

Whereas Nick made comments during his mentoring sessions about the unreliability of the technology, he did not cite it as a problem in his post-mentoring interview. When asked about improving the program, he offered suggestions for different subjects to be studied and different teachers:

> Nick - I'd probably pick my subjects; do some things differently. And maybe more experience with a different teacher.

Cohort 3 (Bryce and Nick), Cohort 4 (Gloria and Rhys) and Cohort 5 (Alice & Sally) shared many common experiences with their technology. Their problems centred mainly on Internet difficulties. This is shown in the following excerpts:

> Bryce – Well, well, well. Fancy us having a few troubles like this! No good at all! Technology! That's what it's all about, Nick. Wonderful when it works, lousy when it doesn't.

> Bryce - There were times that were frustrating, for the simple reason that sometimes the technology didn't work. And you spent 40 minutes, in essence by the time you got hooked up sometimes 10 or 15 minutes of that was trying to get things rebooted or accessing stuff. So that was a little frustrating.

Gloria agreed that the technology was frustrating but also stipulated that the technology did add another dimension to the program in conjunction with what she believed to be the main benefit of the program which was the relationship between two people:

> Gloria - I think, the relationship is the main benefit, but if you put two people together, the technology adds an interest level to it, its unique and exciting and it does cater for the individual.

As the cohorts struggled with the technology, there were other processes at work to assist them in persevering with the program. These processes were making judgements, higher order thinking and constructing knowledge.

4.2 Knowledge Domain

This category was named, Knowledge Domain, because it involved cognitive skills and content. The Knowledge Domain had three sub-categories: making judgements, higher order thinking and constructing knowledge. What follows is an explanation of each sub-category.

4.2.1 Making Judgements

Making judgments was the process whereby teachers made initial judgments about the overall impact that desktop videoconferencing (DVC) was having on the mentoring session and about the implications of particular aspects of teaching with this technology. Through this process they assessed the impact that DVC was having on the content of the lesson, on the students learning and on their teaching. They did this by visualising what adjustments they had to make to their teaching style to accommodate the challenge caused by DVC. Their attitude toward DVC and the particular subject area chosen for mentoring was, in turn, influenced by the picture of how they envisaged teaching with technology.

Initial judgments that mentors made about DVC seemed to be strongly influenced by what they discovered about the technology from outside the classroom. As a result, the outcome of making judgments was largely dependent upon the accuracy and reliability of

information via the major processes in the technology findings, clarifying, analysis and checking by the mentors. In addition, the development of the mentor's initial overall attitude towards DVC, which was associated with the process of making judgments, was influenced by the attitudes of colleagues, school administrative staff, computer enthusiasts and other staff from whom the mentors had obtained information.

Mentors were consistently positive, optimistic and generally supportive about the use of DVC in the mentoring process.

The initial judgments that teachers made about the likely impact of DVC on the nature of learning were based on information received. Consequently these initial judgements were often modified and, in some cases, rejected as the teachers directly experienced computer technology. From the outset of the mentoring period and throughout the study, mentors remained positive about the mentoring sessions.

4.2.2 Higher Order Thinking

Higher order thinking was the process through which mentors challenged the students to analyse, synthesise and evaluate issues relating to key learning areas and special interest topics.

When the teachers engaged in the process of higher order thinking they were encouraging the students to think laterally about their chosen area of interest as well as the problems they were experiencing in the technology area. They encouraged the students to learn and sought ways of accomplishing this by assessing their own strategies and engaging in stimulating activities. During her interview, Gloria reflected on the fact that her ability to facilitate learning was challenged by her student:

> Researcher - What do you see as the advantages of this kind of teaching and learning?
> Gloria - I'm not sure its the technology, its just the way you learn really, its that learning through relationships, which a lot of learning is and this even more so and you can follow areas where the child is interested, but Robert didn't reveal that very much, he was much more of a compliant child; I want to do what ever you want to do, when in fact I think he did have opinions, until the last lesson, the very last one, he wanted to do Lego, can we look at this and can we look at that, I spent a lot of time trying to find out what he was interested in, which was bit of guess work.

The outcome of this process of encouraging higher order thinking skills significantly influenced the extent to which mentors and mentees made judgements regarding the burgeoning of their own knowledge in the mentoring sessions. It was found that all the mentors encouraged higher order thinking skills in the mentees.

4.2.3 Constructing Knowledge

Constructing knowledge is the process whereby mentees have, through questioning and reflecting, initiated their own learning and understanding as a result of high order thinking skills.

Significantly, the outcome of the process of constructing knowledge also influenced the extent to which mentors modified their teaching strategies during the mentoring sessions. Mentors viewed DVC as positive and they willingly modified their teaching to accommodate the needs of the mentee. The researcher's field notes record:

> Simon is rebuking Albert for spending so much time in small talk at the beginning of the session. Simon is frustrated as he wants to get on with the lesson and there is a suspicion that from now on Alan will change his style and move quicker into the lesson. Simon is very courageous.

Constructing knowledge was also strongly influenced by the learning styles of both the mentor and mentee, as well as the teaching styles of the mentors. Both mentees and mentors were learners in this study. Mentors and mentees increased their knowledge base in educational technology, special interest concepts and skills in relational learning. The learning styles were all consistent with Vygotsky's model of social constructivism. The dialogue that recorded the thinking of the mentors and mentees during the problem solving events supported this and examples are recorded in the section on supporting data.

Perseverance was a crucial factor in constructing knowledge. Technical difficulties seemed to increase the cohorts' perseverance. Each of the cohorts was determined to interact with each other and pursue the lesson despite any technological difficulties. This determination and perseverance was evident in each of the cohorts.

The teaching style of the teachers varied throughout the mentoring session and was dependent upon the needs of the students. In any session, mentors could be using exploratory learning at the commencement of the session and then, later in the session, substitute direct instruction because of the need for the mentee to acquire a new skill.

These three processes, making judgement, higher order thinking and constructing knowledge which have just been defined and explained, will now be supported by evidence from the data.

For Cohort 1 (Albert and Simon) and Cohort 2 (Stefan and Mark) numerous interactions took place in the chat box because the sound made it too difficult to sustain a conversation. This slowed down the sessions as the mentees and mentors were not competent typists. Albert, in his problem-solving style, gave his opinion as to how the frustrations caused by the technology problems could still prove beneficial:

> Albert - I suspect until the phone lines are fixed and we get more bandwidth, this sort of videoconferencing idea is going to be slowed down and you cant just do it instantaneously, but not to worry, it's still fun.

This sense of fun pervaded the mentoring sessions as Albert interacted with Simon. Learning usually commenced as the teacher made judgements as to how the learning process was progressing. Albert frequently made judgements about the effects of the technology on the learning process and often rationalised why this was happening, as shown below:

> Albert - We're looking at pictures of bridge climbing, over Sydney Harbour Bridge now and Simon is waiting for it to load. It takes a bit of time, unfortunately, having the video camera and the Internet open at the same time, it takes up a lot of bandwidth so things seem to go a little bit slower. I'm afraid the sound today hasn't been very good, in fact it's been hopeless, we're still motoring along, so we'll see how we go.
>
> I'm having more success tonight with the chat box than I'm having with the actual video and audio. We're communicating more freely and it's good, it's still a little bit slow and I guess that is because Simon is not a fast typist, but that's all right.

These comments and other extracts from the data indicated that Albert was keen to continue despite the frustration of the technology and slowness of the learning process. These statements were indicative of Albert's positive view of learning with technology. It wasn't only the mentors who were problem solving the technology but also the mentees. Mentee Nick was very helpful in posting solutions and helping Bryce with his learning of the technology, as recorded:

> Nick - Yep, go into windows and then go into the chat window. Are you typing it in the bottom box?

Throughout each session there was encouragement from mentors Albert and Bryce to think beyond the obvious. Both mentors used questioning in a way that behoved their mentees to use higher order thinking skills. These higher order thinking skills were used to review lessons as well as current issues. This is demonstrated by the following extracts:

> Albert - I've just asked him does he remember how to open up a web page and also keep iVisit open at the same time. It will be interesting to see what he writes. Yes, good, OK, alright, Yahoo.
>
> Albert - I found some more information about Sydney Harbour Bridge, what type of bridge do you think it is? Why do you think they call it a coat hanger?
>
> Bryce - Why can't you see those stars with your eyes? Why can you only see them through binoculars do you think?

Bryce and Gloria had more opportunities to engage their mentees Nick and Rhys in higher order thinking in the learning of the technology and the new knowledge gained from the special interest lessons they shared. The lessons were not interrupted as frequently by poor quality sound and this permitted the mentor to engage in higher order thinking through questioning and, consequently, allowing more time for in-depth knowledge for Cohorts 3, 4, 5 and 6 as shown:

> Bryce - Why do you think you wouldn't practice cardiac massage on a live person? Now when it goes past the lungs what is it doing? Why do you think the left side of the heart is big and strong?
>
> Gloria - So what is the difference between a spider and an insect? What do you think might want to live near a picnic table?
>
> Why do you think insects have different colours?

In addition to being able to engage in higher order thinking, Mentees 3, 4, 5 and 6 negotiated their own learning as encouraged by their mentors. This allowed them to construct their own knowledge and choose topics that were of interest to them at a comfortable level as shown below:

> Nick - Do you want to try the net again today? We'll go and try how stuff works and this time hopefully we'll get in body and health?
>
> Rhys - Is it possible if we keep on going with insects please?
>
> Sally - I want to go into flower pressing craft
>
> Sam - No, maybe go back to Ancient Rome

As well as allowing students to negotiate their own learning, teachers also used teachable moments to teach skills. This involved direct instruction as opposed to

exploratory learning. In sharing skills, the mentees were exposed to further knowledge. Bryce taught Nick how to use binoculars using the video camera, Gloria encouraged Rhys to write a creative story about a mosquito and Rosie taught Sam how to construct a mind map. The following quotes show the degree of lateral thinking was exhibited by these mentors in using the video camera as an adjunct to the acquisition of a skill:

> Bryce - They'll just bend in to fit the side of your face – that's right. Put them on and have a practise – see if you can get them small enough for you. They go pretty wide and I know they can open up very, very flat to fit in the case. Now can you squeeze them together and those eyepieces - close enough?
>
> Gloria - That's sensational, that's great, I really liked it; did you know that only female mosquitoes drink blood?
>
> Rosie - Can you hold it up to the camera. Hold it a bit higher. Direct it towards the camera. Oh, wow. It's coming into focus now.

The use of the video camera was a novel experience for most of the cohorts. While it could be used to promote learning it also proved to be a source of frustration. Throughout the learning, there was the ongoing presence and pressure of an unreliable technological connection. Subsequently, the learning was ubiquitous. Each cohort had to learn how to use the computer technology, solve any problems that interfered with the flow of the lesson, gain new knowledge in their chosen topic of interest and learn how to relate to each other. The mentors verbalised the difficulties and frustrations being experienced:

> Albert - I said, we'd better call it quits tonight, because the sound is going in and out of quality.
>
> (To researcher, on tape) The sound is terrible today, sometimes it's been good, other times it's dreadful. His picture is also breaking up on the screen, you know it's going blocky, he is typing something in for me, but I can't see!
>
> Stefan - Everything looks slow tonight, are you talking to me Mark? I've just typed everything looks slow tonight, I can't hear or see you, over, Try to get him to answer, my video picture is changing, once every 3 seconds, I just got a chat message, we have the same problem. I'm going to suggest we close down and reconnect, maybe we should close down our computers and try to reconnect.
>
> Nick - Ah, no! You're frozen
>
> Bryce - Can you close that box down – that ah, box that's got a frozen image in it.
>
> Bryce - Sorry about the problems today but we'll see you next week.

Alice - Well, unfortunately, my computer has just collapsed in the middle of it and then it went back to rebooting itself and now, I've just got to sit and wait, which is very frustrating. I don't know why. It did this the other day too. Can you go back?

Rosie - My picture of you is completely frozen. Oh it's coming back on now. What would you like us to cover today?

Frozen pictures, collapsing software programs and unreliable connections were some of the frustrations experienced by the cohorts. These frustrations, however, furthered the cohort's construction of knowledge in the area of educational technology. As the cohorts engaged in the mentoring process they were all constructing their own knowledge in the four levels: learning how to use the computer technology, solving any problems that interfered with the flow of the lesson, gaining new knowledge in their chosen topic of interest and learning how to relate to each other.

Overall, Albert and Bryce's judgements of the learning and with the technology, were positive for both themselves and their mentees. These judgments encouraged higher order thinking and enabled both Albert and Simon to construct a knowledge base of the technology and the interest areas being examined. Albert frequently made suggestions as to how to improve the sound and picture quality. Cohorts 1 and 3 were the most proactive in attending to the technical difficulties of the educational technology, as shown below:

Nick - Mr C, I've found out a way to do it. If you type really big on the computer, I can make it mirrored. So to um, on the computer use Word and type out what you want to say or put a diagram or something in there – you can down load that off the Internet. And then you go into view and you do angle, you can mirror it

Bryce - And spin it around? Well, that's a pretty clever idea

Albert - Simon, have you changed your picture to black and white. Try changing your picture in the settings button to black and white, it will make it easier

Technical difficulties seemed to increase the cohorts' perseverance. Perseverance is crucial to this type of learning. Albert showed patience and perseverance with the technology as he learned more about how it could be improved by trial and error of the various software settings. Not only was Albert sharing his love of geography and bridges but also he was instructing Simon on how to solve problems. This was also true for Bryce and Nick as they persevered with the technology. Bryce's love for scientific phenomena was not hindered by the unreliable technology. Bryce, however, was more visionary and looked for future possibilities. Both these mentors viewed the technology with perseverance and promise:

> Albert - the thing that we discovered from last Saturday night is that if you sacrifice picture quality for sound quality and probably the best thing to do is to put it on a medium picture size, medium picture quality I should say and that we facilitate in getting sound, you have that backed up with the, what do you call it, the dialogue box, the chat box, then that makes it a lot better as well again.
>
> Bryce - I think that the terrific thing is mentoring, as a concept is a brilliant idea. And for kids with special needs, of extension and enrichment is a wonderful opportunity. And the great benefits of this are that it opens the possibility of mentoring to kids who don't have physical access to these sorts of people. And while it might not reach the same degrees of success in penetration in terms of learning outcomes, as being able to be in one place at the one time, it's so far much further along towards that goal than not having it, or doing it via e-mail or doing it via just a speaker phone. It was great. The times when the picture got lost and all you had was the speaker, they were some of the most frustrating. So, fantastic for kids in isolated remote situations. Or the need for a mentor who can't come and be here, where they are, for whatever reason.

Encouragements from the mentors were evident in all interactions. Each of the mentors was relational, some more than others. Albert's manner towards Simon was always relational, sometimes to the frustration of Simon:

> Albert - so you asked me how things were going. I've had four or five or six meetings with Simon on the Internet as I said before we got wiped out, it's been difficult because I had to establish a relationship with Simon before I could talk about different bits and pieces; it took time to get to know him and I got a bit of the shock about two meetings ago when he said when are we going to start our lessons. That made me think that's right, I'm committed to do some work rather than just chatting away

4.3 The Affective Domain

This category was named the Affective Domain since it involved emotions, feelings, attitudes and relationships. This domain had three sub-categories: respecting, befriending and playfulness. What follows is an explanation of each sub-category. Throughout the mentoring program, there was a deliberate intention by mentors to build a relationship with their mentee. The choice of language and the use of it appeared to be

integral to the learning that was associated with the technology. Each of the cohorts used dialogue not regularly used in a classroom situation. Language chosen by the mentee and mentors was for specific purposes. These purposes will be now outlined.

4.3.1 Respecting

Respecting involved teachers and students choosing greetings and language that showed a mark of respect. The greetings were always polite, sprinkled with pardon, sorry and please and thank you. This respect manifested itself in a mutual regard for what each other brought to the relationship. It was not only the mentee who was overly polite, but also the mentor. There was a modelling of best practice for each participant in the cohort. By engaging in this process teachers and students attempted to interact using language that they believed would enhance the student/teacher relationship. The overall aim of this process was to make a positive impact on the relationship with neither party wanting to offend the other. This desire to be polite and respectful enhanced the relationship and learning experience of each cohort.

4.3.2 Befriending

Befriending involved the use of a variety of strategies, namely, making friends by friendly interactions such as asking personal questions pertaining to family, hobbies and school. For all teachers the befriending process tended initially to be focused on the student's family life. In particular, it was the brothers, sisters and/or parents. Some teachers then delved beyond this and targeted special interest or hobbies of the student. Yet other teachers took the additional step of asking questions about curriculum content or their specific area of interest.

The extent to which teachers befriended their students was somewhat dependent upon the personality of the teacher. There were some teachers who spent considerable time at the beginning of the session putting the mentor at ease. In one case this was to the frustration of the student.

Encouragement and praise permeated every session. When things happened to thwart the flow of the lesson, mentors continued to praise their mentees. Mentees were praised for their technical ability, their thinking skills, their ability to answer complex sentences and their ability to follow instructions and remember computer technology. Mentees did not imitate the encouragement and praise, but it did effect enjoyable

interactions between the mentees and mentors. Phrases were aimed at valuing the responses of the mentee, even when the responses were incorrect.

4.3.3 Playfulness

As well as befriending, mentors and mentees engaged in the use of playful language. The process of playfulness involved students and teachers joking when the technology was difficult and when, for a variety of reasons, conversations stagnated. In most cases, playfulness was motivated by the desire of mentors to establish and maintain an effective rapport with the mentee. This led to and resulted in productive outcomes for the mentee in the mentoring session.

Mentors used a variety of strategies in playfulness to put the student at ease during the mentoring session. This enabled the mentor to engage in questioning and problem solving which effected the creation of knowledge, as outlined in the previous section. These three processes, respecting, befriending and playfulness that have just been defined and explained, will now be supported by evidence from the data.

The mentors were very encouraging and frequently praised their students for their knowledge, skills and thinking abilities. The interactions were always polite and respectful. Humour played a significant role in coping with the technological difficulties. In spite of the difficulties, there was a sense of fun and excitement. Fun and perseverance were two of the elements for success in the mentoring process. All of the mentees found the experience to be motivating, with ‘fun’ being the most common word used to describe their pleasure:

Simon - Its fun when you are doing things, like work

Nick - Yeah. I had a ball. Heaps fun

Rhys - Yes, I really enjoyed it, thank you

Sally - I liked it because it was fun and exciting

Sam - Well, you actually get to play all the time so it’s a lot more fun.

Similarly, in the mentoring sessions there were many statements exhibiting high levels of mentee and mentor motivation. Coupled with the perseverance with the technology, was this pervading sense of fun, manifesting as a high level of motivation. These statements supported this view:

Bryce - Alright, look. I'm really looking forward to the next few weeks if we talk about some space and things like that – that'll be great- OK.

Gloria - When you collect insects you have to dry them out or they rot; maybe we could work out a way when you can collect some insects and you need special pins, to dry them, so you can keep them forever, would you like to do that?

Sally - Wow, look at this, aren't they gorgeous, oh, they're beautiful!

Sam - Fantastic, so let's have a look at that one then.

Gloria - I think he was motivated, I suspect he was given sufficient priority or opportunity; just the whole thing of coming together was a bit of fun.

Throughout the mentoring program, each cohort used very polite language in greetings and they all demonstrated good manners. They shared the language of respect. This respect remained throughout all sessions, as shown:

Simon - Have a good trip Mr B.

Albert - Thanks Simon, I'll speak to you from Grand Rapids,

OK, See you later.

Stefan - Sorry, Mark, what did you learn about David, in reading that passage.

Bryce - Good man. Carbon dioxide. And how does that get into our blood? Do you know that?

Gloria - Have you heard of a thing called biological control?

Rhys - No, I'm sorry, I haven't.

Alice - Oh, hang on. Sorry I made a mistake. Sorry, mine doesn't do capital D. Oh, yes it does.

Rosie - It's really good to be able to see each other, isn't it?

Albert and Alice spent the most time getting to know their respective mentees, Simon and Sally. In each mentoring session, Albert and Alice would ask personal questions as they sought to befriend Simon and Sally. These questions pertained to family, sport, interest, hobbies, homework, or schoolwork. These questions were usually at the beginning of the session after any technology issues had been rectified. Overall, the interactions were respectful and direct questions were used to engage the mentees in initial conversations, as shown:

Albert - What was your day today; did you have a good day today?

Simon - Yes I did, over,

Albert - What did you do, over?

Simon - I played board games and was listening to music.

Albert and Alice were similar in that they spent considerable time getting to know the students and making them feel at ease. They actively sought to ask as many questions as they could in order to know the mentees better. The other mentors, Stefan, Bryce, Gloria and Rosie also spent time in every session getting to know their mentees, however, these mentors had a swifter transition into the content phase of their session. The beginning sessions were similar to that of Albert and Alice, only much more concise:

Stefan - Mark, I'm going on mission tomorrow to Cooma. I'm taking my daughter.

Mark - What is your daughter's name?

Stefan - Her name is Bonita, she's very interested in this because she likes computers and also likes the Bible.

Bryce - Anything interesting happening over the past week?

Nick - We get to play cricket for the first time this afternoon,

Bryce- Who's we?

Nick - My two friends Tim and Shane and me and my brother.

Bryce - And is that part of the school team or a team outside of school?

Nick - It's down at the Dural Indoor Sports and Leisure Centre.

Gloria - Is there anything that you did in the week that you would like to tell me about?

Rhys - Yes, we had an athletics carnival and I was in the shot put.

Gloria - How did you go?

Rhys – Good, thank you.

Rosie- How are you Sam?

Sam- Good.

Rosie- Sorry to keep you waiting. How are you today?

Sam- Mmmm. It was pretty good.

Rosie- Oh, that's good. What sport do you play?

Sam- Oh, soccer, for the rest of the term.

The mentors set out deliberately to make friends with their students. The questions they asked were simple and direct. By engaging the mentee early in the sessions, the scene was set so that the mentee would not be awkward in future exchanges. These exchanges were mainly focused on school activities or recent events such as camps and holidays. The questions were literal and did not exert any undue pressure on the students. The mentors readily answered the questions.

Befriending was also evident in the encouragement and praise directed at the mentees. These phrases were to encourage and to affirm mentee responses. Throughout the mentoring sessions, mentors continued to shape the behaviour of their mentees by encouraging them and praising them. This affirmation made the sessions enjoyable for each participant and encouraged engagement in the learning process. It also gave feedback to the mentee that they were learning new skills, as shown in the following examples:

Mark - I think it was because he killed Goliath and that's why they considered him special.

Stefan - That's a very good answer, Mark, because that was the start of why they thought he was a special king.

Gloria - That's really cool, that's really excellent, did it take you very long to make?

Alice - Good! You're very clever.

Sally - Thank you.

Rosie - So the coalition is between what three people?

Sam - Pompey, Cassis and Caesar

Rosie - Excellent. So they were known as the first triumvirate.

The friendliness of Cohorts 1, 2, 3, 5 and 6 then allowed for playfulness. Playfulness was the third sub-category identified in relating to each other. Playfulness was demonstrated by the humorous language and actions of the cohorts with each party demonstrating and articulating a sense of fun and enjoyment.

Mentors Albert and Stefan enjoyed the humour that some situations presented as was evident in their playful language:

Albert - Simon you have to say that over. What, am I still a fish, what do you mean by that, over. Can you still hear me, it sounds like you're talking in a fish tank, over.

Simon - Pardon, over.

Albert - I can hear and see you very well. I'm sorry I sound like I'm drowning. I think it's the telephone line. Sorry, Simon, I think it's the phone lines that may be sounding like I'm drowning in a fish tank.

Albert- What is your brother doing behind you, over?

Simon- He is acting like a monkey, over.

Albert- He is a monkey.

Stefan - Mark, you sound like a dance record that has gone wrong, mate. It's very hard, do you think you can reboot so that we can get your camera working and maybe sound a bit clearer?

Sally - So, we're not there yet.

Alice - That's the story of our lives darling. We're always getting there, but we never quite get there!

Playfulness was not reserved only for the mentors. Mentees were also keen to be involved in playfulness. Using the camera to freeze expressions of his mentor and giggling at the picture showed Nick's playfulness and Sam was caught pulling faces at himself as shown:

Bryce - Oh, OK, I'll keep on waving (giggling)

Nick - I just paused you in mid air with some silly grin

Bryce - Thanks very much, I'll come and deal with you some time. See you next week.

Nick - See ya.

Rosie - Are you pulling faces at me or the computer.

Sam - At you.

Rosie - Sam, so rude!

Sam - I was only joking! (laughing).

Cohort 4 was the only cohort that engaged in telling each other jokes related to the topic that they were studying, in this case, space:

Rhys - Why should you never insult an alien?

Gloria - I don't know, why?

Rhys - Because he might get his feelers hurt?

As a consequence of the cohorts' respecting, befriending and playfulness, a strong relationship was achieved over distance, through the Internet, in a relatively short space of time. Their interactions were always polite and respectful in spite of the difficulties that they experienced in maintaining contact with, at times, unreliable technology. There was a sense of fun and excitement with humour and the motivation to solve the challenge of the technology playing a significant role in the learning experience. All of the mentors found mentoring a positive experience as indicated in their post mentoring interviews:

Albert - I have some fun trying to show Simon the techniques of having Windows open and the Internet, all at once. Also, as well as the difficulties of iVisit (and they have been difficult), particularly with the audio part, I've also had to teach him

how to use these other things, things like the buttons but that's fine. I've done this with Simon and with his two older brothers, with Andrew and with David and sometimes his mum and sometimes his dad, but that's fun that's good

Stefan - Yes, the main points are that it was lots of fun but very unreliable.

Bryce - Yes, I did find it enjoyable.

Gloria - It's unique and exciting and it does cater for the individual.

Alice - Indeed, I did enjoy it.

Rosie - Yep, just because it's novel and it's different. And we had lots of scope to do whatever we wanted each week. Like we could talk about ancient history or maths and then we got into chess. And that was really fun.

4.4 Notes on the Mentors

After the cohort's final session, the participants were individually interviewed using the semi-structured interview schedule. All the mentors seemed to enjoy the experience of mentoring despite the frustrations that were sometimes encountered. The mentors remained positive and motivated throughout the sessions and the following section demonstrates these traits.

Albert continued to enjoy the experience of mentoring and was very encouraging when colleagues asked him how things were going. Albert has a love for learning and this was exemplified by the perseverance he showed in finding out how the technology worked and how it could be improved. Albert also involved other members in Simon's family and showed them how the software worked. He was inclusive in sharing this technology with those who wanted to learn.

Similarly, Stefan enjoyed the mentoring experience although he was not as technically astute as Albert. This lack of computer technology did not deter him from enjoying the mentoring experience. Stefan was more focused in completing his lessons and sought ways of compensating for the poor technology.

Stefan was not as keen to use the technology again. After clarifying, analysing and checking, he would not use it again until it had been further refined. In his post interview, Stefan explained that he liked the idea of finding technology where he could prepare material ahead of time, talk about it, send excerpts that he had found, read through, discuss and reflect upon it.

Bryce enjoyed the mentoring experience and could see the benefits and possibilities of this program. He saw it as limiting in that learning outcomes may not be met to the same degree as with conventional teaching. He saw it as a wonderful opportunity for special needs children. There was no evidence of an improvement in learning.

Gloria was very computer literate and analytical about the program and its capabilities. She was more interested in the relational value of the experience.

Alice was not very proficient with computer technology. She did however, persevere with the technology and even when the Internet connection continually failed, she remained positive about the capabilities of the technology.

Rosie, the youngest mentor, was quite balanced in her analysis of the mentoring program. She was able to see the educational possibilities, but also the financial restraints that videoconferencing would demand as a preferred teaching strategy.

The following dialogues were the views expressed by the mentors after their last mentoring session:

> Stefan - This type of project, yes, but not with this technology. I wouldn't recommend it. I think in principle, the project is terrific; it needs to be modified, so this technology doesn't dominate.
>
> I like the idea of finding a technology where we can prepare material ahead of time, talk about it, send excerpts that I had found, to read through, discuss, reflect upon and if they are sending material, especially when you can edit into stuff, send that back down the line, look at this material together.
>
> Bryce - So fantastic for kids in isolated remote situations. Or the need for a mentor who can't come and be here where they are, for whatever reason
>
> Gloria - I'm not sure it's the technology, it's just the way you learn really, it's that learning through relationships, which a lot of learning is and this is even more so and you can follow areas where the child is interested.
>
> Alice - Rather than doing distance education, you can actually have a teacher, actually going through a program and learn. They can do whatever they want to do and feel that they're taking part and talking to someone who is real, rather than in writing. You can actually see the person up on the screen; I think it has huge potential.
>
> Rosie - I see it as being really useful for things like school of the air or rural teaching. I don't see it taking over the face-to-face method that we have at the

moment because economically if they can put one teacher in front of 30 students, then they're going to do that instead of computers.

4.5 Notes on the Mentees

Similarly, after the final mentoring session, each mentee met separately with the researcher and was interviewed using the interview schedule. All the mentees seemed to enjoy the mentoring experience despite the frustrations that were sometimes encountered. The mentees also remained positive and motivated throughout the sessions. There were no apparent differences between the mentees and the mentors in terms of motivation and perseverance. The mentees were not as articulate in the interviews as the mentors but the following dialogues are an expression of their views:

Nick - Yep, it was great.

Simon - It was fun.

Rhys - I really enjoyed it.

Sam - It's a lot more fun.

Sally - It was fun and interesting.

Mark - It was fun.

4.6 Notes on the Cohorts

The relational style of each cohort was not disadvantaged by the technological difficulties. To the contrary, these technological difficulties posed a different set of problems to be solved and were intrinsically motivating, enhancing the interactions between the mentees and mentors. There were many similarities amongst the cohorts in their love of learning, keen interest in computing and relational style. The language was engaging and stimulating with a warm manner that pervaded each session and contributed to the motivation and perseverance of the cohort in their continuance of the program. This warmth was evident in these excerpts, taken from the transcripts of the final mentoring sessions, all of which are supportive of relational learning:

Albert - That's a very good idea to go over. I'll just wait here and see if you come back. I can see the picture now, over.

Simon - OK. Mr B, I can see your picture, over.

Stefan - Well done Mark, it's been good tonight, let's hope we have another good session tomorrow night. I'll see you then, Bye.

Bryce - Hope you have enjoyed it Nick, I've really enjoyed the 10 times that we've seen each other.

Nick - Yep, it was great.

Bryce - Again I say, I invite you warmly.

Nick – OK.

Bryce - If you ask, I can find out anything you want to know, I'd be very happy to talk with you.

Nick – OK.

The last three sub-categories, respecting, befriending and playfulness, reflected the enthusiasm and enjoyment that each of the participants experienced while in the mentoring program.

4.7 Notes

This chapter is a description of the findings of the study reported in this dissertation. The aim of the study was to observe and develop a theory about the nature of learning in a mentoring context conducted through the medium of computer technology. The study utilised qualitative methods of data analysis as outlined in the chapter on methodology. During the data collection and analysis, three categories, each with three sub-categories and processes emerged. These emergent categories and sub-categories were the result of analysing the mentoring sessions of the six cohorts and interviews from the participants at the end of the data collection period.

By listening to the tapes and analysing the transcripts of the mentoring sessions and interviews, the researcher was able to gain insights into the thinking of the participants and to make sense of the similar and dissimilar interpretations and lines of thought that can be drawn from the mentoring program conducted through the medium of computer technology.

In drawing this chapter to a close, the researcher asked the questions: What has been discovered? What has emerged from the data? and concluded that three categories had emerged, each with three sub-categories. These categories and sub-categories illuminated the complexities that had been created by the impact of technology on both learning and teaching during the learning process.

From these findings, the researcher now poses the next set of questions: What does this mean? Is a theory emerging about the nature of learning in a mentoring context conducted through computer technology? This will be discussed in the next chapter.

Chapter 5 - Discussion

5 Introduction

This chapter is aimed at drawing meaning from the results of the study reported in chapter 4. It will be argued that these findings support the emergence of a theory about the nature of relational learning in a mentoring context conducted through computer technology. The theory will be explained through three sets of propositions and diagrammatically represented so that the reader's discernment is enhanced. In conclusion, the researcher has drawn on previously held understanding about the nature of learning to illuminate the diversities and complexities that have become apparent from these deliberations.

In review, the results of the previous chapter described the emergence of three categories or domains (technology, knowledge and affective skills) consisting of nine subcategories (clarifying, analysing, checking, making judgements, higher order thinking, constructing knowledge, respecting, befriending and playfulness) that mentees and mentors engaged in when mentoring through the medium of desktop videoconferencing (DVC).

The first category, the Technology Domain, involved processes whereby the mentors and mentees working with the technology were also engaged in learning. In addition, they were learning about the software program (iVisit) and the hardware through clarifying and examining specific aspects of the technology. In analysing the technology issues and checking with other colleagues and information sources, further understanding and meaning was achieved.

The Knowledge Domain represents the second category and comprised processes through which mentors made judgements as to the impact of the learning occurring within mentoring interactions. The purpose of these judgements enabled mentees to initiate their own learning and, as a result of higher order thinking, construct their own knowledge.

In the third category, the Affective Domain, mentors and mentees started to develop a working relationship, described as befriending and in the selection of language used by the participants was associated with the practice of respecting. The quality of this relationship was then actualised in playfulness as part of the learning process. Mentors and mentees engaged simultaneously in all three categories (domains) and nine sub-categories. Pedagogy sustained each of these domains and stimulated the learning processes. How these processes were enacted is found in Table 5.1.

Table 5.1

The Categories, Sub-categories and Processes Employed in Mentoring

Categories	Subcategories	Processes
Technology Domain	Clarifying	Examined specific aspects of educational technology
	Analysing	Analysed the issue at hand as presented by the technology with perseverance
	Checking	Persistently sought information from multiple sources and compared responses
Knowledge Domain	Making judgements	Continually made judgements about the effect of the technology on the learning process
	Higher order thinking	Stimulated participants to analyse, synthesise and evaluate issues with perseverance
	Constructing knowledge	Highly motivated to initiate own learning and understanding as a result of higher order thinking processes
Affective Domain	Respecting	Respected each other by using polite greeting and demonstrated good manners
	Befriending	Friendly interactions and asking personal questions motivated continuation of relational behaviours
	Playfulness	Engaged in joking and light hearted interactions to create an atmosphere of enjoyment, humour and trust that motivated continuation of these skills

5.1 Global understanding and emergent categories

The aim of this study was to investigate the type of learning that takes place with mentoring conducted through desktop videoconferencing. By using emergent research design, a clearer understanding was gained of the central processes that encapsulated the

learning of mentors and gifted mentees. The researcher proposes three sets of inter-related propositions that have emerged from the data that give an explanation as to a possible developing theory.

5.2 Set 1 Propositions Regarding the Technology Domain

1. The participants examined specific aspects of educational technology. It was not a progression that moved through a particular sequence. Rather, it was an ongoing dynamic interaction whereby the participants continually engaged in the processes of clarifying, analysing and checking information.
2. The participants persevered in their analysis of the technology issue at hand that, despite its frustrations, motivated participants and resulted in enjoyable learning experiences.
3. The participants persistently sought information from multiple sources and compared their responses, simultaneously learning educational technology and content. Pedagogy sustained this domain. Technical ability did not limit engagement of participants in the learning experiences.

5.2.1 Clarifying

As the participants were continually engaged with the technology, clarifying was evident throughout the period of the mentoring relationship. Clarifying was necessary as the mentors used this information to guide their decision making in what they deemed the important components of a mentoring session: teaching strategies, thinking skills and the acquisition of knowledge. Mentees also used clarifying to ascertain what they needed to do to fully engage with the technology. The skill of clarifying was satisfying, motivating and rewarding to the participants.

5.2.2 Analysing

Similarly, analysing also motivated the participants. As the technology was somewhat unreliable, the participants were continually analysing the problems presented which assisted the participants to fine tune the software to suit their mentoring sessions. Analysing can be closely associated with perfectionism, a recognised character trait of gifted learners and cited by researchers such as Terman (1926) and Welte (1996). Perfectionism has driven gifted learners to overcome obstacles and challenges and in this

study, DVC became the challenge that motivated the participants to overcome technological obstacles that hindered learning.

5.2.3 Checking

The mentors and mentees continually checked or evaluated the views of others concerning the technology which resulted in positive relationship outcomes in addition to proving highly motivational for the participants. Similar findings were also reported by O'Neill et al. (1996) and Wighton (1995) when they investigated the relationships between teachers and students with online mentoring. In this study, DVC contributed to positive relationships between the participants while the technology provided support for mentor teaching practices and learning. This also supported the earlier findings of McGee (1998) who investigated learning in telementoring contexts, reporting a high incidence of teacher learning.

Pedagogy sustained this category. Despite the technological difficulties experienced, there was an acute awareness by the mentor that they each participant had to learn both the computer technology and the lesson content, a dilemma that has always existed and likely to persist. Studies conducted by Goldman et al. (2000) found that once teachers experienced an engagement with technology and saw students "shining" and moving beyond expectations, they were willing to cope with the tension created by the resulting competition for attention.

As mentors and mentees simultaneously clarified, analysed and checked technology information, they were engaged in critical thinking processes consistent with the current literature regarding the characteristics of gifted learners and teachers of the gifted (Borland, 1989; Welte, 1996). Critical thinking involved a logical and systematic examination of the problem. This ability to think critically when using computer technology has been cited by educators such as Vochell and Van Deusen (1989).

In summation, the participants engaged in all the processes of clarifying, analysing and checking in all sessions. Several possibilities can be offered to explain what happened in the Technology Domain. It could mean that the learner, or participant, had to engage in these processes of clarifying, analysing and checking because the technology required these processes in order for learning to take place. It could also mean that the learner had to have these skills as necessary prerequisites for engaging in DVC. Alternatively, it could mean that both dynamics occurred simultaneously. That is, the learner needed some skills

as a prerequisite to commencing the engagement, yet needed to be prepared to have these skills extended.

Based on the data in this study DVC involved the following technological processes:

- Participants were involved in clarifying and that required an examination of all the specific aspects of educational technology.
- Participants were involved in analysing and that required technological issues to be analysed with perseverance.
- Participants were also involved in checking information from multiple sources and comparing their responses with each other.

5.3 Set 2 Propositions Regarding the Knowledge Domain:

1. The Knowledge Domain was not a progression that moved through a particular sequence. Rather, mentors and mentees continually engaged in the processes of making judgements about the effect of the technology on the learning process, higher order thinking and constructing knowledge.
2. The Knowledge Domain involved participants analysing, synthesising and evaluating issues as well as motivating them to persevere, resulting in enjoyable learning experiences. DVC provided a learning environment that supported the creative characteristics of gifted learners.
3. The participants were highly motivated to initiate their own learning and understanding as a result of higher order thinking processes. Pedagogy involved the simultaneous learning of content and educational technology while continuously engaged in relational learning and social-constructivist activities.

5.3.1 Making judgements

As a result of the desktop videoconferencing experiences, participants increased their understanding of DVC, improved their knowledge and skills in their chosen field of interest and heightened their perceptions about the relational side of the teaching and learning process. How this learning occurred was also related to their learning styles, cognitive processes, motivation, attitude to technology, social processes and their inherent characteristics as gifted learners.

From the commencement of the DVC experience, participants engaged in making judgements prior to acting or responding to each other and the pervading technology.

Making judgements or evaluating was crucial to the learning process. According to Borland (1989), the process of learning; what to learn, was not value free. This was evidenced in the research by observing and making decisions on strategies to be used to develop the mentees' cognitive processes that assisted in the motivation and perseverance of the participants.

5.3.2 Higher Order Thinking

In persevering with the DVC, the participants used higher order thinking skills to solve problems regarding technical difficulties and to respond to questions related to lesson content. Higher order thinking has been cited by researchers such as Borland (1989) and Welte (1996) as an attribute that gifted learners possess as an intellectual trait and using DVC facilitated the learner exercising this characteristic of giftedness. Higher order thinking was intrinsically motivating to the gifted learner and gave the learner a sense of pride and satisfaction in achievement. This was precisely what Borland (1989) described as being what teachers wanted for gifted students. That is, they wanted to see effort and ability as positively related. It would seem that DVC was a mechanism whereby gifted learners developed their intellectual skills in the technical and knowledge domains, thus supporting Borland's earlier proposition.

5.3.3 Constructing Knowledge

The use of higher order thinking provided further evidence of the mentors employing pedagogies that were consistent with constructivist teaching practices (Brooks & Brooks, 1993; McNabb, 1997). In the mentoring sessions the mentors:

- Allowed mentee responses to drive lessons, shift instructional strategies and alter content.
- Inquired about mentee understanding of concepts before sharing their own ideas.
- Encouraged mentee dialogue.
- Encouraged thinking by asking open-ended questions.
- Allowed mentees time to answer questions.

Although DVC was well suited to the constructivist teaching approaches based on the theory of cognitive constructivism as proposed by Piaget (1963), it appeared to have its best fit with social constructivist teaching approaches that have a greater emphasis on the

interaction between teacher and student (Vygotsky, 1978). During the interactive DVC sessions mentors used social constructivist teaching styles to facilitate learning and this style was emulated when the mentors were flexible with their lesson content (i.e. continually analysing and making decisions on the spot). This style was also emulated when mentees negotiated their own learning and made curriculum decisions.

Consequently, mentoring using DVC allowed for knowledge to be constructed based on interactions between the mentors and mentees. The mentors interacted with the mentees and modelled appropriate language as they taught directly through the video camera skills; for example, how to use binoculars or construct a mind map, how to construct a wooden model of a mosquito and how to conduct simple science experiments. Mentors use of guided discovery, modelling and coaching, as well as beliefs and thinking all affected learning. Learning and understanding required interaction and conversation. The mentors guided and helped the mentees to construct their own understanding through dialogue. This has given support to the social constructivist theory that was foundational to the Vygotsky concept of the zone of proximal development, where the mentor aided the mentee's learning by providing explanations, demonstrations and discussions.

This also provided further support to situated learning theory in recognising that learning ultimately could only be established by and not for the learner (Collins et al., 1989).

Based on the data in this study, DVC involved the following pedagogical processes:

- Participants continually engaged in making judgements about the effect of the technology on the learning process. Mentors facilitated the learning by providing external support to the mentees such as hints, feedback, models and reminders referred to in the literature as the Vygotsky zone of proximal development.
- Participants involved in higher order thinking stimulating participants to analyse synthesise and evaluate issues with perseverance. This also involved mentees in reflecting on their progress and comparing their problem solving to their own performance and that of their mentors.
- Participants engaged in initiating social constructivist learning and teaching. The mentees received conceptual scaffolding and they modelled their performance on their mentor.

5.4 Set 3 Propositions Regarding the Affective Domain:

1. The participants respected each other by using polite greetings and demonstrated good manners. Participants were motivated to persevere through relating which resulted in pleasurable learning experiences.
2. The participants engaged in friendly interactions and questioning motivated a continuation of these relational behaviours.
3. The participants engaged in joking and light-hearted interactions to create an atmosphere of enjoyment, humour and trust that motivated continuation of these skills. The more the participants related the more they wanted to relate to each other.
4. In the Affective Domain, the relational practices of respecting, befriending and playfulness during DVC proved continually engaging for the participants and provided an environment that supported relational learning. Pedagogy also sustained this domain.

5.4.1 Respect

Throughout all the mentoring sessions, the cohorts continued to use respectful language. Respect was evident in the first half of the mentoring sessions when the participants greeted each other. The process of respect was cited by Otero (2001) as a permeating condition for enhancing all phases of relational learning. Relational learning, proposed by Otero (2001) was a radical new look at how relationships make learning possible. This was clearly apparent in the ongoing mentoring sessions. In the desktop videoconferencing sessions, respect was enacted by mutual regard for what others brought to the relationship. It meant honouring the uniqueness and value of each person in the relationship. This may mean that the dynamics of the traditional authority relationship between teachers and students proposed by Townsend and Otero (1999) need to be altered. This may further support respect, a mutual regard for what others bring to the relationship and the need to reconsider how relationships facilitate learning. This should not be considered surprising as studies have shown that gifted students were more socially valued and active than their peers (Dauber & Benbow, 1990; Gallagher & Crowder, 1957; Grace & Booth, 1958).

Furthermore, respectful mentoring using DVC allowed for knowledge to be socially constructed based on situated learning. That is, knowledge was situated and partly a product of activity, context and culture (Seely et al., 1989). The mentees were assisted to help construct their own understanding of the agreed topic. The mentors provided the cognitive scaffolding that helped the learner make sense of the topic.

5.4.2 Befriending

Befriending, or the act of making friends, was part of the socialisation process in this study. Mentors and mentees actively befriended each other. Initially, the friendship that developed between the cohorts was based on the discovery of similar interests, similar beliefs and similar values but those friendships quickly grew into relationships of intimacy. This supports the findings of Rubin (1980) that we consciously seek and choose friends on the basis of similarities. The age difference was not a deterrent to friendship. This was evidenced, for example, when Gloria was keen to engage Rhys in friendly interchanges and encouraged bringing in insects (whether alive or dead) to show each other via the video camera; Stefan and Mark were keen to talk about Stefan's involvement in his missionary trips.

Sayler (1997) identified the quality of friendships as a key issue for the gifted population. The relative social and emotional maturity of the intellectually gifted population allowed them to see intimate friendship centred on an exchange of feelings, insights and confidences. This may explain why the mentees exhibited signs of social maturity and had relative ease in befriending their mentors. Gross (1989) proposed that levels of giftedness were attributed to the ease with which intellectually or academically gifted mentees found or formed friendships. This behaviour of seeking friends of similar ability was consistent with behavioural characteristics of gifted learners (Jones, 1992) and was evidenced in the level of maturity each mentee brought to the relationship and their ability to sustain it with a previously unknown adult.

Each of the mentors exhibited a meditated personal presence whereby there was a sharing of personal information at the beginning of each mentoring session. The importance of these exchanges had also been cited by Ferneding-Lenert and Harris (1994) as contributing to the success of telementoring projects. Over the course of the mentoring sessions the participants continued to share personal information and events that occurred in their daily lives and these exchanges contributed to building their relationships.

Examples of sharing personal information, disappointments, highlights and personal achievements abound throughout the transcripts of the mentoring sessions. For example, Albert shared his excitement about his overseas trip; Rhys described his holiday with his grandfather; Gloria shared her joys of being a mother; Nick shared his anxiety over witnessing a car accident and Bryce often shared insights and topics that he thought would motivate Nick.

The sharing of information about family experiences, hobbies and other events had much to do with relational learning. DVC provided an opportunity for participants to feel connected socially. This desire to be socially integrated supported an earlier study of Anderson and Harris (1997) who also found that students needed to feel connected socially. To successfully participate in DVC, both participants needed to engage in friendly interchanges. As the relationship developed into friendship, there were benefits for both mentee and mentor. These benefits included companionship, stimulation, affection and intimacy as previously identified by Erickson (1963), Fromm (1957) and Sullivan (1953).

5.4.3 Playfulness

It was only possible for the participants to engage in playfulness because both parties felt safe and secure. According to Ryan (1991) relationships have to be at a certain level of intimacy where each party feels connected to each other. For example, mentors Albert and Stefan continually jollied about the audio difficulties. Light-hearted phrases were used to diffuse the frustration caused by the unreliable technology.

Playfulness, according to Otero (2001) was that condition of spontaneity, involvement, growth and self-governance, which produced longer lasting and satisfying engagement in the relational learning process. Playfulness in the DVC sessions fuelled itself, in that the more the participants played, the more they wanted to play. This was highlighted in the mentoring sessions when mentees Nick, Simon and Sam pulled faces into the camera and played tricks with the camera to seemingly upset their mentors. These acts of tomfoolery appeared to be a result of attempts to socially engage mentors.

According to Gross (1993), Hollingworth (1942), O'Shea (1960), Silverman (1989) and Terman (1926), student's play interests and preferences were strongly determined by their stage of cognitive development and tended to resemble those of students some years older. Interestingly, this could explain why intimate relationships blossomed between

mentees and mentors. The mentors were highly intelligent, enthusiastic, stimulating, imaginative and motivated to achieve and these traits were absorbed by their mentees. These characteristics had been previously identified by researchers such as Bishop (1968), Hultgren and Seely (1982) and Whitlock and DuCette (1989).

Based on the data in this study DVC involved the following affective and pedagogical processes:

- Mentees and mentors shared a mutual respect for each other. They used polite language and demonstrated good manners.
- Mentees and mentors actively sought to befriend each other by asking personal questions. This friendliness motivated the continuation of relational behaviours.
- Mentees and mentors participated in friendly exchanges that resulted in playfulness. They engaged in joking and light-hearted interactions to create an atmosphere of enjoyment, humour and trust that motivated a continuation of these skills.

5.5 Motivation and Perseverance

Frustration with the desktop videoconferencing technology seemed to challenge the mentees to participate in problem solving and highlighted the character traits of perseverance and persistence. This gave further support to the work of Bryant (1989) and Renzulli and Reis (1991) who cited motivation and persistence as the most single recurrent traits of productive gifted students.

Mentoring using DVC had an optimistic quality in motivating learning. Computer technology, as the source of the motivation, was intrinsically motivating and personally satisfying for all the participants in meeting challenges such as inaudible sound, jerky pictures, a somewhat unreliable Internet provider and the occasional inability to connect via email. Using DVC required the learning of new skills and the practice of those skills and in learning the same technology mentors and mentees were able to assist each other in the learning process. Hence, teaching and learning with DVC was a relational experience that appeared to enhance the relationship between the mentor and the mentee.

Other researchers, for example, Ferneding-Lenert and Harris (1994); Fulton (1992), Moore and Karabenick (1992) and Sandholtz et al. (1997), who have studied the impact of technology in classrooms, have also cited high levels of motivation in students and

teachers. Fun was the word often used by students in describing the mentoring process and DVC was motivating because it supported learning. Mentors learned along with their mentees; directing the provision of information aimed at mentee questions as well as collaboration during mentoring projects. This mutual learning is also reported in the work of McGee (1998).

Similarly, mentoring using DVC also required perseverance. This perseverance in gifted children has sometimes been referred to in the literature as persistent, goal-directed behaviour driving absorption, passionate interest, extreme dedication and an unwillingness to give up (Clark, 1997). These were all phrases used to describe the energy, perseverance, commitment and motivation of highly creative individuals (Amabile, 1985). This was evident in each of the mentees.

The educational technology was both exciting and frustrating for both mentors and mentees. The exciting moments when the technology was performing well were highly motivating and stimulating for the participants. The frustrating moments challenged their skills in problem solving and tested their levels of perseverance. They had to be patient with the technology when it failed and had to have faith that the technology would be restored to usable levels. Fishman (1997) and Johnson (1996) also found similar results in their research regarding perseverance with technology.

DVC was aimed at developing a relationship between the mentor and the mentee. This relationship was also affected by the elements of perseverance and motivation. The category of Affective Skills had many similarities to that of relational learning as proposed by Otero (2001). Relational learning, enacted through DVC, embraced the human connection: connection of self to self, of self to others and self to content. Mentoring using DVC was where dialogue connected and reconnected and built, stored and changed relationships.

These three sets of propositions, together with the overarching aspects of motivation and perseverance, represent a developing theory. To encapsulate these propositions the following story line is offered to enable the emerging theory to be conceptualised (Strauss & Corbin, 1998).

5.6 A Developing Theory

The following “storyline” captures the relationships between the categories, sub-categories and processes comprising the developing theory. The researcher has chosen to

tentatively name this theory techno-socio-constructivism (TSC) as it incorporates the categories of technology, knowledge and affective skills. When mentors and mentees engaged in mentoring through desktop videoconferencing (DVC) they were learning through the process of techno-socio-constructivism.

Initially, the cohorts had some positive experiences of success and had reason to believe that they would be successful in subsequent projects. The willingness of the mentors to engage with the mentees and help them share their expertise was a factor that contributed to the desire to persist with the technology and this permeated each of the DVC sessions. In addition, the mentors reported personal and professional benefits from participation in DVC activities that contributed to each cohort's decision to continue. DVC appears to fit well in learner-centred, constructivist inspired environments. The mentor's philosophy of teaching was found to be important in the use of this technological innovation and provided an open-ended activity that could be adapted to meet the plans of both mentors and mentees.

Furthermore, the mentees recounted that DVC contributed to their personal satisfaction that motivated them to continue. DVC matched their desire to use computer technology and fostered some of the characteristics of gifted learners. DVC provided intrinsic motivation in the learning process and fostered perseverance to the task that intensified the motivation. Mentoring conducted through the medium of computer technology seemed to ignite a driving absorption and passionate interest that motivates highly creative individuals. Motivation and perseverance were key elements in the TSC theory. Of importance was the relational learning that developed between the student and the mentor. A key issue for gifted learners was the need for intimate friendships centred on exchanges of feelings, insights and confidences. Mentoring through DVC provided a vehicle for making friends and forming lasting relationships with like-minded individuals, devoid of age or socio-economic factors.

Of paramount importance was the connectedness of the three domains; technology, knowledge and affective and this tended to form the foundation of the TSC theory. Mentors and mentees appeared to engage simultaneously in all three categories with each category permeating through to the other. The desire to use and learn computer technology stimulated constructivist and relational learning. Similarly, constructivist learning stimulated relational learning and a desire to use technology. Relational learning stimulated constructivist learning and a desire to use technology. Integral to the themes that were interwoven throughout the processes were perseverance and motivation. This

TSC theory is presented with caution, remembering that this was a small sample and restricted to only one school. Techno-socio-constructivism, as a model of employing mentoring using the medium of DVC is represented diagrammatically in Figure 5.1.

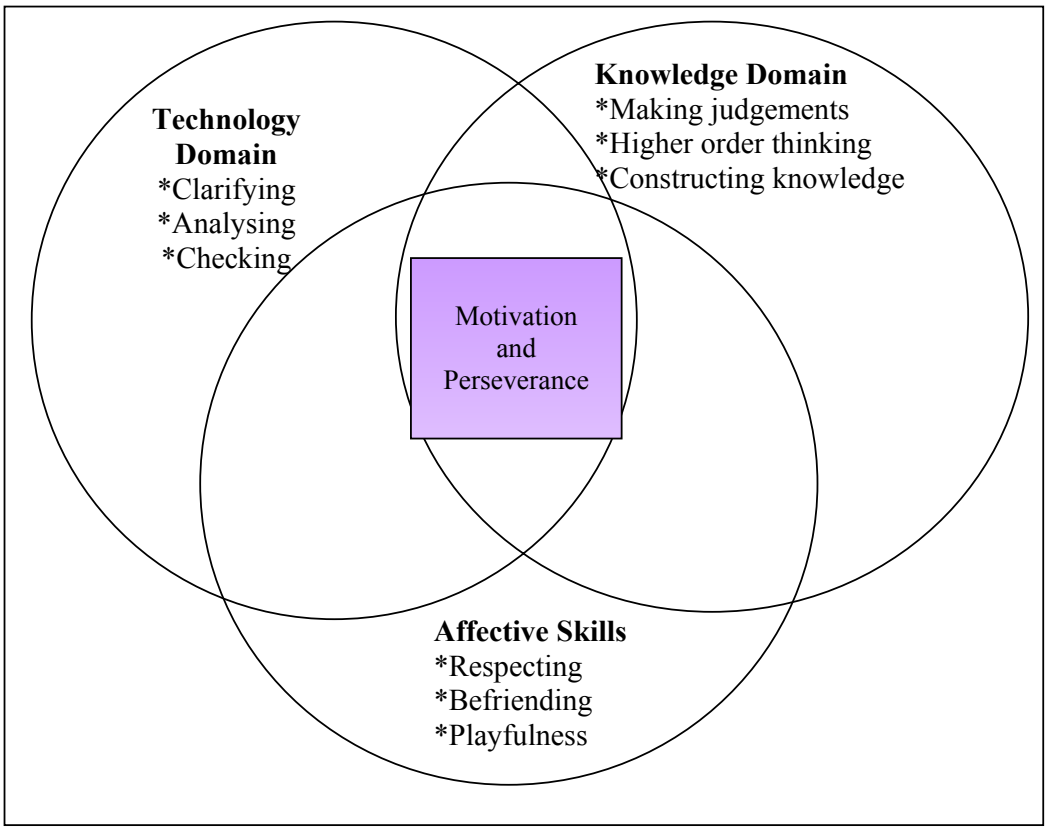

Figure 5.1: Techno-socio-constructivist model of employing mentoring using the medium of desktop videoconferencing (DVC)

5.7 Notes

In drawing this chapter to a close, the researcher again asks the question: What has been learned and what new understanding has been gained about the nature of desktop videoconferencing (DVC) learning? To which question, the following is now posited.

The researcher understands more about the complexities of technology. It is unreliable yet has the potential to motivate learners to persevere in the quest for knowledge and relationships. Learning how to use technology and learning with technology are two facets of the one inseparable identity. The complexity of educational technology can complicate the efforts of educators to integrate computer-driven media into classroom activities. Technical support for educators is a necessary accommodation that will allow innovative practices in education.

The researcher understands the diversity of learning through DVC. Learning is ubiquitous. Learning, using computer-driven media, such as DVC, can lead to new processes in learning. Traditional learning theories such as behaviourism, social constructivism, cognitive constructivism and critical theory contribute to the mentor's philosophical premise. Although social constructivism is the leaning theory most aligned to educational computing, new processes may emerge as learners continue to engage in educational technologies.

The researcher understands the need for the relationship that both learner and mentor bring to the mentoring sessions. This relationship is about respect, friendship, playfulness, motivation and perseverance. DVC is as equally about relational learning as it is with technology learning and content learning. Relational learning enables the learner to relate to ideas and feelings and develops the process of critical thinking, conveys knowledge of self in society and establishes a common base of understanding. Relational learning does not see the mentee as a computer to be programmed or the mentor as the programmer, but as a marvellous blend of mind, body and spirit with whom to be engaged.

The researcher understands more about the cognitive and affective needs of gifted learners in that socialisation and emotional development is as important as cognitive development. These cognitive and affective needs of gifted learners seem to promote relational learning, highlighting a new way of seeing the learning process. Relational learning is a process of recognition, understanding, valuing and relating. Throughout the process, it provides a caring, nurturing environment for the learner, which transcends personal fears about the learning process. It promotes community. The researcher also understands that this means that rather than groups of age peers, grouping gifted learners with similar abilities is of paramount importance for gifted mentees and that gifted students should be provided with an environment that is conducive to their superior cognitive and social levels of development.

There is understanding that there is a focus on education as a consequence of globalisation. This means a shift from the notion that everyone is a learner; everyone is a mentor, to one in which everyone is a learner, mentor and leader. Learners, mentors and leaders all play leadership roles in terms of making decisions, acting on the decisions made and teaching responsibility. Mutual respect is the primary norm of behaviour. Educators need to be respectful in their interactions with young people and to model respectful interactions for them and vice versa.

In conclusion, chapter 5 has been a discussion about the meaning of this study. It has been argued that the findings of the study support the emergence of a theory about the nature of learning through computer technology, in a mentoring context. The emergent theory of techno-socio-constructivism (TSC) has been explained through a diagram and three sets of propositions. The reader has been enabled to discern for themself through computer technology the nature of DVC and its impact on learning. In concluding, the researcher has addressed the nature of learning and illuminated the diversities and complexities that have become apparent from deliberations during the course of the study. Chapter 6 will report on final conclusions, reflections and perceived implications about the nature of learning when using a mentoring program with DVC, the use of DVC with gifted learners and the emergent TSC theory.

Chapter 6 - Conclusions

6 Introduction

In this chapter the researcher will report on observations about the nature of learning when gifted mentees participate in mentoring using the medium of digital videoconferencing (DVC). The research question: What learning takes place when mentoring is conducted through desktop videoconferencing with gifted primary school children? The guiding questions that were foundational to this research will be considered. From the categories that emerged in data collected during the analysis, review of the literature and experiences with mentoring and directing research, explanations will be constructed about the use of DVC with gifted learners and the developing theory of techno-socio-constructivism that emerged.

6.1 The Innovative Technology

In commencing the study, the researcher hoped to learn from the mentors how feasible DVC technology could be as an instructional tool. From the mentors' experiences, it was anticipated that they would share their stories with other colleagues and this sharing might then lead other teachers to implement technology in their classrooms, especially for their gifted learners. The sharing of stories did happen. However, the further implementation of this technology into classrooms has not yet eventuated.

DVC technology was an appropriate teaching medium for mentoring. It allowed the participants to expand their technological skills. They were also encouraged to explore their chosen areas of interest. In addition, the participants explored software and hardware that was associated with this technology, though not directly related.

Despite the present lack of implementation of DVC in classrooms, this may be altered with the rapid advancements with this technology. When asked directly about the difficulties of DVC, the mentors cited the technology as an ongoing issue that created interruptions to the flow of learning and this hindered the accomplishment of learning content within the specified time frame.

Technology problems proved a continuing frustration. For example, not all participants had easy and consistent access to the Internet in their homes or classrooms. They did not have immediate on-site technical support as the school only had one part-time technical support worker at that time. The participants had support from the researcher at the beginning of DVC sessions and support from the researcher and trusted colleagues

between sessions. This perceived limited support might be another reason for the lack of implementation of this technology into classrooms.

The challenge of time to learn the technology was an ongoing concern. The researcher tried to encourage the mentors along the way and always kept in touch with them. With all that teachers have to do, mentoring could be a burden if the task is hard going or fraught with frustration. Accordingly, Stefan (mentor) found mentoring dispensable as recorded in the researcher's journal:

> After interviewing Stefan today, he was not keen to continue with this program, but would do so, for the sake of the project. When asked when he thought it would finish, he said that he would try in the holidays, but he was going to be in and out a lot. This was interpreted as meaning that maybe at the end of Term 1 he would finish). So far, he has completed five sessions.
>
> When asked his opinion about the technology, he was concerned about the sound and the variability of it and the quality of it. To the question, if he were to continue, what improvement would you make, his response was to look into another software package or use the telephone until the technology improves in the speech area.

Intriguingly, the participants did not engage in criticisms of the technology, nor did they have a limited understanding of the benefits of computers as predicted by Sandholtz et al. (1997). Rather, they were enthusiastic about the potential of computing, as Bryce (mentor) put it, "The benefits of it would outweigh whatever limitations there might be from time to time".

As technology continues to expand and improve at a rapid rate, the frustrations that the participants experienced should dissipate over the next few years with the increased use of broadband telecommunication lines and improved communication software programs. The researcher expects that the images and audio quality of DVC will be clearer and faster, without lines dropping out or disconnecting. For example, since commencing this research using iVisit another more sophisticated software program, Yahoo Messenger (2003) is now available assuring participants privacy, clear audio and visual quality and an immediate connection just for the cost of a local telephone call. This will surely support teachers who wish to incorporate this technology into their classrooms.

6.2 The Nature of Teaching and Learning

As with any innovation, in order for DVC to achieve educational benefits, teachers need to integrate technology into their instructional practice in an ongoing and meaningful way. The question educators should ask is not whether the innovation is effective, but rather how should it be implemented. The initial guiding questions regarding learning were:

Is learning sequential or hierarchical?

Is the learning relational, that is, social and collaborative?

Are the teacher and student interactive in the learning process?

DVC is definitely one medium that promoted learning and engaged both the mentor and the mentee interactively in the learning process. Mentors made decisions about what they were going to teach and how they were going to teach based on their personal values and beliefs. These mentors viewed teaching as a good and worthy profession, they had a desire to serve others and they were committed to the mentee in their teaching practice. They sought out strategies that worked for their mentees. As Bryce (mentor) explained, "To find avenues where we could explore his interests". When teachers have found what works for their students, they will continue to use it. Similarly, students involved in mentoring using DVC were able to make decisions about what they wanted to learn and be more proactive in their learning. This learning was not sequential or hierarchical. Learning through DVC was ubiquitous.

In addition, it would seem that with the added dimension of technology into the learning environment, there are other contingencies that affected the learning. These contingencies related to the learner's cognitive and affective levels of functioning. The gifted learner needs an environment that caters for high levels of functioning in cognitive and affective education and it would seem that DVC is well suited to the needs of gifted learners. Therefore, learning was found to be relational. It was social and collaborative. This answers the second guiding question: Is the learning relational, that is, social and collaborative?

Learning is omnipresent. The traditional learning theories such as behaviourism, social constructivism, cognitive constructivism and critical theory will always impact the teacher's philosophical premise. What teachers may also need to be cognisant of is the way social constructivism is being impacted by educational computing. As learners

engage in educational technologies teachers can expect an emergence of new learning processes as described in the developing theory of techno-socio-constructivism (TSC).

The participants described mentoring using DVC as fun. They enjoyed the experience and were always positive about the mentoring sessions. This answers the final guiding question, are the student and teacher having fun.

6.3 The Mentoring Relationship

As Gloria (mentor) stated, "I think the relationship is the main benefit, but if you put two people together, the technology adds an interest level to it; it's unique and exciting and it does cater for the individual".

Participants sought to befriend and reach out as they established a working relationship. By reaching out, the stage was set for the development of relationships among them. These relationships were a key ingredient in perseverance. DVC provided a means to connect with other human beings and develop relational learning. As Albert (mentor) put it, "I had to develop a relationship with Simon (mentee) before I could talk about different bits and pieces".

Motivation was a key ingredient in the relational learning. As the participants became better acquainted, the more they wanted to participate in DVC. The participants had mutual regard for what they each brought to the relationship. The traditional authority relationship between mentor and mentee did not exist. Rather, the cohort was equally responsible in all aspects of learning. As Albert (mentor) explains, "I got a bit of a shock about two meetings ago when he said when are we going to start our lessons. That made me think, that's right, I'm committed to do some work, rather than chatting away". An entry in the researcher's journal described another aspect of the relational nature of mentoring that differed from the traditional teacher-student relationship in that the mentee knew more than the mentor -Initially Mark (mentee) was ready to begin this technology before Stefan (mentor) and Mark had to wait until Stefan was more familiar with it.

The researcher believes that educators are changing in the way they facilitate the learning of their students. In today's knowledge explosion, globalisation and rapid change, learning communities are emerging. Students and teachers are now viewing themselves as life-long learners with a blurring of the line separating the roles of teacher and learner. That these roles can change at any point during a relationship is evidenced by Albert (mentor) and Simon (mentee). This will ultimately result in schools viewing their

members as part of a learning community and acknowledging that learners, teachers and leaders are roles that everyone may adopt at some point.

It would appear that DVC allowed for simultaneous learning in three distinct realms. Participants were continually learning technology content and relationally. This merging of the three learning areas appeared possible because of the level of perseverance and motivation that each participant brought to the learning environment. This allows an affirmative answer to the guiding question: Are the teacher and student well motivated and challenged.

6.4 The Developing Theory

This research has led to the advancement of an emergent theory that the researcher has labelled techno-socio-constructivist theory (TSC). This theory is an integration of technology, pedagogy and affective skills that have been permeated with motivation and perseverance. This integration is a delicate balance and relies on the interplay of the key elements. The TSC theory appears to provide a new insight into learning in the technological age when compared to earlier traditional learning theories. Although what has emerged offers a potentially new view of learning, the TSC theory is still embedded in the framework of earlier theories.

There are many similarities that the TSC theory seems to have with earlier learning theories. For example, most behaviourists have been concerned with rewarding the learner extrinsically as each skill was acquired. The TSC theory also concerned itself with rewards. However, learners using DVC were intrinsically rewarded by the learning experience and extrinsically rewarded by the verbal affirmation of the mentors. The mentees appeared to call for the positive commendations from their mentors. Cognitive constructivists adhered to the importance of the construction of knowledge. This occurred with the mentors and mentees and is foundational to the developing TSC theory. Social constructivists advocated the critical importance of people in the cognitive development of the student, which is also foundational to the TSC theory. Critical theorists also recognised that information technology is not value free and the TSC theory would also argue that as well. The most marked similarities of the TSC theory compared to earlier theories are mainly concerned with the social development of the student, especially in the area of relating.

Secondly, the TSC theory appears to focus on the whole task and skills are acquired as the learner needed or wanted the knowledge or the skill. One of the differences that the TSC theory appears to emphasise in relation to DVC is the need for participants to have a relationship to enhance learning. Behaviourism has mainly focused on the teacher breaking knowledge down into smaller segments so that content and skills are taught one by one rather than participants relating to each other. In this study the mentee engaged the mentor in the learning process, preferring to be taught by relating to each other. For example, this was evidenced when Nick (mentee) needed to learn how to use a pair of binoculars. Cognitive constructivism founded on the work of Piaget (1963) is also focused on the acquisition of knowledge that is constructed through assimilation and accommodation. The TSC theory tends not to concentrate only on the construction of knowledge. Rather, it is regarded as one of the subcategories along with making judgements and higher order thinking in the main category of pedagogy. Construction of knowledge appears to take place after the learner has made judgements and engaged in higher order thinking.

The TSC theory is an integration of pedagogy, technology and affective skills and all categories appears to be equally important. Whereas social constructivism emphasised the critical importance of the interaction with people (other student, parents and teachers) in cognitive development, TSC theory seems to need the key elements of motivation and perseverance. Critical theorists could argue that current government educational and social policies and practices determine the learning outcomes of students. While this may steer the acquisition of knowledge and skills, government policies can have little to do with the values and beliefs of learners. The TSC theory illuminates the affective skills that learners need in this technological age. As education advances technologically and pedagogically, the need to relate to each other has become even more essential.

One of the most compelling findings was that TSC learners needed to continue to relate. Computer technology can have the potential to segregate learners from social contact. The interconnectedness via the World Wide Web network of electronic data can ensnare educators into thinking this is another form of human relationship and an advancement in socialisation. Computer consumption can easily cut a person off from social relationships on which our moral nature is, in large part, dependent. What is paramount is that the learner does not become isolated in their learning. The relational aspect of teaching remains a key element in the socialisation of the student. Despite advancements in computer technology, all students needed to feel connected with their

teacher, to be affirmed in the learning relationship and to continue to socialise. Talking, listening and discussing will continue to be the tools and strategies of educators as they impact the academic, physical, spiritual, social and emotional development of their students.

6.5 Limitations

It cannot be expected that all mentors will be as dedicated as the ones in this research study. These teachers were very dedicated mentors and possibly too much may have been asked of them. What is not known are the sacrifices they may have had to make to be part of this research as each of them also had a full-time teaching role and family commitments. The expectations of mentors from the school community and wider community are sometimes unrealistic and the role of mentors may well be suited to part-time teachers, casual teachers, or retired teachers who do not have the responsibility of a full-time teaching load. In this research, these dedicated mentors have positively affected the outcomes of this study.

In addition, it cannot be expected that all mentees who engage in mentoring using DVC will be as compliant and good-natured as the ones in this research. The personalities of the mentees were appealing and endearing. The results may have been adversely affected if the mentees had been offensive or had unpleasant dispositions. To the contrary, the mentees' personalities have positively affected the outcomes of this study. Furthermore, the mentees in this study were all identified as gifted learners. Similar results may not be expected for all students.

Another limitation is that of the voluntary nature of this research study. The participants were all volunteers who wanted to be involved. Should this study have involved participants who were requested by a school authority to engage in mentoring using DVC as part of their prescribed curriculum the results could have been markedly different. The very fact that there was willingness from all participants cannot be discounted and may have positively affected the outcomes.

An additional limitation is that of cost. In this study, Peace Community School provided the hardware and software for each of the participants. The school allowed time for the research director to train each of the participants. In a less affluent community access may be limited due to the resources of the school. This answers the guiding

question regarding equal access to technology resources. There is only limited access to this technology and that access is dependent upon the financial resources of the school.

A further limitation is that of the Australian way of educating students. In Australia students are generally encouraged to ask questions, to discuss, to give their opinions and to be an equal participant in the learning process. This way of educating is conducive to the use of DVC in the Australian context and may be culturally defined yet globally limited. The education systems of countries such as the Lebanon, India, South Africa, Hong Kong, or Korea, from where some students in this school have originated may not be able to sustain mentoring using DVC depending upon how those countries educate their students.

6.6 Implications for Using Mentoring and DVC with Gifted and Other Students

The success of mentoring using DVC is dependent upon a number of factors: the selection of the mentors, the selection of the mentees, engaging with the technology that works and the available time that each pair has for this relationship.

This research study had many positive features that enhanced its success and this has implications should teachers choose to emulate it. Firstly, teachers should choose mentors wisely. The mentors were highly motivated people who willingly gave time to this study. They enjoyed computer technology and viewed it as a tool for instruction as well as entertainment. They were also very flexible and lateral thinking. Frustrations did not deter them or demotivate them and they were able to adapt to the unreliability of the technology. It is best to have voluntary mentors who have the characteristics of being highly motivated and the ability to persevere with frustrations. They also need to be friendly and have a desire to promote respectful language and demonstrate good manners.

Secondly, teachers should choose the mentees wisely. The mentees were highly motivated in their desire to use this educational technology and in furthering their knowledge and skills with an expert in their special area of interest. This motivation persisted throughout the study with the additional benefit of relational learning.

Thirdly, teachers should be aware of what engaging with the technology really entailed. It meant that sometimes the technology was unreliable and could cause frustrations. It meant that disruptions to the flow of the lessons were not always detrimental to the learning process. It meant that when the technology did cause concerns it allowed for making judgements and higher order thinking that stimulated the cognitive

processes of the participants to solve the problems. It meant that teachers would be advised to allow their students time to initiate their own learning and understandings. It meant that DVC stimulated higher order thinking processes.

Fourthly, the available time required by mentoring cohorts to enable a relationship has to be considered carefully. The business of schooling does not always allow teachers to also be mentors, especially if they work full-time. The fullness of the student's curriculum does not always allow them the opportunity to use DVC during class time. The time chosen and the length of time and the frequency of the interactions all have to be considered. Allowing mentees to examine specific aspects of educational tools such as computer technology; allowing mentees to analyse the current issues presented by the educational tools and allowing mentees to seek information from multiple sources and comparing responses were all important considerations.

6.7 Future Directions

Desktop videoconferencing (DVC) is one viable strategy for gifted learners. Research in this area is still sparse; however, most results are positive about its potential. Additional research is still needed and the researcher would like to posit further research areas. DVC as a strategy for students:

1. With special needs such as Autism or Asperger Syndrome to investigate the impact on relational learning.
2. With behavioural difficulties to investigate the impact on basic literacy and numeracy development and attitude to learning.
3. With limited English language as the result of being a migrant to investigate their acquisition of language and culture.
4. Who have to complete the personal project requirement from the MYP (Middle Years Program) that is the junior section of the International Baccalaureate Program.

6.8 Conclusion

To return to the research question: What learning takes place when mentoring is conducted through desktop videoconferencing with gifted primary school children? The researcher has come to the conclusion that learning has to be viewed as a relational process not merely a product. I have had to relinquish my formerly held traditional view of

learning where I acknowledged that the product (the assessment grade, the college certificate or even the university doctorate) was the goal of learning. My present perspective is to view the process of learning as more important than the product. The process is the engagement, the active participation and the involvement in a relationship with another human being who is the mentor. This view of learning as a relational process has influenced my thinking in all areas of teaching and learning, not just in the area of information technology.

In reflecting further on the journey taken, it is clear to the researcher that technology is an evolving paradigm and teachers are becoming learners as well as facilitators of learning. As people grapple with learning new skills teachers will have to focus more on teaching processes rather than knowledge. Education is more about relationship and maximising the potential of the learner. It is about engaging the learner in the learning process so that the learner is active rather than passive. The learner is not only the child. The learner is the child, adolescent, adult, teacher, parent and retiree.

As the researcher has also been engaged in a journey in undertaking this research and, at the same time, being mentored by my supervisors, so, too, have the participants in the research been simultaneously engaged in the process of mentoring. The outcomes for all of us have been both a mutual exploration of challenges yet rewarding relational experiences.

The researcher has found that the use of technological tools facilitated perseverance and resilience. For gifted students, the use of DVC can be a viable technology-integration within our classrooms. It is suited to the imaginative learning styles of gifted children (Oakland, Joyce, Horton & Glutting, 2004) and provides intrinsic motivation (Skollingsberg, 2003). DVC allows our gifted students the ability to use the vast resources of the Internet to solve problems and achieve specific literacy goals efficiently and effectively (Siegle, 2004).

In addition, the use of DVC further developed the thinking, calculation and communication skills of the mentoring cohorts. The nature of learning during DVC was constructed as an emergent theory based on the teaching philosophies of the teachers and their goals for their students. These educators created supportive environments for DVC and substantiated that the use of technology is about adding to relationships, not substituting for them. Teaching will always be relational.

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Appendix A: Letter Home to Parents

Mentee Application Form & Parent Permission Form
for Mentoring in the PeaceCS Junior School

Name _____

Class_____

Address _____

Telephone and E-mail Address _____

List 3 Special areas of interest eg. Dinosaurs, horses, whales, football, puzzles, chess

1. _____

2. _____

3. _____

Would you like your mentor to be a man or woman? (Optional question)_____

Are you able to sit at the computer twice a week for ten weeks to learn more about your special area of interest? _____

Do you have your own IBM Compatible Computer at home? _____
Does it run Windows 95 or Windows 98? _____
Do you have a USB port? _____
Do you have a Digital Video Camera? _____ **If so, what sort?**_____

Do you need to borrow a School Laptop that has all of these features and borrow a School Video Camera?_____

Parent's Permission:

I give my permission for my child to be part of this Mentoring Program.
I am also willing for myself and my child to take part in the research project as described in this handbook.

Yours faithfully,

Parent's signature
Date

Appendix B: Letter to Teachers

Invitation to Prospective Mentor

Application Form for Mentoring in the Peace CS Junior School

Name _____

School_____

Address

_____

Telephone and E-mail Address

_____

List 3 Special areas of expertise and/or interest

1. _____

2. _____

3. _____

Would you like your mentee to be a boy or a girl? (Optional question)_____

Are you able to sit at the computer twice a week for ten weeks to teach a mentee about your special area of interest? _____

Do you have your own IBM Compatible Computer at home? _____

Does it run Windows 95 or Windows 98? _____

Do you have a USB port? _____

Do you have a Digital Video Camera? _____ **If so, what sort?**_____

Do you need to borrow a School Laptop that has all of these features and borrow a School Video Camera?_____

Mentor's Commitment:

I would like to be part of this Mentoring Program. I will endeavour to give it my time and energies throughout the term.
I am also willing to take part in the research project as described in this handbook.

Yours faithfully,

Mentor's signature *Date*

Appendix C: Modified Mentoring Handbook

Peace Community School

Special programs: Development of Talent

Modified Mentoring Handbook

(June, 2000)

PEACE COMMUNITY SCHOOL

SPECIAL PROGRAMS: DEVELOPMENT OF TALENT

MODIFIED MENTORING HANDBOOK

An important component of any school's program for gifted and talented students should be mentoring (Haeger & Feldhusen, 1991).

Mentoring is an educational process in which students are teamed, usually one-to-one, with an older person who has some talent, knowledge or expertise to share. Recognised as important facilitators for the gifted and talented, mentors help these youngsters in positive ways, especially as simulators and counsellors for talent development.

This handbook includes:

- Program description
- Some questions and answers
- Mentee application form and Parent Permission Form
- Invitation to Prospective Mentor application form
- Mentor-mentee matching form
- Mentor-mentee waiting list form

Program Description

Goals

The goals of the PHCS Mentor program are based on those of the Purdue Mentor Program (Ellingson, Haeger & Feldhusen, 1986). These include the extension of learning opportunities beyond the classroom for students who have previously performed well or not being challenged) by existing Gifted and Talented extension programs. The ultimate goal is to help talented children and youth understand higher level thinking and adult occupations, respectively and stimulate interest in and knowledge of, such thinking and occupations.

Student Selection Criteria

In the PHCS Junior School only students who are currently in the Year ¾ Composite class for talented learners are eligible for this program. In addition mentees need to be independent learners who are self-motivated and able to work closely with an adult.

Mentor Selection Criteria

As Peace Community School is a Christian School with an ethos of employing Christian staff, it follows that Christian mentors should staff the mentoring program. Mentors will initially be sought from the large staff at Peach CS (110 employees). Mentors will also be invited from other Christian Schools in NSW and nationally if necessary. The mentor will apply through the Mentor Application Form, after initially being invited by the researcher. Mentors will be experts in their field and have a desire to work with young children.

Preparing for the Mentoring Process

- Researcher invites staff to be Mentors for Research Project and provide staff with Mentors Application Form
- Researcher invites students personally through a class visit to be part of Research Project
- Students take home Mentee Application form and Parental Permission Note with this Handbook
- Students who are able to be matched with a suitable mentor are given a Mentor-Mentee Matching Form
- Students who are not successful will be placed on a waiting list and notified by the Mentor-mentee matching form

The Mentoring Process

- An initial meeting is set up with mentee, mentor, parent/s and researcher. At that meeting the researcher explains the objectives of the project, the data to be collected and the Mentoring Workbook. Questions are discussed. The process of video-conferencing is also explained with a demonstration of how is works with a set session with a colleague.
- Parents, mentee and mentors are invited to practise the technology with the researcher before beginning the mentoring sessions.
- All mentoring sessions and interviews will be audiotaped.
- Mentors, mentees and parents can withdraw at any time should they not want to participate in the research project.

Time Frame

- The practising of the video-conferencing should take a week.
- The mentoring sessions should be for 30 minutes, weekly for ten weeks.

Evaluations

- Each session will be audiotaped
- Each session will be recorded with mentor and mentee responses in the Mentoring Workbook
- At the end of the term there will be individual interviews with mentors, mentees, parents and class teacher.

Additional Data collection

- Pre- and post tests with PAT Reading and Mathematics Test to test for improved academic achievement
- Pre and post attitudinal scales towards learning
- Pre and post interviews with parents, mentors and class teacher regarding mentees' motivation in regard to the technology of videoconferencing

Questions and Answers

Information about the Mentor Program

1. What is Mentoring?

Mentoring is a partnership in which an adult shares expertise in a field with a young person called a mentee. The mentor is not just a teacher but a guide. A successful mentorship is characterised by mutual interest and respect.

2. Is Mentoring something new?

No, mentoring is one of the old teaching/learning methods. Plato had a mentor, as did Alexander the Great and King David. The name comes from Odysseus's confidant Mentor, who was entrusted with the instruction and guidance of Telemachus, the son of Odysseus, while Odysseus was away during the Trojan War.

3. What benefits can the mentee expect to receive from the program?

The mentee will be able to study and learn on a close personal level with an expert in his or her field of interest. The mentor may be able to introduce the mentee to other experts in the field. Mentees should experience an increase in both general and specific knowledge and skills.

4. What benefits can the mentor expert to receive from the program?

Mentors have the opportunity to work with bright students who have new ideas and creative ways of looking at things. Mentors have the satisfaction of introducing to their field young people who someday may make substantial contributions to their field. The mentor feels a sense of accomplishment at meeting the goals and objectives of the program. Finally mentors often establish long term friendships with the mentees and have the personal satisfaction of helping the mentees mature and grow.

5. What are some of the possible characteristics of good mentors?

- They like children and are able to relate comfortably with bright children
- They are knowledgeable in an area of study, profession or hobby and care and are able to convey such knowledge with enthusiasm
- They understand the educational, emotional and social needs and problems associated with giftedness
- They are able to express clearly and fluently and show evidence of some degree of introspection and self-awareness
- They are a companion to the mentee as they move toward adulthood, offering encouragement, advice and counsel
- They provide realistic appraisal of the mentee's progress
- They teach with an emphasis on the individual needs of the mentee

6. What are some of the possible characteristics of a good mentee?

- They are able to work independently with a minimum of supervision
- They are able to work closely with an adult
- They have interests, abilities or expertise in specialised areas or fields which may extend beyond the everyday classroom
- They have sufficient motivation to complete a mentorship situation

- They have basic planning, communication and research skills

7. How much time is involved?

There will be ten sessions delivered weekly for 30 minutes at a time. There will be time for practising the technology and time for filling the Mentoring Handbook.

8. What if I cannot attend the meeting?

Mentees should call or E-mail their mentors and Mentors should do the same.

9. Does the Mentor have a lot of paper work?

No. At the end of each session, there will be a section that needs to be completed in the Mentoring Handbook.

10. What happens if problems arise between the mentor and the mentee?

Call the Researcher immediately. Do not wait until things get out of hand. The Researcher will help in any way possible.

11. What happens if I want to withdraw from the mentoring program?

You are free to withdraw from the program at any time.

Mentee Application Form & Parent Permission Form
for Mentoring in the PCS Junior School

Name _____

Class_____

Address _____

Telephone and E-mail Address _____

List 3 Special areas of interest eg. Dinosaurs, horses, whales, football, puzzles, chess

4. _____

5. _____

6. _____

Would you like your mentor to be a man or woman? (Optional question)_____

Are you able to sit at the computer once a week for ten weeks to learn more about your special area of interest? _____

Do you have your own IBM Compatible Computer at home? _____
Does it run Windows 95 or Windows 98? _____
Do you have a USB port? _____
Do you have a Digital Video Camera? _____ **If so, what sort?**_____

Do you need to borrow a School Laptop that has all of these features and borrow a School Video Camera?_____

Parent's Permission:

I _____give my permission for my
(please insert name)
child_____ to be part of this Mentoring Program.
(please insert child's name)

I am also willing for myself and my child to take part in the research project as described in Modified Mentoring Handbook. I understand that the mentoring sessions and interviews will be audiotaped and that my child and I are free to withdraw from this study at any time.

Yours faithfully,

Parent's signature
Date

Invitation to Prospective Mentor Application Form for Mentoring in the PCS Junior School

Name

_____

School_____

Address

_____

Telephone and E-mail Address

_____

List 3 Special areas of expertise and/or interest

_____

1.

_____

2.

_____

3.

_____

Would you like your mentee to be a boy or a girl? (Optional question)_____

Are you able to sit at the computer once a week for ten weeks to teach a mentee about your special area of interest? _____

Do you have your own IBM Compatible Computer at home? _____
Does it run Windows 95 or Windows 98? _____
Do you have a USB port? _____
Do you have a Digital Video Camera? _____ **If so, what sort?**_____
Do you need to borrow a School Laptop that has all of these features and borrow a School Video Camera?_____

Mentor's Permission:

I _____ would like to be part of this Mentoring
(Please insert name)

Program. I will endeavour to give it my time and energies throughout the term.
I am also willing to take part in the research project as described in Modified Mentoring handbook. I understand that the mentoring sessions and interviews will be audiotaped and that I am free to withdraw from this study at any time.
Yours faithfully,

_____
Mentor's signature
Date

_____

Mentee-Mentor Matching Form
for Mentoring in the PCS Junior School

Part A:
Name of
Mentee

Class of Mentee_____

Address of Mentee

Telephone and E-mail Address of Mentee

Your Special areas of interest eg. Dinosaurs, horses, whales, football, puzzles, chess

---

1.

2.

3.

Part B: The Mentor
Name of Mentor_____
School of Mentor_____
Address of Mentor _____
Your area of interest for your mentoring sessions will be:_____
Are you able to sit at the computer once a week for ten weeks to learn more about your special area of interest? _____
Do you have your own IBM Compatible Computer at home? _____
Does it run Windows 95 or Windows 98? _____
Do you have a USB port? _____
Do you have a Digital Video Camera? _____ **If so, what sort?**_____
Do you need to borrow a School Laptop that has all of these features and borrow a School Video Camera?_____

Mentee Waiting List Form

Dear Student,

Your application to be in the Mentoring Program has been unsuccessful. You have been placed on a wait list.

Should a suitable mentor become available then you will be contacted in due course.

Yours faithfully,

Tina Whiting
Researcher

Appendix D: DVC Workbook

Mentoring Workbook
for Mentors using

Desktop Videoconferencing

Mentoring Workbook for Mentors using Desktop Videoconferencing

Introduction

Welcome to the exciting world of desktop videoconferencing. Just a few details from you first.

Name_____

School you are currently teaching_____

Class/es being taught_____

Preferred age group you'd like to work with _____

Mentee's name_____

Special area of interest/s_____

Reminder:

From the Modified Mentoring Handbook, the possible characteristics of good mentors are:

- They like children and are able to relate comfortably with bright children
- They are knowledgeable in an area of study, profession or hobby and care and are able to convey such knowledge with enthusiasm
- They understand the educational, emotional and social needs and problems associated with giftedness
- They are able to express clearly and fluently and show evidence of some degree of introspection and self-awareness
- They are a companion to the mentee as they move toward adulthood, offering encouragement, advice and counsel
- They provide realistic appraisal of the mentee's progress
- They teach with an emphasis on the individual needs of the mentee

And the characteristics of good mentees are:

- They are able to work independently with a minimum of supervision
- They are able to work closely with an adult
- They have interests, abilities or expertise in specialised areas or fields which may extend beyond the everyday classroom
- They have sufficient motivation to complete a mentorship situation
- They have basic planning, communication and research skills

Directions:

1. **Please read the following sections on videoconferencing.**
2. **Please complete the response sheets after every session.**

Things you need to know before beginning videoconferencing

Connecting with your Mentee

1. Send your Mentor an E-mail and agree on the two times when you should meet each week.
2. The Mentor will confirm by E-mail, the times that a private room will be set up using ïvisit software. You must also know the name of the private room and the password.

Connecting with your Computer

1. Make sure that your computer can access the internet with an internal or external modem
2. Your computer will need to have Windows 95/98
3. Your computer will need to have a USB port for the connecting of the videocamera
4. Check to see if you need an external microphone, they are much clearer to use than the inbuilt ones.

Your Videocamera

1. Make sure you have loaded the Video camera software onto your computer
2. Plug your videocamera in the USB port

Accessing a Room

1. Down load iVisit from the Internet
2. When this is successfully done, the icon iVisit will appear on your screen.
3. Double click on the iVisit icon

Suggestions for a successful conference

1. When you are finished talking use the word over
2. Keep the chat box open so that if you do have an technological glitches then you can still communicate

Suggested topics for discussion

- **What you do**
- **What your work is like**
- **How you became interested in your special field**
- **What is exciting to you at the moment**
- **What are you working on at the moment**

Mentor Response Sheet for Mentoring using videoconferencing

Week 1

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 2

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 3

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 4

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 5

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 6

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 7

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 8

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 9

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor Response Sheet for Mentoring using videoconferencing

Week 10

Session 1
Date
Mentee
Activities conducted: 1. 2. 3. 4.
Successes of the Session
Problems encountered
Did you enjoy the session? Why?
Date and time of next session
Activity planned
Any homework for the mentee

Mentor's Evaluation of the Mentee

Mentor_____ Date _____

Mentee_____

Area of Interest _____

Please rate your mentee on a scale of 1 – 5 by circling the number which best describes your thoughts and feelings as follows:

1= Strongly Disagree 4= Agree

2= Disagree 5= Strongly Agree

3= Uncertain

My mentee

1. Showed initiative on projects	1	2	3	4	5
2. Seemed to feel comfortable in the sessions	1	2	3	4	5
3.Takes an active interest in the subject	1	2	3	4	5
4.Is cooperative and follows directions	1	2	3	4	5
5. Is able to work independently	1	2	3	4	5
6. Challenged me to do my best	1	2	3	4	5
6. Motivated me to study this subject further	1	2	3	4	5
7. Displays an evidence of pursuing Subject outside of meetings	1	2	3	4	5

8.Works well with adults on a one to one basis	1	2	3	4	5
9. Should continue in program again	1	2	3	4	5

Please add any other comments:
Signed:

Mentor's Evaluation of the Mentoring Program

Mentor_____ Date _____

Mentee_____

Area of Interest _____

Please rate your mentee on a scale of 1 – 5 by circling the number which best describes your thoughts and feelings as follows:

1= Strongly Disagree 4= Agree

2= Disagree 5= Strongly Agree

3= Uncertain

During the program

1.Our interests and needs were respected	1	2	3	4	5
2.We were able to pursue topics which I felt were Interesting and challenging	1	2	3	4	5
3. I have learned about things that will be useful In the future	1	2	3	4	5
4. I felt comfortable expressing my own feelings And desires	1	2	3	4	5
5. I felt my needs were satisfied	1	2	3	4	5
6. I felt free to ask questions	1	2	3	4	5

The mentor program

7. Is one I would like to participate in again	1	2	3	4	5

8.Is different from other special classes I have taught	1	2	3	4	5
9. Was enjoyable	1	2	3	4	4
10. Allowed me to set mutual goals	1	2	3	4	5
11.Provided me with an opportunity to research in an area of interest in depth	1	2	3	4	5

Additional Comments

Please feel free to write anything that may be helpful for this project.

Thankyou for your participation in this project

Appendix E: Open Coding of Mentoring Session

MENT-T01 & S01 – L3 – 30.11.2000

Mentoring Transcript	Coding
Hi guys, can you hear and see me? I'm just using the chat box to see if that has any impact.	Garbled sounds Teacher teaching software
Try using your chat box, over.	Teacher teaching software
Hi Mr B can you hear me? Over.	SCT – Student checking technology
Hi, I can hear you, can you hear me? Over.	TCT – Teacher checking technology
I turned on the computer and I can see you, over.	TPT – Teacher praising technology
Try turning your chat box on (typing sounds).	Teaching software
Did you have a good day at school? Over.	TPQS – Teacher asks personal questions about school
Yes I did. Over.	
Now I can hear you very clearly, that is great.	TPT – Teacher praising technology.
What time did you get home from school? Over.	TPQS – Teacher asks personal questions about school.
About four o'clock, over.	Student's response
Have you had something to eat? Over.	TPQ – Teacher asks personal questions.
Yes I have, over.	Student's response
Now you can tell me, can you hear me clearly? Over.	TCT – Teacher checking technology

Appendix F: Open Coding of Interview Transcript

EVAL – MENT-T03 – INT – 26.07.01

Interview Transcript	Coding
Well, at the minute I think the reliability of the technology is an ongoing issue, that creates enough interruption to the flow of learning so that you don't get a big enough block accomplished in any single length of time for it to really….	TFT – Teacher frustrated with technology TPS – Teacher problem solving TAL – Teacher assessing learning of student TAT – Teacher assessing impact of time TPB – Teacher problem solving
There were instances where I thought N was obviously a very clever kid. Like today, where he made the jump about the mass of planets and the gravity and therefore a big….. that was terrific. And he realised intuitively that it didn't matter, the size of the planet, the amount of matter was going to be the same. Really clever things like that. Then on the other hand, it surprised me when I asked him what did we talk about last time… 'Umm' and it wasn't fresh in his memory. And I think it was because we didn't get far enough in one session that it was a body of knowledge that he then took on board. And I think that was a bit to do with some of the reliability of the technology. So that's….. that will come in time. And maybe even with more expense? If we had better cameras and better network connections then I don't know…..	TPST – Teacher praises student TPST – Teacher praises student TAK – Teacher assesses knowledge gained Teacher makes judgments about student's knowledge Teacher reflects on knowledge retention TPS – Teacher problem solving knowledge acquisition Teacher assessing impact of time Teacher assessing reliability of technology TPSTY – Teacher problem solves the technology TPS – Teacher problem solving – lateral thinking.

Appendix G: Open Coding of Evaluation Forms

EVAL – MENT-T03 – FORM –26.07.01

Evaluation Form	Coding
The concept of mentoring is terrific. This program is not just about mentoring though, it is about mentoring via videoconferencing technology. In this regard it must be said the VC gave some opportunity for something of a mentor-mentee relationship to develop but it was not equitable with face-to-face contact.	Teacher praising concept. Teacher analyses the purpose of the program Teacher reflects on relational side of program Teacher makes judgments and compares with face-to-face teaching
The reliability of the technology (or otherwise) worked to both build the relationship through facing shared challenges and to frustrate the progress of some learning sessions. Flexibility and the absence of strict deadlines for fulfilling the number of sessions were important.	Teacher assesses worth of technology Teacher assesses worth of teaching/learning Teacher acknowledges weakness and frustration Teacher sees possibilities – problem solving Teacher evaluates and gives possible solutions.

Appendix H: Code Note

MENT.TRANS – CODE NOTE 05 – Teacher 01 & Student 01 5.12.2000 – Lesson 5

Code Name: Technology Problems
Related Codes: Sound difficulty
Video difficulty
Internet failure
Garbled message
Code Note: The teacher and student were experiencing difficulties with the technology.

The sound is of very poor quality and it is coming in and out occasionally. Conducting the lesson through the chat box was the only alternative that seemed viable. When the Internet connection failed the teacher sought the mobile phone as a means of teaching the student how to adjust the settings so that the Internet connection could be re-established. Frustration with the technology does not seem to hinder the interaction but is seen as rather an obstacle to overcome and a "challenge to conquer". This raises some interesting questions!

Questions:

What causes the technology to fail?
How does the mentor perceive failure of the technology?
How does the mentee respond to the failure of the technology?
What strategies does the teacher employ to deal with the failure of the technology?
Are there any relational skills the pair experience through this?
Dimensions of Technology Problems – positive/rewarding experience
What are the connections here?
Conflict resolution
Relationship building
Problem solving

Appendix I: Axial Coding Theoretical Memo

Theoretical Memo – relating (to a particular perspective on "mentoring")

Reference – MENT. TRANS. – CODE NOTE 05 – T01/S01 – 5.12.2000

Casual Condition	Phenomenon
Aborted Lesson	Relating
Properties of Aborted Lesson	Specific Dimensions of Relating
Multi-Dimensional Deviation from	Extent – total
The norm.	Intensity – high
Relevance for teacher and student	Duration – intermittent

Teacher seeks out the student to encourage constructive thinking.

Teacher Potential for consequences – high

Context for Relating

Under conditions where the teacher is committed to the student/teacher interactions in mentoring.

Action/Interaction Strategies for Relating

Teacher uses positive language to encourage student interaction.

finds ways of relating positively even in the worst scenarios.

Consequences (for the teacher)

Increased awareness of student's abilities, personality and needs.

Consequences (for the student)

Increased knowledge in technology.

Appendix J: Selective Coding Theoretical Memo

Theoretical Memo

Processes and sub-processes of the category and working.

Techno-socio-constructivism is a complex theory, which is constructed of three distinctive categories:

Working

Interacting

Relating with the technology

Working the first in a series of processes in which the mentor and mentee are engaged in the mentor relationship. The pair who is working with the technology is frequently engaged in clarifying, analysing and checking. Clarifying refers to finding out about the software package that was being used, that is, iVisit.

This may be a passive process or a process initiated by either the teacher or the student. In other words, some teachers actively seek out information about a wide range of practical and/or 'philosophical' matters relating to computer technology. The extent to which teachers seek out information about computer technology varies from teacher to teacher. While some teachers demonstrate a 'thirst' for more information, others seek to clarify specific issues when they arise (linked with the personality type). Once a particular matter or issue has been clarified to a point where teachers are satisfied that they have enough information to 'deal with' it, the process of analysing commences. Analysing is a process engaged in by teachers, which involve detailed analysis of the issue or matter at hand and/or the broad range of the issues associated with 'computer technology'. Teachers engaged in analysing may, from time to time, engage in the related process of checking. Checking occurs when the teacher seeks out information from multiple sources and compares responses.

Appendix K: Permission Notes of Parents and Teachers

Parent's Permission:

I give my permission for my child to be part of this Mentoring Program.
I am also willing for myself and my child to take part in the research project as described in this handbook.

Yours faithfully,

Parent's signature
Date

Mentor's Commitment:

I would like to be part of this Mentoring Program. I will endeavour to give it my time and energies throughout the term.
I am also willing to take part in the research project as described in this handbook.

Yours faithfully,

Mentor's signature *Date*

Appendix L: Bloom's Taxonomy of Educational Objectives: Cognitive Domain

Category	Examples
Knowledge	Defining terminology, symbols
	Recalling facts, names, examples, rules, categories
	Recognising trends, causes, relationships
	Acquiring principles, procedures, implications, theories
Comprehension	Rephrasing definitions
	Illustrating meanings
	Interpreting relationships
	Drawing conclusions
	Demonstrating methods
	Inferring implications
	Predicting consequences
Application	Applying principles, rules, theories
	Organising procedures, conclusions, effects
	Choosing situations, methods
	Restructuring processes, generalizations, phenomena
Analysis	Recognising assumptions, patterns
	Deducing conclusions, hypotheses, points of view
	Analysing relationships, themes, evidence, causes and effects
	Contrasting ideas, parts, arguments
Synthesis	Producing products, compositions
	Proposing objectives, means, solutions
	Designing plans, operations
	Organising taxonomies, concepts, schemes, theories
	Deriving relationships, abstractions, generalizations
Evaluation	Judging accuracy, consistency, reliability
	Assessing errors, fallacies, predictions, means and ends
	Considering efficiency, utility, standards

From Davis, G. A., & Rimm, S. B. (1994). *Education of the gifted and talented* (3rd ed.). Needham Heights, MA: Allyn & Bacon.

Appendix M: The Interview Schedule

Interview Questions

1. I'd like to ask you a few questions about the mentoring program that you have just finished. Is that Ok with you?

2. Can you explain to me what is Desk top Videoconferencing?

3. Did you enjoy it?

4. Why?

5. If you were asked to be involved again, would you take this opportunity?

6. Why?

7. Did you learn anything?

8. What new skills did you gain?

9. How is learning on the internet different from learning with a book?

10. If you could improve this mentoring program using DVC, what improvements would you make?

11. What about the timing of the project being 10 weeks, was it too long, too short or just about right for you?

12. Are there any other issues you would like to talk about?

General Issues

Enjoyment
Learning
Participation
Timing
Technology Issues
Relationships with mentors