Victoria University of Technology

Faculty of Human Development

School of Education

MOTIVATING MALE PRIMARY UNDERACHIEVERS THROUGH A TECHNOLITERACY CURRICULUM

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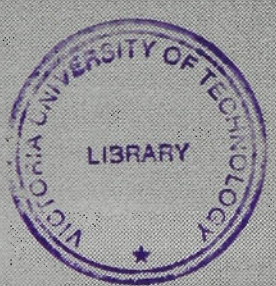

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Master of Education (Research)

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A Child's Potential Is A Precious Resource

All the men that we have ever heard of have triumphed over adverse circumstances, but that is no reason for supposing that there were not innumerable others who succumbed in youth.

Bertrand Russell 'Conquest of happiness'

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Declaration of Originality

This thesis contains no material which has been accepted for any other degree in any university. To the best of my knowledge and belief, this thesis contains no material previously published or written by any other person, except where due reference is given in the text.

Signature:

Abstract

Boys of primary school age growing up on family farms frequently make a significant contribution to the labour force of the farm. Observation suggests, however, that boys from such families who have knowledge, skills and talent beyond their years in relation to farm life, often have poor academic skills and low motivation within the school environment.

The question of why such students with obviously bright minds did not reflect their perceived potential in terms of motivation and academic achievement needed to be examined and an appropriate curriculum for their needs devised.

As a result of early action research, a change in the teaching–learning style was developed, using a student-centred approach with technology as the medium of presentation. This approach overcame the frustration of the focus students and they began to participate in classroom activity. This thesis reports on an intensive study of the response to this innovative curriculum by four students from farming families.

Executive Summary

This thesis, entitled *Motivating Male Primary Underachievers Through A Technoliteracy Curriculum,* was undertaken at Victoria University of Technology under the supervision of Professor John Dewar Wilson and Ms. Rosemary Mulraney in the School of Education.

The study investigates underlying causes of underachievement in a rural school, by primary aged male students who demonstrate bright minds in out-of-school activity. Observation over seven years prior to the study and in several schools, indicated that this phenomenon was not uncommon.

The Problem

Students have preferred styles of learning and the perception was that the teaching–learning style, designed originally for urban primary schools, did not meet the needs of these particular students. The study set out to investigate the findings of other researchers in the area of underachievement and to experiment with a different style of curriculum and classroom environment.

The Research

Assumptions and questions were drawn from an extensive review of the literature and from these, student profiles were developed. Questionnaires for parents and a writing exercise for students relating to their background were created and a series of charts and tables was also created and completed for each student.

The Sample

Four students all from farming families were the final focus of the study but the research activities were conducted with the whole class to ascertain the validity of the assumptions. The literature advised working with an overly large sample for this reason.

The Findings

The style of family environment experienced in early childhood determines traits and characteristics of the individual. An environment such as that of a farming family has been found to develop in some children traits of the highly creative. Such traits and characteristics need independence and self direction in the learning environment . Students responded to a changed learning environment in school where they had some control over their learning, within parameters and a different more motivating medium for presentation.

Acknowledgments

I would like to acknowledge the following people for their contribution to this research.

The parents and students of Yark and Merton primary schools for their co-operation and support. My supervisors Prof. John Wilson and Rosemary Mulraney and mentor Lawry Mahon for their encouragement through some difficult times. Pia Herbert for her advice and constructive criticism and Lester Townsend for technical advice at all hours. Also my family who have maintained an unwavering confidence in my ability to complete the work when my own confidence was more than a little thin.

Dedication

To my late husband Clive Herbert who pointed the way.

1. Introduction to the study

1.1 Background

In 1987 after many years in suburban schools, the researcher relocated to a rural area. The educational culture of suburban schools was well established in the researcher's personal philosophy of teaching and learning, so the culture of rural schools created a steep learning curve.

From the earliest observations of students in the upper primary section of a rural school, one issue became obvious and ultimately led to this research:

> Boys from farming families who contribute to the labour force of that farm and who have knowledge, skills and talent relating to their farm life often have poor academic skills and low motivation within the school environment.

Regardless of why this enigma existed it was obvious that if these students were to be motivated toward learning in school, they needed to be challenged. Between 1987 and 1993 action research was implemented in an attempt to motivate and convince such students that it was worth giving school learning a chance.

As technology, both sophisticated and simple, was part of the daily farm routine for boys from farming families, an integrated programme was devised with a literacy focus using technology as the medium. The approach not only proved to be a motivating force but also indicated that some students could perform at a much higher standard than had previously been evident. This evidence raised a second issue.

> Boys from farming families who have high intellectual potential perform less well in a traditional approach to education.

A traditional approach to education is teacher-centred as opposed to student - centred. That is the curriculum content, end product and study mode are determined by the teacher, with a 'bodies of knowledge' objective.

An intensive study for the purpose of this thesis was already in progress, when in 1994, the school was closed due to new government policy. Students were transferred to the neighbouring school which had been part of the original action research, referred to hereafter as school (b). Although this upheaval was traumatic for the students, parents and the teacher (this researcher), it did facilitate the research as the researcher was appointed relief head teacher to school (b). The move made available, for the study, two additional students who had been identified earlier as possibly being of high

intellectual potential. The move did not affect the research as the two communities were only ten kilometres apart, had integrated social lives and had combined sporting teams.

1.2 The place

The research took place in the Goulburn Valley, north eastern Victoria. The isolated community has towns to the east, north and south-west but none is closer than 25 kilometres. Early this century the district was part of the selection programme devised to put impoverished people on the land. A large part of the district is still farmed by descendants of the original pioneers. Some parents and grandparents of the focus students were once students at the school.

The researcher's familiarity with the home and school environment and social factors which influenced student behaviour and development, enabled the research project to be unobtrusive. It can be difficult for a researcher to break down the reserve of long time residents in a community such as this, but the established role as resident and teacher for seven years made it possible to gain the confidence of parents and students and acceptance of the research project.

1.3 The students

The intention was to maintain gender equity and to this end the study commenced with the entire multi-age class. However, common characteristics were found only in four male students.[1]

Some of these characteristics were observable in other children but as research progressed, the four focus students, all boys growing up on family farms, proved to have many common characteristics similar to those identified in literature as well as by educational psychologists who lectured on 'Children of High Intellectual Potential' at Melbourne University's Summer Schools (1992) and (1993) and further supported by papers given at seminars and conferences on education of the gifted attended by the researcher, specifically, Betts (1993), Atkin (1993). and Coil (1994).

The initial observable characteristics which drew attention to these students were:

- an inexplicable and elusive element, a sense of remoteness
- no aggressive tendencies
- an air of confidence in the wider environment that was not evident

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1 At an earlier stage one female from a family in which there were no male siblings was identified but she had moved to secondary college by the time of this research.

when at school
- a level of maturity beyond their years
- bright minds but poor levels of motivation and academic achievement
- oral skills more highly developed than written skills.

1.4 The research — an ethnographic multiple case-study

'If you truly want to understand something ... try changing it'.

Renzulli (1992:171)

The purpose of this thesis is to report the outcomes that have resulted from research into the educational needs of underachievers with high intellectual potential in rural primary schools. Findings of the research are relevant to a narrow segment of the student population — that is, students with particular traits and family characteristics living in a remote area. In searching for the work of other educators relating to this particular student group, it became apparent that although other teachers have identified the need, little has been published either in Australia or overseas. The work of those who have published indicates that attempts to provide appropriate curriculum for this special group resulted in frustration.

The focus of the thesis is the intensive research project which followed the original action research. Within the case-studies, anecdotes and conceptual field notes are included which highlight the students' response to technical media as a tool for learning. These were computer multimedia, photographic slides with audio tape, video and community radio.

The object of the intensive study based on a technoliteracy curriculum, was to closely observe the learning behaviour of the focus students and draw comparisons between that approach and their response to the school's traditional approach to learning and teaching.

It was anticipated that the technoliteracy approach would motivate the focus students toward school work. This was confirmed and is discussed in the case-studies. Each student responded to different media in different ways, but not only did the technoliteracy approach prove to be motivating, the quantity and quality of work produced was much higher.

The literature review led the researcher into the area of 'creativity' and finally to contemporary research which identifies a category of student described as the 'creative producer–thinker'. Renzulli (1992) highlights the fact that the creative producer–thinker is frequently found among those regarded as underachievers or slow learners, whilst Sisk (1984) contends such students are often found among minority groups including sub-cultures.

It is the belief of the researcher, and one supported by Sisk (1984), that isolated rural communities constitute a sub-culture. Socially, politically and economically their values differ from those of residents in the more populated areas of cities or country towns.

2. Literature Review

2.1 Introduction

The literature review initially addressed that literature which focused upon low achieving students. Views of researchers, however, directed attention toward creativity and ultimately the larger part of the literature reviewed has fallen into the category of creativity. As a clearer understanding of the focus students of the study evolved, attention was focused upon the educational needs of these particular students and finally to consideration of research into the use of technology as a tool for learning.

This review then is grouped under four headings. These are Underachievement, Creativity, Educational Needs, and Technology in Education. Each section has a brief individual summary whilst the conclusion draws together the particular characteristics which are relevant to the focus students of this study.

2.2 A word about gender

Rimm and Lowe (1988:353) note that the disproportionate number of males to females in their study matched a similar dramatic disproportion in the studies of achievers with whom they made their comparison. They claim that most studies included all males and cite Walberg, Tasi, Weinstein, Gabriel, Rasher and Rosencrans (1981), Albert (1980) and Bloom (1985) in support of their contention.

Whitmore (1980:87) also draws attention to this imbalance and indicates that about 90 per cent of all referrals to her programme were boys and that a concentrated effort was made to obtain a minimal number of females for her study. She commented that this disproportionate number of males was reported elsewhere and cites the research of Gallagher (1975) and Zilli (1971). Colangelo, Assouline, Kerr, Huesman and Johnson (1993) studied mechanical inventiveness — creative traits in children. They also failed to identify any females.

2.3 Underachievement

2.3.1 Definition

To the lay person the underachiever is sometimes thought of quite simply as a student who demonstrates poor academic performance. However, according to Whitmore (1980), poor academic performance may be a

symptom of an underlying problem in the student who has high intellectual potential. Whitmore asserts that almost all those placed in the primary underachieving gifted classes of her research unit became high achievers.

Whitmore's concept of the underachiever is supported by Braggett (1992:23) who includes the underachiever in his description of giftedness, and notes that these students are in the category which purists do not accept as demonstrating talented behaviour. He claims that among these underachievers are students who do not do well in academic studies and may even indicate below average general ability. He argues that the same student may have a deep and selective interest which results in high motivation. This category of student, Braggett states, produces many successful adults. Betts (1985) corroborates the view of Braggett with his 'autonomous learner model for the gifted and talented'. Betts designed this to include children such as the creatively gifted, those whom he describes as divergent in nature who may not score as highly in achievement and intelligence tests.

Rimm and Lowe (1988:354) observe that '...a high proportion of underachieving children appear to be highly creative...'. For the purpose of their study, Rimm and Lowe described underachievement as a performance below some index of the child's actual ability. The usefulness of this measure is a matter for conjecture and one that has been taken up by Butler-Por (1993:650). She cites Kornrich (1965) who, in a definition similar to that of Rimm and Lowe, questioned the meaning of the term 'a child's actual ability'. Butler-Por cites many theorists over two decades with similar views to Kornrich. These include:

- Shaw (1964) who defines a child as a gifted underachiever if he or she is in the upper 25 per cent of the class with respect to intellectual ability but falls below the class average with respect to grades.
- Raph, Goldberg, and Passow (1966), who define the gifted underachiever as one who not only fails to achieve the academic level of which he or she is capable but also lags behind the achievement level of their contemporaries.
- Gallagher (1985), Tannenbaum (1986) Renzulli (1986) and Sternberg and Davidson (1986) each of whom considers the concept of giftedness to be multi-dimensional and continually expanding.

It appears, therefore, that definitions based on Intelligence Quotient (IQ) alone have proved to be inadequate in determining giftedness. Green (1986:56) states that achievement tests are fallible. Whitmore (1980) on the other hand selected students for her programme on the basis of their

performance on intelligence testing.

Butler-Por (1993) cites Gowan and Torrance (1972) who suggest that difficulties in arriving at a clear definition of underachievement may account for the failure to arrive at solutions to the problem. In order to try to establish a clear definition, this researcher investigated current research into the traits of the underachiever.

2.3.2 Traits

In coming to some understanding of what causes students of high potential to underachieve at school, current writers have identified a number of features about the environment in which these children grow and learn, as well as certain inherent characteristics. Rimm and Lowe (1988) linked particular features of the family environment to underachievement. They reported that these traits are beyond the control of the family. This view supports Tannenbaum's (1983) concept of the 'chance' factor, discussed here under 'environment'.

Butler-Por (1993) cites her own study undertaken in 1987 where several procedures for identifying underachieving students were tried. Butler-Por found that generally the children had a wide range of interests outside school but put minimal effort into projects undertaken at school.

Green (1986) and Delisle (1992) advocate the term 'non-producer' as opposed to 'underachiever'. Green asserts that self-defeating behaviour traits may be evident in the non-producer. He suggests it is a defence mechanism and considers the concept of self, often manifested in the underachiever as poor self-esteem, to be a key trait. This view is supported by Delisle who submits that a student with poor self concept places limits on him or herself. Green suggests that students may demonstrate behaviours which indicate that they might be:

- driven by the need to be seen to achieve
- obsessed by goals which are unrealistic
- limited by their own perceptions of where their talents lie
- limited by wanting to avoid risk or emotional intensity

Whitmore (1980) lists 20 behavioural characteristics of underachievers (Figure 2.1). She suggests that if a student exhibits 10 of the characteristics, further evaluation should be conducted.

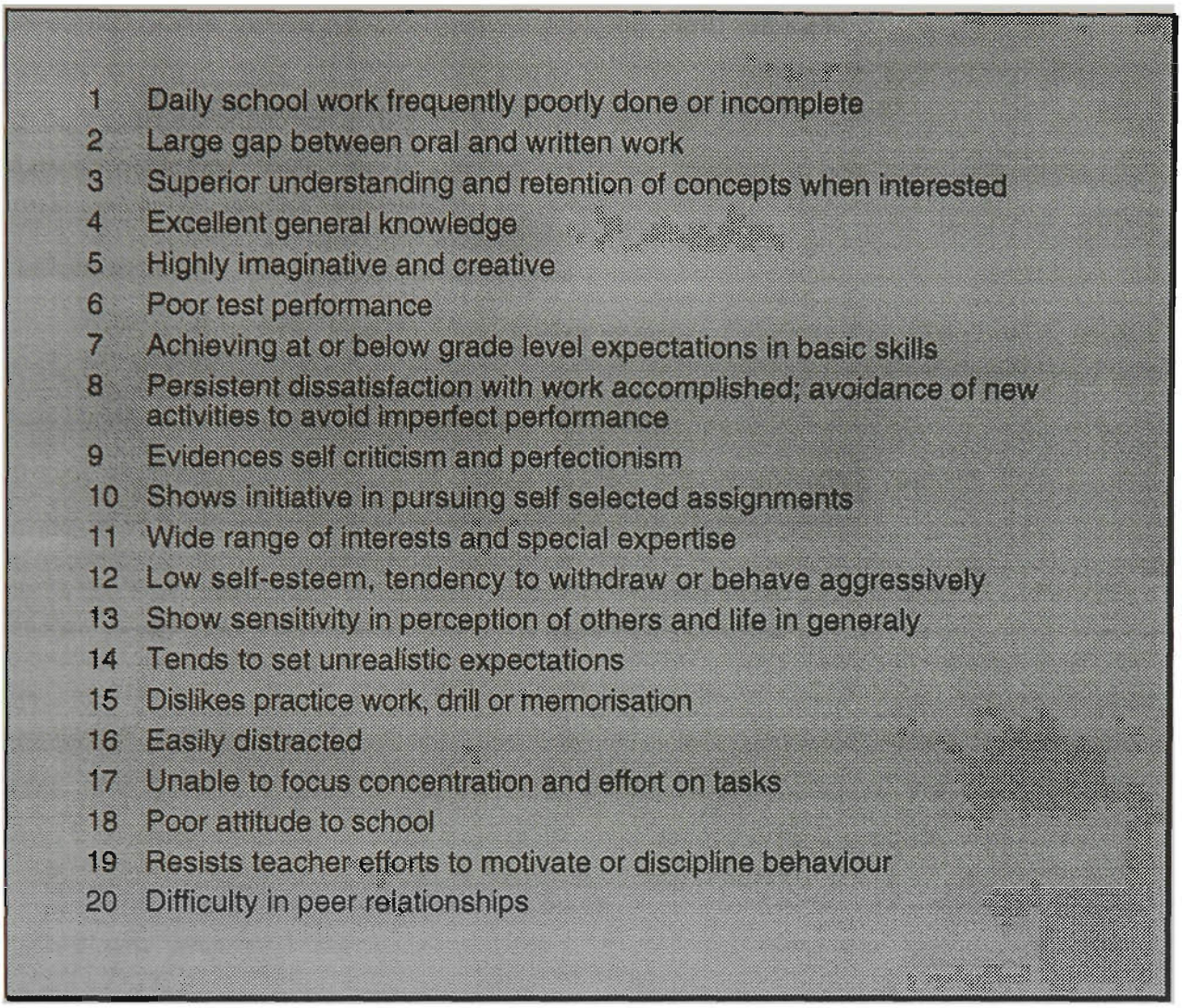

Figure 2.1 Whitmore (1988) Characteristics of Underachieving Students

2.3.3 Environment

Tannenbaum's (1983) research highlights the impact of the total environment, be it rich or impoverished. He draws attention to the role of parent modelling, classroom instruction, attitudes of peers, and neighbourhood resources such as libraries, concert halls, and cultural institutions all of which he asserts contribute to the development of the student's potential.

Rimm and Lowe's (1988) research looks at environment and identifies similarities between a sample of 22 underachieving students in their study and eminent gifted achievers described in earlier studies by Bloom (1985), Walberg, Tasi, Weinstein, Gabriel, Rasher and Rosencrans (1981), Albert (1980), McKinnon (1965) and Goertzel and Goertzel (1962). For example, many homes of the children in each study had other adults nearby, such as grandparents, aunts and uncles, who also lavished attention on the child.

Rimm and Lowe (1988:354) also draw attention to an attribute which they describe as 'specialness'). This may be described as a family attitude

which in some cases simply means that the child was much desired and often given a great deal of attention early in life. Children in the underachiever group had attention withdrawn for some reason and possibly given to another family member such as a sibling or step parent. This was the essential difference between the Rimm and Lowe group and the eminent gifted achievers.

Tannenbaum's (1983) 'five factor model' (Figure 2.2 discussed under section 2.4.2) includes a chance factor which he identifies as 'being in the right or wrong place at a given time'. This feature may also be compared with those identified by Rimm and Lowe (1988) and Butler-Por (1993) That is, the child is in a situation over which he or she has no control.

In the category of family values, Rimm and Lowe (1988) identified similarities between the families in their study and those of eminent gifted achievers with whom they made comparisons. In particular, the attributes included achievement-oriented parents with strong commitment to the given task and similar expectations of their children, provision of early enrichment and a shared interest between at least one parent and the child.

One significant difference between the studies of eminent gifted achievers and the Rimm and Lowe study was that the achievers' study indicated parents who espoused positive feelings in relation to their careers, whilst the parents of underachievers in Rimm and Lowe's study showed frustration rather than satisfaction with their careers.

The education level of parents in the Rimm and Lowe study was similar to that of the eminent gifted achievers. Rimm and Lowe cite studies by Growth (1980), Barbe (1981) and Van Tassel-Baska (1983) in which all parents of the subjects had a college education. This was similar in the Rimm and Lowe group.

2.3.4 Summary — Underachievement

The research cited here in relation to underachievement points to a conclusion that academic performance below a student's ability level is frequently a symptom of the underlying problem not the problem in itself. Several researchers consider IQ testing to be an inappropriate instrument for identifying potential as the tests are too limited. For example IQ tests do not indicate the true ability of a divergent thinker and cannot indicate traits of creativity .

The investigations of some researchers suggest that environment may be critical in the development, or the permanent retarding, of creativity in

gifted underachieving students.

2.4 Creativity

2.4.1 Definition

Creativity may be likened to a marshland, with areas of solid ground that can suddenly become as insubstantial as a quagmire. Academics when approached on the subject by this researcher raised their eyes and their hands and usually replied, 'It depends who you listen to'. In reviewing the current literature, it became apparent that although there has been renewed interest in the concept of creativity over recent years, there was essentially a significant gap between early research undertaken in the 1930s and 1940s and contemporary research. Some research into creative giftedness was undertaken in the 1960s and 1970s, but researchers generally continued to have differing concepts of creativity.

It should be noted that some researchers including Simonton and Sternberg (1991), Renzulli (1986) and Cox and Daniel (1983) acknowledge that creative talent covers a much wider range than previously recognised, and includes mechanical and manipulative skills which were previously overlooked as they did not fit the traditional image of creative giftedness.

In searching for a clear operational definition for the current research, it became quite difficult to identify a common thread within the various researchers' perceptions of creativity. This lends credence, in part, to Sternberg and Lubart's (1993:13) contention that many resources must combine to produce a creatively gifted person. The various definitions considered in this review support Sternberg and Lubart's contention.

The problem with defining creative giftedness is referred to by Sternberg (1991) who draws attention to the fact that although creativity is constantly compared to intelligence, it is less highly regarded. In his view, research into creativity is poor when compared to research into intelligence. Creative giftedness, in the view of Sternberg, is acknowledged but largely ignored by researchers. If there is a dearth of research relating to creativity it may account, at least in part, for the differing opinions and lack of a precise definition. The view of Sternberg is supported by Hennessey and Amabile (1991) who suggest that the problem lies in the fact that many researchers interested in the creatively gifted, whether relying on creativity tests or subjective assessments of products, tend to conduct their research in the absence of clear definitions.

E.P. Torrance (1991:44), a widely acclaimed authority in the field of creativity, illuminates the problem of definition a little when he states categorically that creativity defies definition and that in his view:

> Creativity is almost infinite. It involves every sense; sight, smell, hearing, feeling, taste, and even perhaps extra sensory. Much of it is unseen, non-verbal, and unconscious. Therefore, even if (there was) a precise conception of creativity,...we would have difficulty putting it into words... (Torrance, 1991:44)

Torrance (1991:46) concurs with Guildford who conceptualised creativity in terms of innovation, originality, unusual synthesis or perspective, fluency, flexibility and elaboration. He concludes that creative thinking cannot be equated merely with divergent thinking. He considered sensitivity to problems to be essential to the creative thinking process.

In considering the historical perspective, Torrance (p44) reviews the work of Wilson (1956), Crutchfield (1962), Starkweather (1976) and Lefrancois (1982), who all view creativity in the light of a contrast to conformity. He concurs particularly with Starkweather who describes the creative person as being neither conforming or non-conforming but rather as being free to conform or not to conform, depending on '...what is true, pleasing, good, or beautiful...'

Torrance (1991)considers the views of other researchers, including the following:

- Bartlett (1985:55) who uses the term 'adventurous thinking' which he defines as '...getting away from the main track...' or '...being open to new experience'.
- Amabile (1986 :56) who expresses the view that '...extraordinary talent, personality, and cognitive ability do not seem to be enough — it is the "labour of love" aspect that determines creativity...'. She deduces this from testing and from longitudinal studies. Amabile's view supports that of Betts (1985) who describes the essence of creativity as 'the passion'. ie.its motivation component.
- Torrance (p58) explains that to establish a starting point for research into a definition of creativity he considered the concept from a process perspective and concluded that the truly creative is that which cannot be taught yet cannot come from the untaught. Therefore, he suggests, creative solutions result from the imaginatively gifted 'recombination of old elements'.

2.4.2 Traits

There is general agreement that creativity is represented by many factors within an individual. However, just what these factors are and their confluence is again a matter for debate. Renzulli (1992:170) points out that, while writers such as Monks, Van Boxtel, Roleofs and Sanders (1985), Tannenbaum (1986), Sternberg and Davidson (1986) and Renzulli (1986) have speculated about the necessary ingredients for creative productivity, they fail to explain how the confluence of desirable traits 'ignites the spark' or what drives some people to use their intellectual, motivational, and creative assets to achieve, whilst others with similar assets fail to achieve. Renzulli cites Sternberg and Lubart (1991:17-18) who assert that an excess of one particular trait such as intelligence does not compensate for limitation in other areas. An excess of characteristics such as perfectionism, they suggest, may even be detrimental to creative production.

In Renzulli's (1992) view, one or more of the following factors is usually present in the creative producer. These are moral courage, optimism, vision, charisma, hope, absorption, gender and personal choice. He submits that it is usually these factors that have brought such a person to our attention.

Sisk (1984:237), in considering the historic perspective of the highly creative student, cites Torrance (1962) and Guildford (1959) who agreed in part on the notion of the creative individual having certain character traits. These focus particularly on traits of flexibility and originality in thinking, the ability to redefine and elaborate, imagination and innate intelligence. Sisk submits that although the views of these earlier researchers are still relevant today there are further considerations. She offers an extensive list which differs in focus and includes, alertness, curiosity, independence, experiential learning, risk taking, sense of humour, language rich imagery, leadership, responsibility, adaptability and external motivation. From the factors outlined by Renzulli and Sisk, it is clear that a researcher attempting to analyse a young student who ultimately evolves as possessing high creative potential, has a difficult task.

Tannenbaum's (1983) five point star model (Figure 2.2) identifies factors that may develop into potential for giftedness. In this model, Tannenbaum identifies the role of the environment and suggests that children who have the potential to succeed as gifted adults need special encounters with the environment. In addition to the traits discussed above Tannenbaum emphasises the difficulty of identifying the young, potentially gifted student. He draws attention to the fact that many talents by their very nature cannot emerge until adult or near adult years.

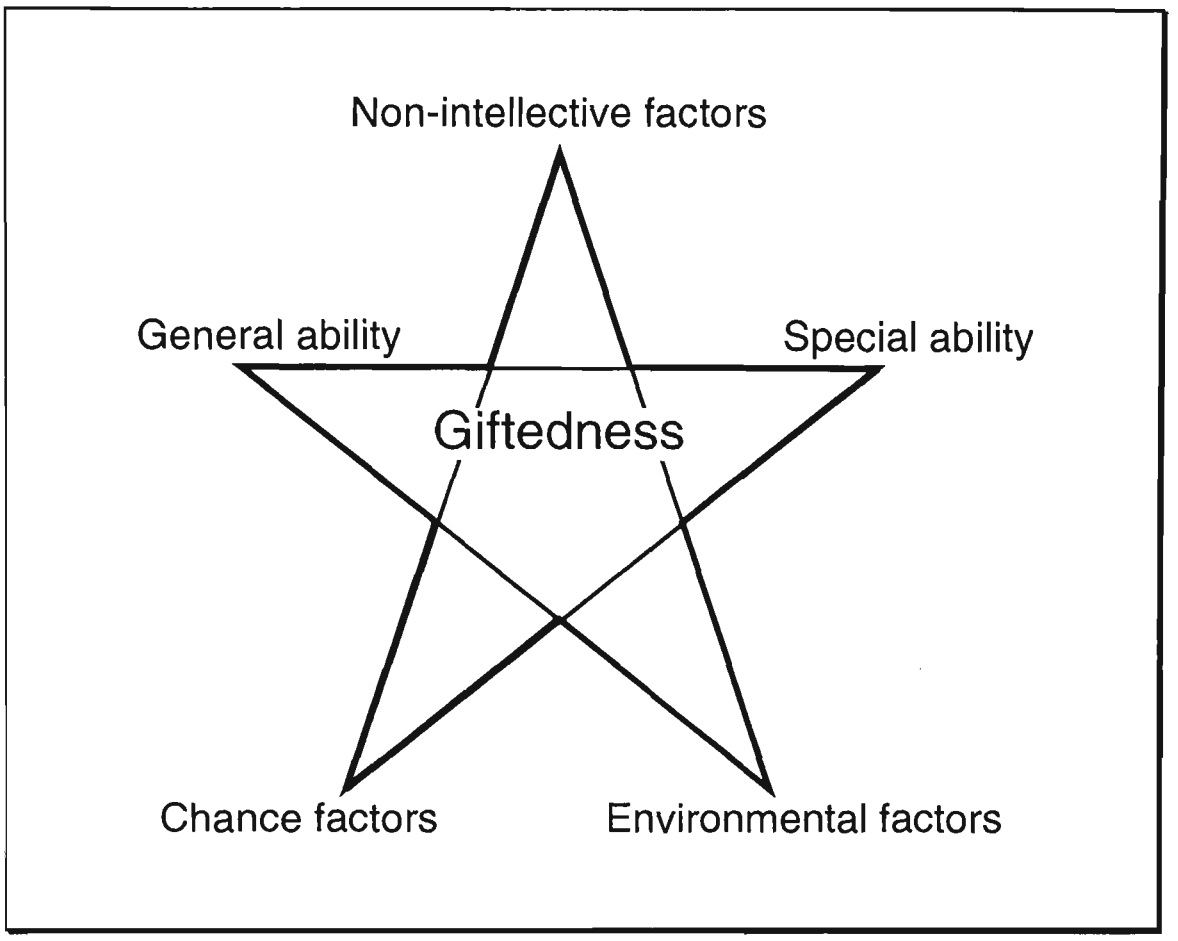

Figure 2.2 Tannenbaum's (1983:95) psychosocial model of giftedness

The Tannenbaum model of giftedness suggests there are five factors, which he represents as a star. He asserts that giftedness lies at the centre of the star, where the five factors converge. Three of these factors relate to traits outlined below:

General ability factor

Tannenbaum suggests that general ability is on a sliding scale and relates in part to the student's particular talent or skill.

Special ability factor

Tannenbaum describes the special ability factor as being especially bright at doing something that is highly respected. The difficulty experienced by creative–productive thinkers, he suggests, is that the special talent they possess may not be immediately respected. Even if the talent is respected by a knowledgeable few, a teacher raised and trained in a different environment may not recognise the intrinsic value of a student's ability, especially if it is counter-productive in the classroom.

Non-intellective factor

Tannenbaum suggests the non-intellective factor includes traits such as ego, strength, dedication and a willingness to make sacrifices. These qualities

are frequently observable in creative–productive thinkers and each has the capacity to be counter productive in the classroom.

Sternberg and Lubart (1993) suggest that creative giftedness stems from a confluence of resources; they define six. These are intellectual processes, knowledge, thinking styles, personality, motivation and environment. On the other hand, Twila and Sternberg (1991) simply group them in three general categories of cognitive characteristics, personality and motivational qualities. Whilst Renzulli (1992) is in general agreement with these categories there is a variation in emphasis, as he substitutes motivational qualities for environmental factors.

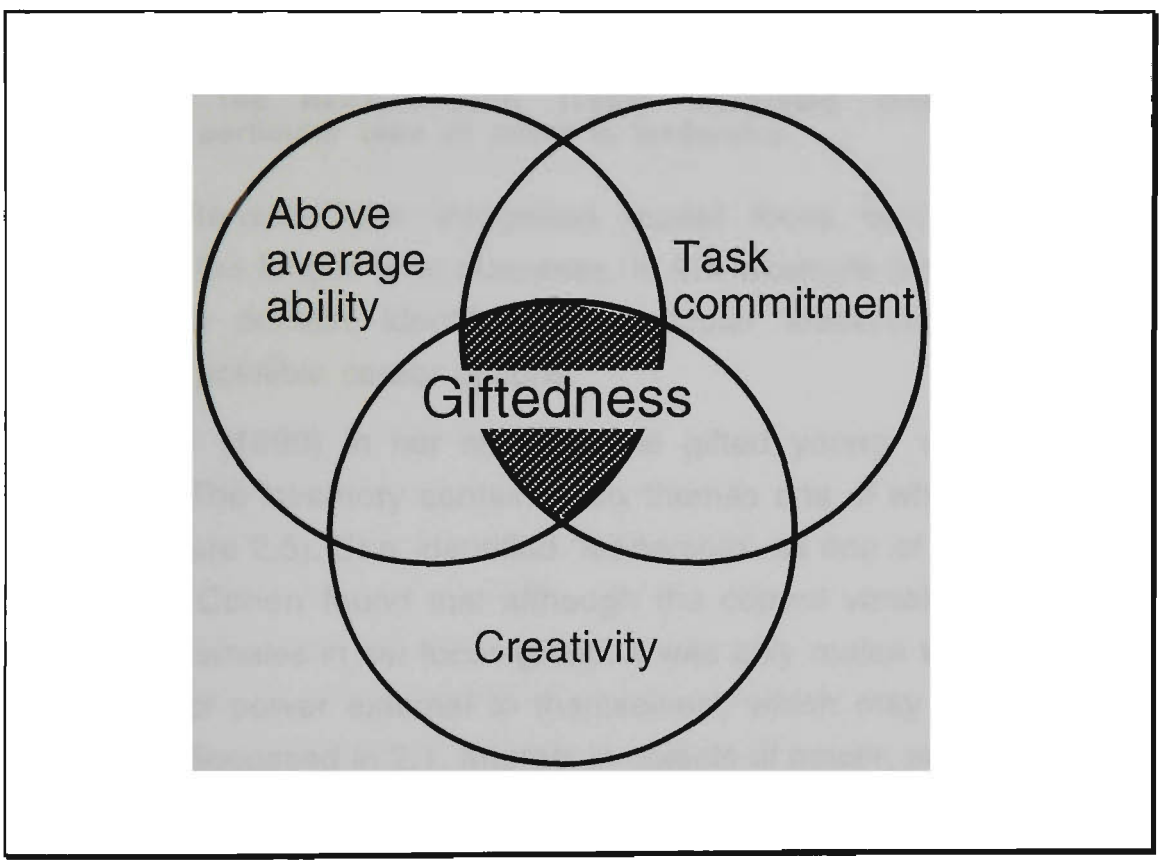

Figure 2.3 Renzulli's (1978) three Ring Model – Interaction of traits in the gifted.

Renzulli's (1978) Three Ring Model illustrates that giftedness is an interaction of three basic traits which may be brought to bear on a range of performance areas. To some extent the model helps to define the confluence of traits which come together in a gifted individual but at the same time it leaves the issue open ended as the model does not define particular traits other than task commitment. It is a more powerful model when seen in the extended form, that is the Renzulli–Cohn integrated model (Figure 2.4) which indicates the wider ramifications.

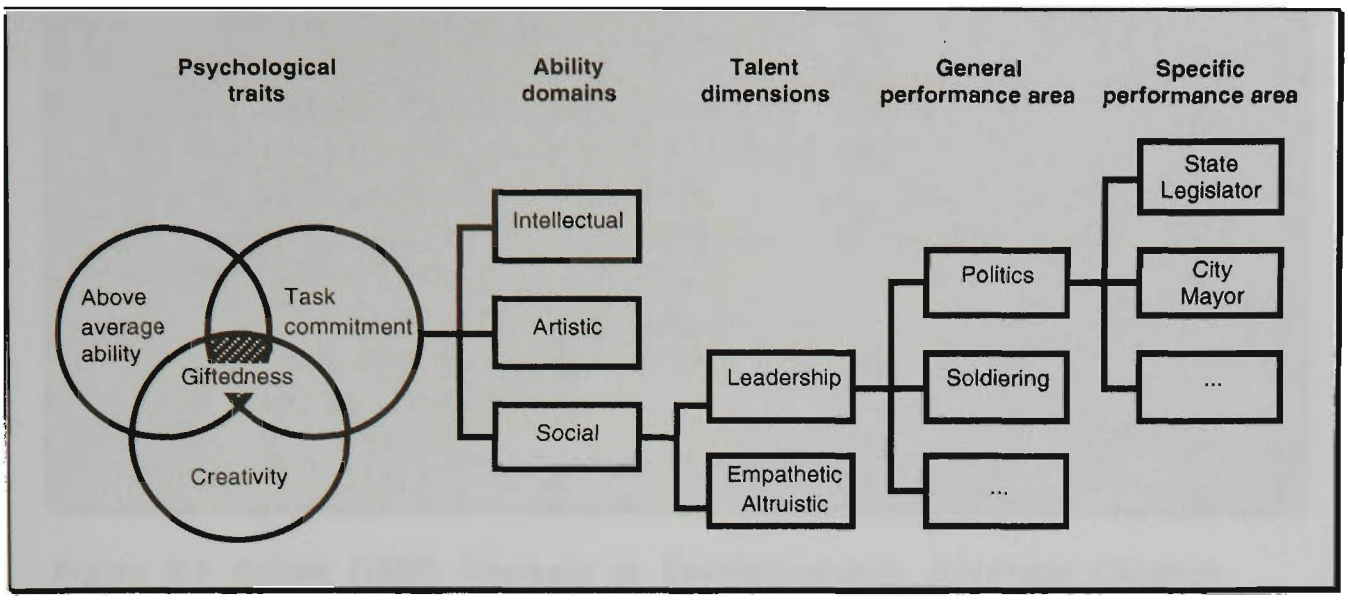

Figure 2.4 The Renzulli–Cohn (1986) integrated model, illustrating the particular case of talent in leadership.

The Renzuli–Cohn integrated model looks beyond the classroom situation to the longer term outcomes. In this example the model extends the social ability domain, identifying in particular 'leadership' as a talent and suggesting possible career options.

Cohen (1990) in her study of the gifted young, created an 'interest inventory'. The inventory contained six themes one of which was the 'control theme' (Figure 2.5). She identified 'leadership' as one of the variables within the theme. Cohen found that although the control variable was common to males and females in her focus group, it was only males who were interested in 'objects of power external to themselves', which may explain the gender imbalance discussed in 2.1. Interest in objects of power, according to Cohen's study, is seen to be linked to leadership qualities. Creative–productive thinking and leadership are comparatively new additions to the concept of talent and giftedness, as discussed earlier. The Government of Victoria's Policy Statement (1996) on gifted students, also includes 'leadership' as a trait of the gifted.

1. the child wants to be in charge of him or herself and the world
2. the child strives for mastery of what interests them
3. the child needs action and movement as a part of play
4. the child shows interest in objects of power external to themselves—for example cars or guns
5. the child prefers set guidelines or parameters
6. the child likes to explore independently
7. the child may seek attention

Figure 2.5 Cohen (1990) Interests of Developmentally Advanced Children

With such a morass of information, lists and differing opinions, it is little wonder that researchers investigating creativity tend to conduct their research in the absence of clear definitions, as highlighted by Hennessey and Amabile (1991).

2.4.3 Behaviour

Torrance (1962) asserts that 'Creative students may not be well liked and that some teachers do not value creativity very highly.' Renzulli (1979) suggests that creatively gifted students are likely to be identified initially by their behaviour. Renzulli (1992) asserts that in a high proportion of underachieving students the particular potential lies in creative thinking; this by its very nature may be identified as inappropriate behaviour. Cohen (1993) cites research undertaken in Alberta, Canada, which suggests that ability may be masked by a reluctance to perform, particularly on tasks requiring convergent thinking. Often this reluctance to perform may be due to the student's own high standards.

A somewhat different view of behaviour traits demonstrated by the creatively gifted is put forward by Sisk (1984). She suggests that creative individuals may be anti-authoritarian, adventurous, intolerant of boredom, divergent thinkers and have a zany sense of humour.

Tardif and Sternberg (1991:436) suggest that what distinguishes creative individuals is the lack of fit to the environment. This, they suggest, is compounded by the creative person's need to maintain distance from their peers and resistance to societal demands.

Torrance (1991:70) reported on the behaviour of primary students of a similar age to those in the current study. He observed that the most creative member of a group may clown when sensing disapproval, may work in

isolation, or may become aggressive under peer pressure. Torrance's observation of behavioural traits appears to support the earlier Alberta research findings — cited in Cohen (1993) — and also that of Sisk (1984) and Tardif and Sternberg (1991).

2.4.4 Environment

Simonton and Sternberg (1991) claim that individuals become creative only in so far as they impress others with their creativity. Tannenbaum (1983) appears to share this view when he suggests that for the potential of a student to emerge, there are some other requirements besides those of personal attributes. These he described as '...encounters with the environment...'. He suggests that special ability of any kind is not enough on its own; the ability must also be respected by those whose opinion is valued. The respect factor is critical and Tannenbaum suggests that creative–productive thinkers, in particular, may experience difficulty. This is because the special talent possessed by these students, may not be respected in the short term and the talent can often take time to develop. Students of high ability in the performing or visual arts, or in sport tend to be recognised and respected more readily, he asserts.

The need for recognition was put forward by Torrance (1965) who submitted that creative behaviour is unlikely to flourish in what the student perceives as a hostile environment. Torrance claimed there is evidence to suggest that the spark which lies within the creatively gifted, will wither if not nurtured and encouraged to flourish. Further to this Runco, Johnson and Bear (1993) contend that a mismatch between a creative child and his or her teacher or parent is likely to interfere with the child's creative and intellectual development.

Lowenfeld (1987:77) warned of the need to be aware of the psychological and physical restrictions that the environment places on children, which can lead to inhibitions and a curbing of their own natural curiosity and exploratory behaviour. Lowenfeld asserts that the creative individual needs a personal environment that will maintain the intrinsic motivational orientation necessary for creative expression.

There is another dimension to the environment which Torrance (1984) identifies in this way — '...wherever independence and creativity occur and persist and important creative achievements occur, there is some other person who plays a role of mentor...'. Critical to a conducive environment for the creatively gifted is a perceived mentor. The mentor as such may be unaware of the role he or she plays in the intellectual development of the

mentee but Haensly and Parsons (1993) suggest that self concept and self-esteem are promoted through signals received from one's environment and they perceive the mentor as an essential part of a mentee's environment. Self-esteem, they assert, has a tremendous impact upon intellectual development. This further supports the view reiterated separately by Torrance (1991), Tannenbaum (1991) and Simonton (1991) on the creatively gifted person's need for recognition. Intrinsic motivation is obviously an essential componet but is not enough. In the view of these writers creativity cannot exist in isolation, there is a need for a nurturing environment.

2.4.5 Summary — Creativity

The research suggests that creativity is infinite and combines many elements. However, the confluence of these elements is disputed.

A key consideration in the study of creativity is the fact that many creative talents cannot emerge until a student is near or at adulthood. A further consideration is that the concept of creativity is now valued more broadly than was historically the case and includes psychosocial concepts as seen in Tannenbaum's model. Some traits of creativity in underachieving students, such as ego, may be counter productive in the classroom, and it may be just such behaviour which is the earliest indicator of potential in a creative underachieving student.

In essence, the literature suggests that individuals with creative potential may embody any one or more of a wide range of behavioural characteristics whilst the very environment in which the individual is developing may enhance or detract from the motivational qualities of that individual. For this thesis the author accepts the definition put forward by Torrance (1991:72) who states that 'Creativity is a multifaceted phenomenon that defies precise definition'.

2.5 Educational Needs

> The intent of identification should be to provide necessary educational services, not award membership in a group called gifted.
> (Gear in Cohen 1993)

2.5.1 Philosophy

Cohen (1990) discusses the views of Piaget (1970, 1977) and Whitmore (1987) who assert that learning rests on interests and underachieving students can learn when interested. Cohen (1985:2) also suggests that: '...interests develop where the neurological and biological inheritance meets

events in the social and physical environment'. That is, where nature meets nurture.

Cohen submits that these interests are structured around themes and that they arise from the unconscious. Cohen further suggests it is an attempt on the part of the child to make sense of the world and his or her place in it. In the opinion of Cohen, interest themes help the child to develop self concept. Parents and teachers, she asserts, should tune in to the child's involvements and should provide many early experiences that may open doors to new interests. Betts (1985) also affirms the importance of experiential learning when he argues that the act of learning incorporates the learner within the process. Betts suggests that experiential learning is the reverse of surface learning, which he claims is what takes place most of the time in schools.

Renzulli (1992) would seem to support Cohen, when he highlights the important relationship between acts of learning and the interest that is present in that learning. Interestingly, he asserts that research undertaken over a five year period based on his enrichment model, indicates that creatively productive students display early and more intense interest than do equally able peers.

Sungaila (1981) addresses the interest factor a little differently. Working from the theory that if children are going to learn they must want to learn, she researched the educational needs of country students in Australia. In particular she searched for clues as to what motivates country children. One of her key assertions is that country children are often called upon in the home environment to act as adults, a fact that needs to be taken into consideration by the school and by the class teacher when planning learning experiences; there needs to be a real purpose for curriculum tasks.

Whitmore (1980:87) suggests that Zilli (1971) is one of the few authors to have seriously considered the school as a potential contributor to the problem of underachievement. Zilli found that inadequate curriculum content, a school atmosphere low in intellectual stimulation and challenge, and teacher emphasis on conformity were major causes of underachievement. These views seem to be compatible with those of Sungaila and support the earlier work by Taylor (1964), who nominated three factors relevant to underachievement and the educational needs of students. They were the value a student places on his own worth, acceptance by peers and the focusing of educational activities around academic interests.

2.5.2 The educational environment

The environment provided by the school is as important in the

development of the student with creative potential as is the home environment.

Whitmore's (1980) study of underachievement found that the curriculum and traditional teacher-centred teaching methods do not take into account the child that understands complex concepts and is capable of formulating hypotheses. The result is boredom and lack of motivation to learn. Butler-Por (1993) asserts that poor scholastic achievement is often caused not by inability to do better but by complex environmental and personality interactions which affect each student differently. Underachievement is an expression of the child's conscious and unconscious choices.

2.5.3 Learning Style

Bacon (1982) attributed deficits in academic capability to concepts of preferred learning style and suggests that school emphasis on conformity stifles independent creative ability. This view supports that of Sungaila (1981) who claims that the single overall perception gathered from her data was the need for students to feel comfortable in the learning situation. To this end she advocates that students need choices in how they will learn, including choices as to whom they will work with. Sungaila highlights the importance of self-concept and contends that group attainment of a group learning goal inevitably enhances self-concept. Betts (1985) submits the view that self-esteem, confidence and increased ability go hand in hand. Betts considers that students with high potential should have the opportunity to pursue their own interests. The act of learning, he argues, incorporates the learner with the process and the material and therefore a need for choice is paramount. Rogers (1983:120) maintains that '...a reliance upon process rather than upon static knowledge, is the only thing that makes sense as a goal for education in the modern world'.

Sisk (1984) asserts that students' strengths, whatever they may be, should be viewed as beginning points for instruction. Essentially, learning experiences need to be open ended, so that each student can make of it what they will, exploring the breadth and depth of the topic to their personal limit.

Following this theme, Smilansky (1984) recommends a programme of sensory bombardment and active participation for students. Sungaila suggests that some students need the opportunity to use all their senses but others do not.

Butler-Por (1993) asserts that the failure of the school environment to fulfil the creative student's needs may result in underachievement. These needs include freedom of choice in thinking modes, selection of scholastic

activities and learning experiences. However, there is a 'vicious cycle' as the students' needs remain hidden until their high abilities can be expressed and that requires an environment which nurtures creativity.

Atkin (1994) links motivation to personal need and purpose. Individuals, she claims, have thinking preferences as well as learning style preferences. Thinking preference may be right or left brain, upper or lower quadrant, whilst preferred learning style may be auditory, visual or kinesthetic (Figure 2.6 and Figure 2.7).

Atkin's models illustrate the possible range of a student's learning and thinking mode and can be valuable to the observer–teacher in identifying an appropriate process. Atkins asserts that '...effective teaching requires stimulation of the appropriate processing in the learner, for the learning task...' (1994:13). The models can also be used to identify learning and thinking modes which need to be encouraged. Atkin states that a learner should be helped to develop the whole brain not simply exercise the preferred thinking mode.

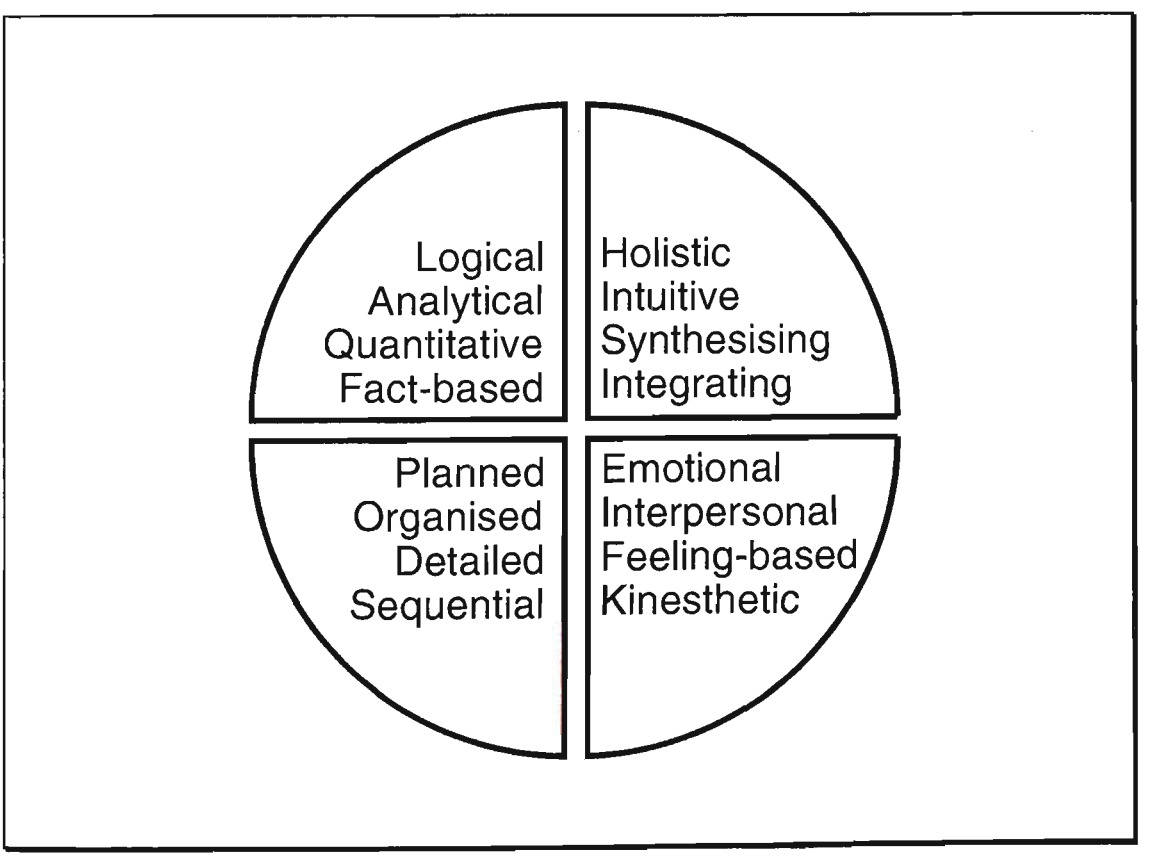

Figure 2.6 Atkin (1994) Cerebral Mode Thinking Processes: the quadrants of the brain and their functions. (from Herrmann 1989)

Left mode processing	Right mode processing
• serial–sequential	• parallel–simultaneous
• focal–convergent	• diffuse–divergent
• verbal	• image–spatial
• logical–analytical	• intuitive–holistic
Left brain does best	**Right brain does best**
• Explaining with words	• Explaining visually
• Remembering using language	• Remembering using images
• Step-by-step thinking	• Holistic thinking
• Controlling emotions	• Expressing emotions
• Taking life seriously	• Approaching life playfully
• Working with facts	• Working with pictures
• Analysis	• Synthesis
• Logical reasoning	• Intuitive understanding
• Practical tasks	• Design and people related tasks
• Structures activities	• Fluid open activities
• Organisation	• Improvisation

Figure 2.7 Atkin (1994) The Natural Flow of Learning: conditions which enhance and maximise learning.

2.5.4 Educational strategies

Whitmore's (1980) study was followed up with school-centred intervention, based on the creation of an educational environment that produced opportunities for improving learning habits and skills. Butler-Por (1993) saw this as an imaginative curriculum with teaching methods that emphasised:

- a non-threatening classroom environment
- a child-centred approach
- a good pupil-teacher relationship
- a supportive peer group.

Whitmore's evaluation of her intervention programme claimed that underachievers improved their:

- self concept and sense of control
- school attendance and work habits
- ability to set more realistic goals
- self evaluation
- school achievements
- social behaviour.

Butler-Por (1993) suggests that the results of the intervention programme highlight the important role of the teacher as an agent for change in reversing underachievement. In order to fulfil this role the teacher needs to

understand the nature of underachievement and the specific problems of the individual underachieving child.

Delisle (1992) addresses the role of the school in the development of underachievers with high intellectual potential and describes two types of student, underachievers and non–producers. He outlines strategies which work equally well with either type. He cites Whitmore (1980) who classifies three clusters of reinforcement strategies. The first cluster affirms the worth of the student in the classroom. The second cluster is designed to develop intrinsic achievement motivation, whilst the third cluster identifies remedial strategies which address areas of perceived difficulty. These strategies put the child back in charge of their own learning and ultimately their academic success. In each situation, that is with non-producing and underachieving students, the teacher is a supportive partner but adopts a different stance for each.

Delisle argues that low achieving students require the support of teachers in different ways from that of mainstream students. Non-producers need greater autonomy whilst underachievers will vary and must receive support appropriate to their particular needs. In this Delisle has some areas of agreement with Betts (1985:28) who, in addressing the role of the teacher in the educational needs of students, puts forward the idea that a teacher '.... facilitates, guides, questions and supports but does not direct...' Emphasis, Betts maintains, '...must be placed on the development of skills, concepts and attitudes...' (p24). Allen (1992) argues a similar point of view, that the emphasis in developing programmes should be on skill and concept development. However, Allen suggests knowledge acquisition where Betts suggests attitude. A further strategy for learning put forward by Betts is that of live presentation by the student at the completion of a project or unit of work. Live presentation, he suggests, reinforces the knowledge and comprehension for the presenter and helps in the development of self confidence.

In examining some of the alternative approaches which schools may adopt, Braggett (1995) highlights '...the willingness of teachers to vary their teaching strategies...'.

Sungaila (1981) in searching for clues as to motivation in rural students, concluded that the organisation of the learning situation was a key concept. In her view, motivation is affected by interaction among students and they should be allowed to form social groups for instruction. Groups should also form on the basis of preferred learning style or common interests.

2.5.5 Educational enrichment

Braggett (1992:20) argued that an enriched background broadens learning and this is especially apparent where family communication is strong and where children experience language from birth and are encouraged to interact with others. He suggests that curriculum outside the normal school pattern may reveal previously unsuspected talent and interest (p35).

Drawing on discussions with teachers, Braggett (1992:82) reported that many teachers are of the opinion that enrichment goes beyond the basic routine. Their view was that enrichment improves, supplements and extends the school curriculum. He noted that some teachers claim presentation is the key and that activities can be enriching if the presentation is challenging.

Allen (1992) experienced difficulty with the term 'enrichment'. There was some dispute between members of her team as to what constituted enrichment. Ogilvie (1980) asserts that '... true enrichment involves digging deeper and wider...'. Allen was involved in developing materials and programmes for gifted students in rural schools and in her view just exposing students to new experiences comprises enrichment. Braggett (1992:83) considers there is a need to be more specific about enrichment. His view is that enrichment needs to be implemented as a well thought out strategy; it should be developmental and goal oriented. Braggett defines enrichment as '...any activity designed to broaden knowledge, understanding, interests, processes, strategies and skills beyond the normal (core) school programme and at a level appropriate to the developmental needs of the student...'. Braggett (1992:97) asserts that enrichment activities are not content-based alone but include the extension of interests. Unless learners are challenged with appropriate intellectual stimulation, they may develop the attitude that all learning is easy and that sustained effort is not required. They may become bored with school, careless in their study and accept their own underachievement.

2.5.6 Summary — Educational needs

General agreement exists that the school environment is important in the development of the creatively gifted student, that inadequate curriculum and low intellectual challenge contribute to underachievement and that there is a need to focus educational activity around student interests. A child-centred approach in a non threatening environment gives creative students a sense of control over their learning and improved self image which lead to enhanced academic performance.

2.6 Technology In Education

> Man is a tool using animal. Without tools he is nothing, with tools he is all.
> Thomas Carlyle (1795-1881), in Rowe(1993)

2.6.1 Philosophy

Rowe (1993) is a strong advocate of the use of computers in the classroom, seeing them as a cognitive tool which stimulates the thought processes. However, mastery of the computer is not instantaneous and although some students demonstrate a particular facility for using the computer, others do not. This is particularly noticeable for those with poor self concept and/or poor fine motor skills.

Rowe points out that computers are being advocated by diametrically opposed theoretical approaches to learning and teaching. She maintains that computers can be used to make highly structured methods of instruction even more structured, but they may also be used to make open democratic learning situations more open. That is, they can increase the self-directed learning. Rowe argues strongly, that people do not learn from computers or other devices, rather the learning is facilitated by the technology. The focus should be on what students do with computers; how they adapt the technology rather than how they adapt to the technology. One revelation of the Sunrise Project, (1984–1986), with which Rowe was associated, is that '...computer programming can make the abstract concrete and personal and thus help children learn more effectively by making their thinking processes conscious...' (p11).

The following aims in making use of computers in the classroom were the basis for the Sunrise Project.

- To make some of the most powerful ideas of the techno-centric culture accessible and tangible to students at an early age in their schooling.
- To provide an environment in which learning can be intrinsically motivating and fun.
- To allow students to discover, explore and create knowledge.
- To help develop skills of thinking and problem-solving.

Rowe (1993:4) suggests that the computer revolution has the potential to increase the power of the human mind in a manner comparable to that of the industrial revolution's amplification of human physical power. Empowerment, Rowe concludes, is especially important to children whose previous experience with school has consisted of one failure after another. As children

become empowered in their quest for learning, the dynamics of the social learning environment may change as well. Rowe is confident that computers will inevitably and profoundly amplify human mental power and alter both what we do and how we do it. What we achieve with computing will be limited only by what we can imagine for it.

Woodhouse and McDougall (1986) take a similar view. They suggest that every use of the computer is as a tool which emancipates people from time consuming tedious tasks. However they point out that in some modes the computer leads the user through the tasks so that it is the computer which is in control. This, they assert, should be avoided; a view supported by Rowe.

Rowe asserts that many schools strive for the latest and best in educational technology but she decries the tendency to focus solely on computers rather than on a multitude of concurrent interactions with the wider technological learning environment.

2.6.2 A different kind of learner

Boldt, Duff, and Harris (1993), three young teachers in the USA, established a technoliteracy programme for years one, two and three at their school using film, video, audio and computer multi-media. It is their view that technology facilitates the exchange of information at such a rapid rate that such a revolution cannot help but change the face of education. In their view, the 'bodies of knowledge' model of education is no longer adequate. It is not possible in today's world to know everything in a given field. The pace of today's information revolution requires a different kind of learner; they must be powerful users of technology. Fletcher, Gatti, and Michael (1985) suggest that human society is now located along a continuum according to an individual's capability with the technology of information. Rowe (1993) argues that in the information age the ability to access and use knowledge becomes a form of capital. To this end, the hands-on approach to teaching computing and other technical skills can enable the student to develop considerable skill and confidence in their interaction with technology.

The aim of Boldt et al. was to establish classroom communities where students and teachers explored the technologies together. They believed literacy must be broadened beyond reading, writing, listening and speaking to include presenting, viewing and discerning. Educators must take advantage of the possibilities offered by technology. Today's learners must be able to identify what they want to know and know how to find out. This requires a different style of classroom.

Learners must be presenters of information and be able to recognise

effective presentations. Boldt et al. report that as they recorded student activity, it became apparent that final products were a compilation of effort from the whole classroom community. Composing on the computer was a very public event; students read aloud to friends from the screen and the critical observers offered advice. They noted similar processes in video production, where camera angles and special effects were discussed and understandings gained were subsequently used in later productions.

2.6.3 Facilitating learning

Boldt et al. noted that the three most significant effects of their technoliteracy programme were awareness of presentation, non-linear access to information and increased enthusiasm for reading, writing and research.

Kearins (1984) suggests a motivating environment has a high level of interest where assistance can be obtained from peers, where the atmosphere is non-competitive and there is a significant reliance on visual instruction. Fletcher, Gatti and Michael (1985) stress the importance of computers in the development of today's society as they provide for a student's intuitive thinking abilities. Computers have the potential to:

- develop habits of thinking in an orderly and logical way
- exploit the natural inquisitiveness of students
- offer the particularly adept a new way of expressing their ideas
- develop a student's perception of the role of technology.

Some of the benefits of computers are immediate feedback and motivation, a non-threatening environment, a non-critical environment and freedom from peer pressure.

2.6.4 Motivation to learn

Boldt, Duff and Harris (1993) showed that technology can change children's expression of literacy, and this raises the question of whether children with access to powerful technology might develop '... abilities that are different [to those] we had previously...[perceived]'.

Rowe (1993), in reviewing research on the motivating aspect of computer use, argues that using a computer gives a student a sense of mastery over his or her environment. Rowe claims there is a growth in self-esteem and consequent improvement in cognitive development. Students have a sense of power which comes from gaining skill or knowledge. Rowe condemns the view that personal computers will negatively affect social interaction among students. The empirical findings of the Sunrise Project strongly support her claim. '...computing allows for dialogue between

students and projects that encourage co-operation. It allows students to create pieces of work about which they are excited and which they want to discuss...'.

2.6.5 Summary — Technology

The literature identifies the empowerment properties of technology for young students and the relevance empowerment to self-esteem and motivation. Boldt et al. (1993) and Rowe (1993) assert, however, that information technology for students should not be limited to computers alone but should include the technologies of film, audio and video. They state unequivocally that learners of the future will need to be powerful users of technology which, as a medium for learning, is intrinsically motivating, offers challenge and transcends curriculum boundaries. It is foreseen by Rowe (1993) that skill with technology will become a form of capital. Each of these concepts are of special relevance to this study.

2.7 Literature Review — Conclusion

Within this review key concepts are identified which relate to students who appear to lack motivation in school. The most important of these is the link between underachieving behaviour of students in the classroom environment, such as poor motivation and the student who has high intellectual (creative) potential. Researchers Braggett (1992), Rimm and Lowe (1988), Betts (1985) and Whitmore (1980) all identified this link within their research.

The nature of creativity is diverse and the many researchers cited within this review differ more than they agree. However, two points of agreement are a passion or a 'labour of love' attitude toward a key interest and a combination of sensitivity and imagination.

The relationship between the nature of the school environment and underachieving behaviours is identified by Butler-Por (1993), Rimm and Lowe (1988), Tannenbaum (1983) and Whitmore (1980). They claim that the curriculum and teaching style, if incompatible with a student's preferred learning style, may contribute to underachievment.

Another key concept relates to the family and social environment in which the student is developing. Sungaila (1981) suggests that a mismatch between expectations of a student at home and at school can send confused messages. A student who is held in high esteem at home and treated as a developing adult may find it difficult to be one of a crowd at school, expected to be a passive recipient of instruction rather than a meaningful contributor. A student in this situation may consider school to be unimportant and unrelated

to the 'real world' and demonstrate a lack of motivation which results in underachievement.

3. The Research Questions

The literature review has identified that many students, including some specifically described as 'special populations' or 'sub-cultures', may be perceived to be underachievers in the classroom. However, some of these students may demonstrate skills and qualities in the family context which reflect creative abilities. This combination of characteristics, underachievment and creative ability, is particularly noticeable when curricula offered by the school are unimaginative The nature of the family climate and structure were seen to be crucial factors for the fostering of creative skills, while the lack of challenge from the curricula is pivotal to poor motivation in the traditional school curriculum. These factors raise the question of how such students might respond to a self-directed curriculum which is held to be more in tune with the respect and responsibility that these students enjoy within the home environment.

The research study set out to explore the following specific questions.

1. How can the enigma within a rural school, of bright minded students with low academic achievement be explained?
2. In what ways did the introduction of a technoliteracy curriculum, which emphasizes self-directed learning, influence the motivation of these students?
3. How can the effects of the self-directed technoliteracy curriculum on the performance of individual students be explained?

4. Methodology

4.1 Overview

Upon moving from a suburban school to a school in a rural area the researcher noted a marked difference in learning style between rural and urban students. Structured teaching and learning approaches left some students unmotivated and the researcher became interested in the potential of a technoliteracy approach to the curriculum as a means to motivate the students who were of particular concern. The particular type of student who became the focus of the intensive research project was identified from observation over several years prior to commencement of the research project. These students lacked motivation yet appeared to have greater ability than was demonstrated in the classroom. Ultimately the technoliteracy approach was introduced for the whole class, in order to provide a benchmark by which to assess the response of these particular students. The students are identified within the thesis as the focus students.

Owing to circumstances beyond the control of the researcher the research project took place in two parts on two similar sites. Each was a remote rural school with two teachers and approximately 22 students and in each school the grades were arranged in two multi-age groups, prep to grade three and grades four to six. The two schools were some ten kilometres apart.

The first school site — to be referred to as school (a) — was closed at the end of 1993. The project continued in the second semester of 1994 at the school to which the students transferred — school (b). The researcher had taught at school (b) in 1988–89 and continued to be accepted as part of the community. Burns (1994) suggests that being accepted as part of the community is essential in ethnography.

This chapter describes the intervention curriculum identified in this thesis as a technoliteracy curriculum, which was implemented over a period of three terms in 1993–94 and also describes the methods used to collect data from students, other teachers and the parents of the focus students.

4.2 Ethnographic–Case-study

Essentially this research adopts a case-study methodology which is recommended by Gross (1993:60) as a sound approach for developing specific knowledge on a broad topic and providing a holistic view of the people who are being studied. The case-study enables the researcher to closely observe the student in the natural setting and develop and validate

theories grounded in direct observation. It was considered therefore that a combined ethnographic–case-study method was appropriate to this particular research project.

Gross (1993) outlines four essential properties of qualitative research. The studies, she asserts, should be 'particularistic', 'descriptive', 'heuristic' and 'inductive'.

The current research meets these criteria in the following ways.

It is *particularistic* in that it seeks particular indicators relevant to the theory of underachieving children and it closely observes four students and examines the learning needs and learning style of each.

It is *descriptive* in that it provides a rich description and interpretation of the students' educational and social environment and their individual response to that environment. This is achieved through observation, discussion with families, students and teachers through questionnaires and other data, such as work samples and student records.

It is essentially *heuristic* as its purpose is to better understand and respond to the educational needs of students within the study. This understanding is sought through a process of analysis, synthesis and evaluation of the data.

Finally, it is *inductive* as participant observation generated ideas on which to build subsequent investigation such as parent interviews and discussion with other teachers. From this emerged an understanding of the students' preferred learning style and learning needs.

Gross (1993) commends case-study as being particularly suited to development and elaboration of a new theory as opposed to confirming an existing theory. In her view its strength lies in its ability to present a view of the individual or group through a variety of evidence — for example, observation, interviews, documents and artefacts. The current study proffers a new theory; it suggests that the particular educational and social environment in which the focus students were nurtured was essentially responsible for the development of creative–productive thinking.

This research study is not a scientific experiment but the story of one teacher's inquiry into the reasons for particular behaviours in some students and their response to a different approach in curriculum design. As a teacher, the researcher has been influenced by the teaching style and research of Herbert Kohl (1977) who worked with a sub culture (Afro-American) that produced a high number of low achievers. Another influence has been the

approach to curriculum in schools such as the Fitzroy Community School, situated in suburban Victoria. The researcher has some personal contact with this particular school which has a child-centred philosophy of teaching and learning.

There is an essence of ethnography associated with the research as the researcher had participated socially within the community for more than seven years and was well aquainted with the sub-culture. As the class teacher, the researcher was established as the participating observer and in a good position to understand events and situations as they evolved. Burns (1994) suggests that the researcher who joins in the life of the group, establishes great authenticity for the research project.

4.3 The Research Design

Methodology	Date of data collection	Nature of the data	Analysis of the data
Implementation of intensive teacher designed technoliteracy curriculum with the whole class.	July - November 1993 and Sept. - November 1994[1]	Teacher- researcher observation, anecdotes and conceptual field notes. Work samples both technological and traditional.[2]	Noted during class time and written up later in the day, individually for each student.
Questioning of the students as part of class written work on matters relating to family environment.	October - November 1994	Written responses to questions by students about self and family	Comparison of student responses with findings from Rimm & Lowe (1988) relating to family environment
Discussions with. a) previous class teacher, b)current itinerant teacher.	October 1994	Teachers' views on focus students in relation to findings of theorists.	Noted during recess and written up each evening for inclusion in case-studies.
Commence development of a case-study for each focus student.	November 1994	Behavioural indicators from checklists. Testimony of students, parents, and other teachers.	Individual case-studies.
Questionnaire mailed to parents of focus students. Questions based on literature related to traits in students who are creative thinkers.	February 1995	Individual parents response. ie On a scale of 1-5 the extent to which parents consider the statements of the theorists to be relevant to their child.	Included in case-studies.

Figure 4.1 Overview of Research Design

Figure 4.1 presents an overview of the research design. The first column indicates the methods used in the study, the second, the date when the data was collected, the third, the nature of the data collected, and the fourth, how these data were analysed. The rows indicate the range of techniques used in the study.

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1 The interval in the research project was due to closure of the original school and the transfer of students.

2 The quantity of data varied for each student, approx. 10 field notes & approx. 50 checklists items. (detailed in the case-studies)

4.3.1 Data collection

The data were collected in diverse ways; they included :

- Participating observation by the class teacher–researcher.
- Students' work samples from the traditional curriculum and the technoliteracy curriculum of the research project.
- Students' written responses to a series of questions which were presented as part of the writing curriculum.
- Discussions with other teachers familiar with the focus students — that is the specialist art–science teacher and a teacher who had been class teacher at an earlier stage in their schooling.
- Questionnaire sent to the parents of the four focus students.
- Informal interviews with parents of the focus students.

Work samples from traditional and technoliteracy curricula, questionnaire and checklist data for each focus student are held at Victoria University of Technology, School of Education, Footscray campus.

4.3.2 Data analysis

A series of entries were made as anecdotal records based on observations and the raw statistic results charted in the classroom. Interpretation of the results indicated differences in individual student responses to the different learning / teaching context, which moved from teacher-centred to student-centred. On the basis of the interpretation and cross comparisons, drawing on notes collected by questionnaire, interviews and informal discussions, four students were identified for further consideration.

At the next stage commonalities were identified from data gathered through questioning of the students, their parents and other teachers. These data were used to complete the tables and checklists which were created directly in relation to the literature.

4.4 The Technoliteracy Curriculum

4.4.1 A Definition of Technoliteracy.

Technoliteracy is a term coined by Boldt et al. (1993) and is an integrated approach, which transcends curriculum boundaries. Literacy is the host curriculum area whilst technology is the medium of presentation. It is important to note that technology is simply the means to an end not an end in itself. For example, a unit of work may target a particular genre of writing or reading, speaking or listening. In each target area, this approach requires the

student to extend their thinking skills. The technology selected was always that deemed most appropriate to the literacy goal.

Literacy focus	Technology Focus	Time frame
Descriptive writing, reading and speaking to a script.	Video — magazine style production.	July to September 1993 — school (a)
Writing, reading and speaking to all genre.	Radio — live broadcast on community station.	October to November 1993 — school(a)
Research, writing captions and short descriptive text.	Computer — multimedia	September to December 1994 — school(b)
Graphic representation.	Overhead projector	September 1994 — school(b)
Drama, writing narrative and dialogue, reading and speaking.	Film and audio (see sample lesson plan Fig. 3.3)	October to November 1994 — school (b)

Figure 4.2 Technoliteracy curriculum overview of units

Figure 4.2 summarises the technoliteracy programme that constituted the context of this research. It shows that five curriculum units were undertaken with each unit having a different literacy focus and technology medium.

Key Focus	Literacy focus — to write a dramatic piece and perform it. Technology focus — to use film and audio tape as means of presentation.
Teacher Preparation	Purchase suitable film and audio tapes, obtain photographic equipment, check audio recording function on cassette players, investigate film developing location and processing time, plan the work schedule — ie how will it all dovetail, ensure there are sufficient art supplies, act as facilitator for each group.
Materials	Film, audio tapes, art supplies, writing and drawing paper.
Work Requirements	Students form social groups of three or four. Initially they are told they are writing a story; this is to avoid a stilted dialogue.
Discussing	a) class brainstorms to create a pool of ideas. b) students work in groups to plan the outline of their story.
Writing	Students collaborate to write a fictional narrative — each student must take a turn at writing as well as developing ideas.
Reading	Each group reads their story aloud to the other groups. Each student in the group must take a turn at reading.
Planning	Each group is given drawing paper. First the paper is divided into 12 sections and a storyboard developed from the narrative as a guide to the photography and the writing of dialogue.
Processing	a) Based on the storyboard outline the students develop a dialogue and narration for the drama. b) Groups demonstrate static scenes for other groups to view. c) Constructive criticism given and received. d) Creation of scenery, props etc. e) Photographing the static scenes. f) Rehearsing the dialogue. g) Recording the dialogue. h) Public viewing.
Evaluating	Viewing, discussion, constructive criticism.

Figure 4.3 Sample unit plan as used in the technoliteracy curriculum

Figure 4.3 comprises a sample unit plan which outlines a teaching unit. This unit plan has been selected because it was the final unit and encompasses all the best attributes of the technoliteracy approach.

4.5 Organisation of the programme

Within this research project each technoliteracy unit was the main thrust of one term's curriculum, each unit focusing on a particular technological medium. There were five units altogether and on average each unit took approximately 100 hours. There were two exceptions. The first was the unit in which the technical focus was the overhead projector, this took less than 20 hours and was a precursor to the film and audio unit. The second was the computer unit which had to be organised differently as there was only one computer which could run the particular software. For this, the computer was timetabled continuously throughout the day and students worked in their allotted time and caught up with other work when they had finished.

The timetable was arranged to create a 2 to 4 hour block in the middle of each day specifically for work on the technoliteracy programme. Recess was flexible and it was left to the students to choose precisely how the time would be used. The use of the technical equipment was timetabled in one hour slots and this was drawn on a section of the chalkboard. Students entered their name or that of the group at a time when they wished to use the equipment. At other times during the technoliteracy block they worked on other aspects of the project such as scriptwriting, conferencing, set designing, reading and rehearsing.

Although mathematics was an essential component in the integrated technoliteracy programme, a formal programme of arithmetic was taken in the first hour of each day. Other subjects in the curriculum such as art and science, taken by the visiting specialist and music, sport and religious instruction were taken before and after the technoliteracy block.

4.6 Description of the units

4.6.1 Video — a cultural exchange with a sister school

Key focus

a) **literacy** focus — non-fiction scriptwriting for a magazine style video programme

b) speaking to an audience

c) secondary focus — social studies and applied mathematics

d) **technological** challenge — use of the camera — for example, wide and close up shots for a particular purpose such as use of colour and light.

The video project was designed to communicate with Aboriginal students from a sister school in central Australia and help them understand about society, climate, terrain and industry in the Goulburn Valley, Victoria. The production of the video promoted all aspects of literacy, it focused on the genre of non fiction — scriptwriting and included reading, listening, speaking and thinking. Mathematics featured largely in climate, terrain and industry and, importantly, the social studies focus required judgments which differed from those of other units. For example, deep thought and serious discussion in the classroom, centred on the target audience rather than upon the particular presentation which appealed to the individual student–producer.

The format of the video was initially developed by the whole school. Students then individually or in small groups produced, directed and videotaped the segment of their choice. The segments were planned and rehearsed and the camera used for 'dry runs'. Concepts of light, colour, space and angle encouraged lateral thinking.

This magazine style production was particularly selected for use with the video camera as opposed to a drama production, in order to avoid 'grandstanding', or showing off, which can occur with young students in the live action of a drama style production.

4.6.2 Live-to-air radio broadcast

The key focus

a) **literacy** focus — reading and writing in a variety of genres; reviews, interviews, reports, narrative

b) speaking to an audience

c) **technological** challenge — the constraints and demands of broadcasting

d) working with people in the 'real world' — that is, beyond the classroom

The local community radio station asked primary schools for expressions of interest in producing live-to-air radio programmes. After discussion at the school council meeting it was decided that the school would participate. This unit focused heavily on language — the essential components being thinking, planning, discussing, writing, reading and speaking. All students were involved to a greater or lesser degree, depending on age and level of competence. An ideas sheet was started and students freely wrote on this over a period of several days. A theme was identified from the ideas sheet and students discussed at length various genres which would be appropriate.

The final selection included a film review, an interview with a senior citizen, a report on particular knowledge gained from an excursion, discussion about a particular endangered species, and a short story. These were interspersed with recorded musical interludes. Each student wrote their individual piece, conferenced it with a critical friend first and then with the teacher - researcher. Finally, each student typed their own piece on the word processor. The radio station's programme co-ordinator came to the school to brief the students on procedure. This included planning the running schedule so that students could be rotated in and out of the small studio during commercial breaks. A maximum of three students could be in the studio at one time and it was necessary for everyone to work as a team. It was a requirement of the broadcasting station that the broadcast go live-to-air and be of one hour's duration.

4.6.3 Computer multimedia

Key focus

a) **literacy** focus — research skills (for content)

b) writing of short descriptive passages and captions

c) **technological** challenge — students were required to create their own computer programme using the software functions for animation, scanning images, and creating dialogue boxes for the purpose of communicating an idea.

There was only one computer in the school which could run the 'Linkway Live'[3] multimedia software supplied by Victoria University of Technology. So, in order to accommodate the whole school, the approach had to be organised as described earlier (see 4.6).

The functions and options of the software were taught, demonstrated and practised as group lessons for one term (July to September 1994) prior to the period of intensive observation for this research project. These lessons included scanning photographs and other images, producing animation and creating programmes which included on-screen 'buttons' or 'options'. To consolidate this training component of the unit, the class constructed a procedure book which was then kept beside the computer for future use. Each student chose one feature of the software and created a page with graphics and text; this was then tested by another student and weaknesses rectified.

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3 Linkway Live is a commercial multimedia authoring programme, produced by IBM — a software package through which students may incorporate, audio,video, graphics and text into their self produced computer projects.

The following term (September–December 1994), the students worked on the creation of their individual computer programmes. They selected their subject or topic, using the library and resources beyond the school to collect suitable material for their particular project. Some worked independently and others worked with a partner. Each programme included several of the options learned in the previous term.

4.6.4 Overhead projector.

Key focus

a) **literacy** focus — to stimulate divergent thinking eg. communicating an idea without use of the written or spoken word.

b) **technology** challenge — focus, size, distance. (an introduction to the photography / audio unit which was to follow)

c) to use rather than abuse freedom and choice (some students at school (b) took time to come to terms with freedom and choice)

The overhead projector was used for non-verbal communication. Students cut shapes, characters and images from black paper to create a type of shadow puppet and others guessed what was represented. These 'shadow puppets' included nursery rhymes, television icons and characters from literature. This was an art–language unit run over several sessions and was treated in a variety of ways, from simple to very complex depending on the individual. Some of the focus students incorporated movement of the pieces whilst others relied on static graphics. The overhead projector was also available for students to use during independent work periods.

4.6.5 Photo transparencies and audio tape

Key focus (see sample unit plan (Figure 4.3))

Narrative and dialogue writing, drama and mime were the literacy focus for the transparency slide and audio tape unit. The unit also incorporated space, measurement, design, history, social value and fantasy.

Students co-operated in small groups of three or four to develop fictional narratives, then divided them into ten or 12 sections using a storyboard to assist in the planning and to keep the group on target as the production developed. The task was to create from the narrative static scenes which could be photographed using transparency film, to give a visual representation of the key ideas in the story. Once the photography was completed, students developed a dialogue and recorded this on audio tapes.

Students made a lot of their props, partly during art sessions but some

groups also worked on props and scenery before school and at lunch times. Ultimately, the making of the props became an oral language component in its own right through the discussion and constructive argument that ensued. It was also an exercise in lateral thinking.

Before we commenced the photographic sessions, each group mimed their production and other groups offered suggestions as to how the intended message could best be conveyed through the medium. (The photographic sessions took a lot of time but groups not involved worked on costumes, props and scenery and rehearsed the dialogue in preparation for the audio taping.) Students took the photographs themselves set up the scenes and each person in the group checked the Viewfinder before the 'shot' was taken. In presentation, the audio tape was played whilst the slides were shown using a remote cable.

4.7 Summary

This section has reviewed the different units of the technoliteracy curriculum to provide insight into the range of activities involved and how the learning environment was managed. The next section describes how the researcher collected data by observation of students engaged in these activities.

4.8 Observation of the technoliteracy curriculum in action

In 1993 the researcher implemented a period of intensive technoliteracy curriculum with the whole class. It was decided to work with the whole class of 22 students for the following reasons.

- because the researcher had also to be the class teacher
- to establish the feasibility of the technoliteracy curriculum in a whole class situation
- because studying the focus students in the class context enabled the researcher to make objective comparisons of their performance relative to that of other students
- because no decision had been taken as to the total size of the group of students to be focused upon
- to ensure that the focus students had no sense of being singled out, which might have affected their behaviour.

Throughout both periods of the project — July to November 1993 at school (a) and September to November 1994 at school (b) — the teacher–researcher observed the behaviour of all students during class time and also listened to playground conversation. Brief field notes were made during the

day noting on a desk pad the students' involvement, attitude and motivation toward the technoliteracy units. More detailed notes were written up each evening (Figure 4.4). During the computer unit a tape recorder was used to record the students' conversation as they worked, as the organisation of this unit made it difficult to observe at first hand constantly. All these data were reflected upon, analysed and written up each evening and subsequently used to complete the competency evaluation checklists (Figure 4.5 and Figure 4.6). The checklists were based upon the Victoria Department of Education Frameworks (1987) for technology, science and art. The checklist was originally based on the Technology Framework alone but was extended by the researcher to include the Frameworks for science and art as many of the students' greatest strengths were not reflected in the Technology Framework checklist. The information was entered once for each student, as and when the researcher observed each particular trait and following several weeks of intense observation.

Sample field note — this field note followed a session on the computer.

Jake — 9 August 1994

Jake was as tense as usual but he knew what he wanted to do. He worked with the Mazda vans that he had tinted last session. He chose one of these to be part of the opening screen for his project. He wanted to use the animation but not with the vehicle. We discussed the possibilities and I suggested he could use it for the title. He was able to relate this to graphics he had seen on television and decided to adopt the idea but he did not have the patience that other students had demonstrated and made only four screens. He accepted the result without enthusiasm. However it was his turn to use the computer at lunch time and he wanted to attempt the idea of a moving car similar to that which Brock had created. Brock helped him to get started but Jake's level of tension makes it difficult for him to execute the fine control needed on the mouse. Because of this he again decided to make only four screens and he was not satisfied with the result.

Figure 4.4 Sample of a field note written up at the end of each day.

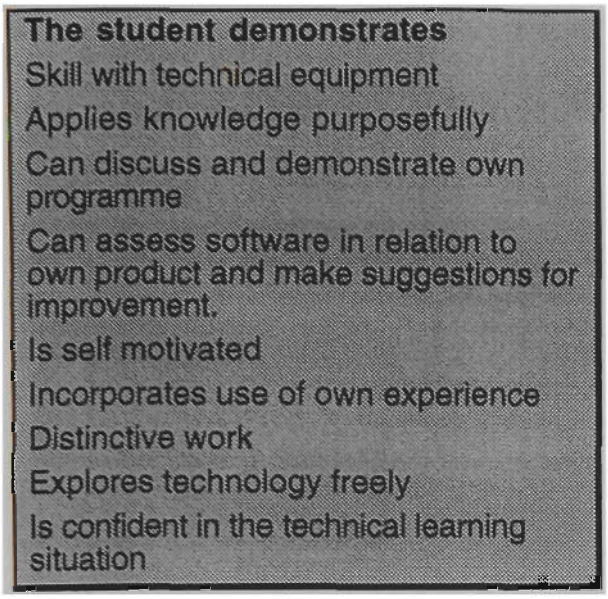


Figure 4.5 Checklist based on Technology Frameworks (1987).

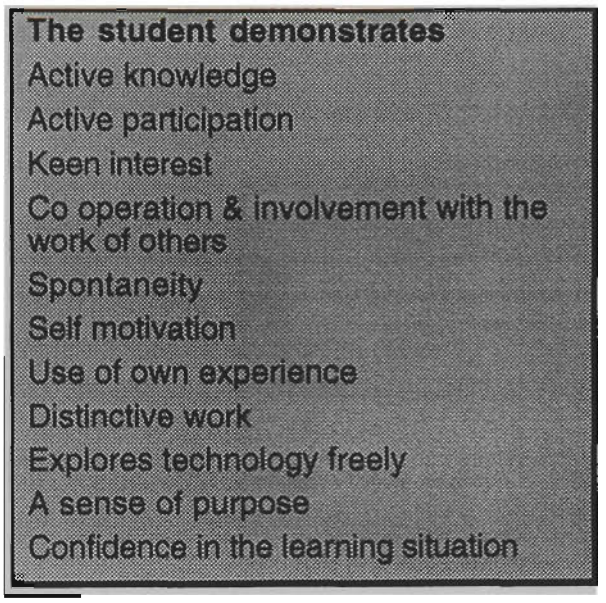
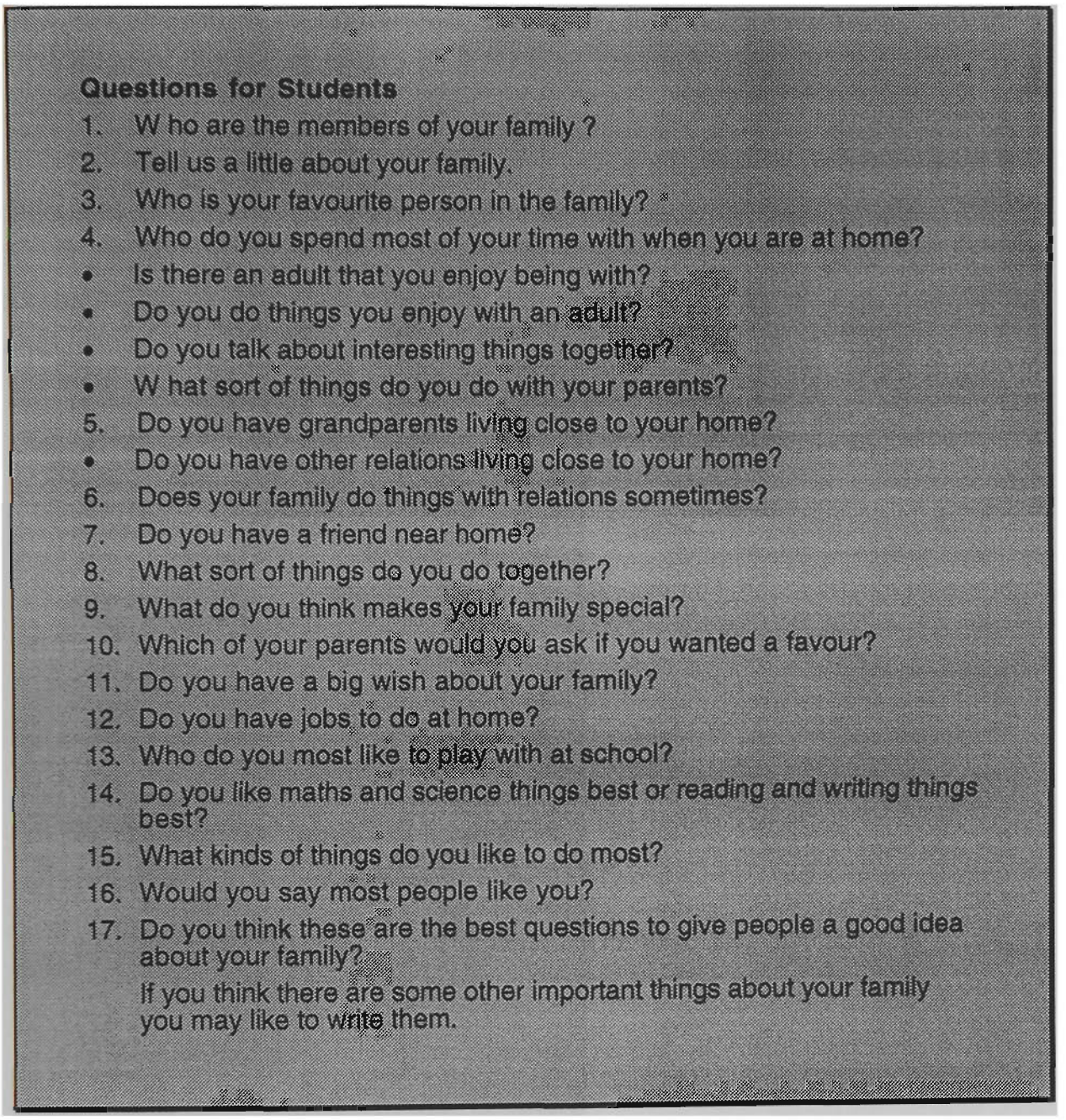


Figure 4.6 Checklist based on Art–Science Frameworks (1987).

4.8.1 Questions for students

In October 1994 a set of 17 questions for students was devised (Figure 4.7). These questions were based upon a checklist of characteristics drawn mostly from Rimm and Lowe (1988). The questions related predominantly to family climate, family structure and family values. One or two questions were related to individual interests and these were drawn from Cohen (1990). The intention of the questions was to establish the type of family environment in which the students were developing, in order to gain an impression of the 'whole person' and seek broad commonalities in the student's background. The data were applied to the checklist — 'Comparison of Family Characteristics' (Figure 4.8).



Questions for Students

1. W ho are the members of your family ?
2. Tell us a little about your family.
3. Who is your favourite person in the family?
4. Who do you spend most of your time with when you are at home?
   - Is there an adult that you enjoy being with?
   - Do you do things you enjoy with an adult?
   - Do you talk about interesting things together?
   - W hat sort of things do you do with your parents?
5. Do you have grandparents living close to your home?
   - Do you have other relations living close to your home?
6. Does your family do things with relations sometimes?
7. Do you have a friend near home?
8. What sort of things do you do together?
9. What do you think makes your family special?
10. Which of your parents would you ask if you wanted a favour?
11. Do you have a big wish about your family?
12. Do you have jobs to do at home?
13. Who do you most like to play with at school?
14. Do you like maths and science things best or reading and writing things best?
15. What kinds of things do you like to do most?
16. Would you say most people like you?
17. Do you think these are the best questions to give people a good idea about your family?

    If you think there are some other important things about your family you may like to write them.

Figure 4.7 Questions for students — part of the writing curriculum during October and November 1994

The questions were answered by the whole class and were presented as part of the class writing curriculum over a period of 10 writing sessions; there were 17 questions in all. The exercise was occasional, not daily, in order to maintain the natural spontaneity of the students' response. The questions were written on the chalkboard a few at each session and time was taken to discuss the questions with the students. They were encouraged to approach the task in any way they wished and one or two students included graphics such as a timeline or family tree. To reinforce the special nature of the questions students were given paper of a particular colour each time the questions were set.

The organisation of the question sessions presented some difficulties. For example obtaining responses to all the questions from all the students in

the class, proved to be impractical. However, long term interaction with and knowledge of the students and their families compensated for incomplete raw data.

The time constraint of working in a class situation was another of the difficulties experienced, as the researcher was also the class teacher. Whilst the implementation of the technoliteracy curriculum was practical in the context of whole class teaching, the requirements of data collection from the whole class for the purpose of research were more difficult.

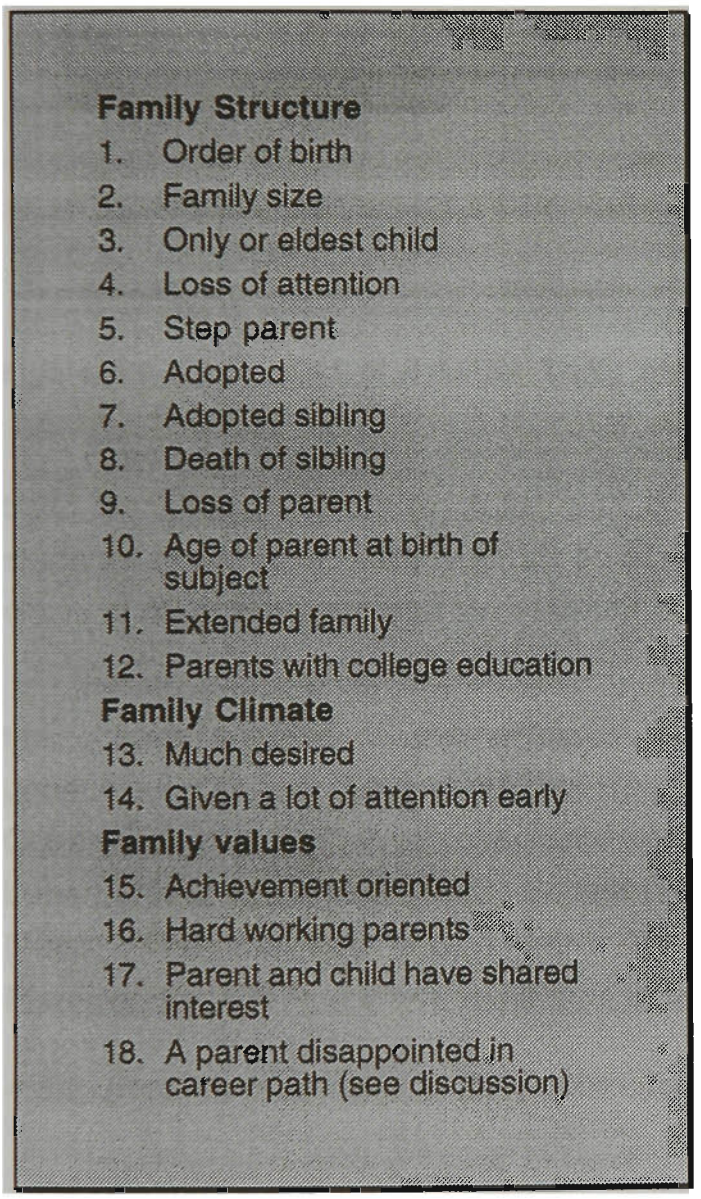


Figure 4.8 Family Characteristics Checklist — based on the research of Rimm and Lowe (1988)

The checklist of 'Family Characteristics' (Figure 4.8) was completed by the researcher for the whole class, partly through the students' responses to the questions, but also from local knowledge based on the researcher's observations. Point 18 was deemed too intrusive and was not treated in any of the questioning; however, it proved critical in the analysis and is discussed in

the results.

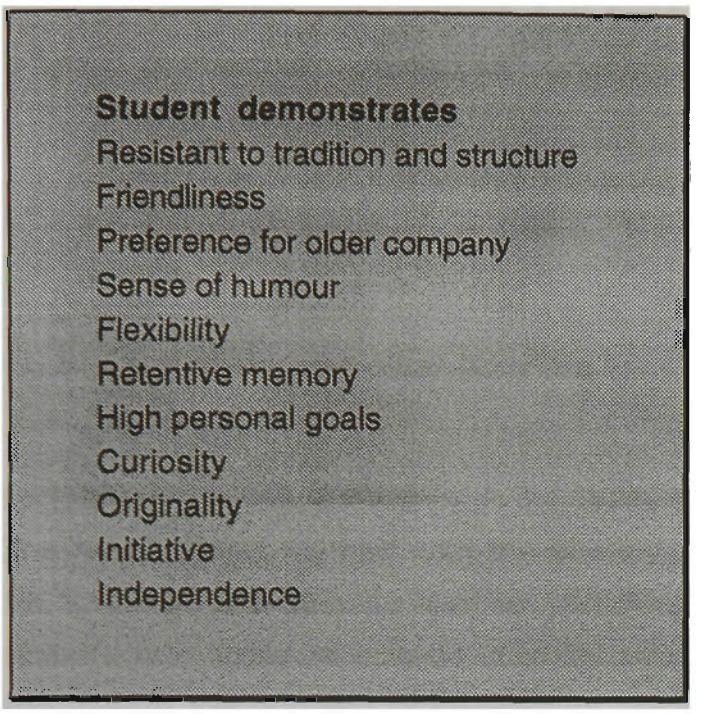


Figure 4.9 A checklist of Creative Traits drawn from the research literature

Figure 4.9 shows the checklist of creative traits which was devised from traits identified in literature. A list was completed by the researcher for all students drawing on data from all sources — that is parent questionnaire, views of other teachers and the researcher's observation.

Because of the constraints associated with working in a small community the checklists used in the analysis were not trialled. It was deemed unnecessary as two of the checklists were designed by Whitmore (1980) and Cohen (1990). A further two checklists were based upon studies by Stern and Lubart (1993) Lowenfeld (1993) Brittain (1987) Sisk (1984) and Tannenbaum (1983). The fifth was drawn from the Victorian Ministry of Education-Frameworks (1987), current at the time of the project.

4.8.2 Process of Identifying the Focus Students

Identification of the focus students was by individual checklists, data were collected for all students in the class. Analysis of the raw data identified traits in the four students that set them apart from the rest of the class. These were:

a) Competency evaluation criteria based on the Victoria Education Departments 'Frameworks', for technology, science and art (Figure 4.5 and Figure 4.6) to establish general ability levels.

b) Behaviour Characteristics (Figure 2.1) to identify students with ten or more characteristics as recommended by Whitmore (1980).

c) Family Characteristics (Figure 4.8) to identify those students with common characteristics in both the home and school environments.

d) Creative Traits (Figure 4.9) based on a, b and c above, teacher–researcher perception, anecdotal and archival data, and work samples.

Finally, the same checklists were completed showing characteristics of the focus students as a group. These checklists are included in the results.

4.8.3 Discussion with other teachers

In October 1994 the researcher sought the opinion of two other teachers each of whom was familiar with the learning behaviour of the focus students. One teacher had worked with the students as a class teacher, the other was the specialist art–science teacher. A formal questionnaire could not be used as there was some resistance from the teachers toward the project as a whole and toward the concept of intellectual potential in students who were initially identified through negative learning behaviour. For these reasons the teachers were engaged individually in informal discussion during breaks in class. The questions were put to the teachers as a result of behaviour identified in focus students which had also been identified by Whitmore (1980) as an indicator of high intellectual (creative) potential. The purpose was to have the existence of a particular trait in one or more of the students corroborated by colleagues. The views and comments of the teachers were briefly noted after the discussion and written up the same evening. Some comments by these teachers were also located in the records of the focus students.

4.8.4 Questionnaire to parents of the focus students.

Data were requested from parents in order to triangulate the responses (student, teacher and parent) and determine the validity of the findings at that stage of the research. A pilot study to test the questionnaire was difficult in the small community where the research took place, as to trial it locally would have pre-empted responses. Therefore the questionnaire was trialed in an inner suburb by an associate of the researcher. The trial was essentially to ensure that the questionnaire was clear to the parents, so it was given to parents of a child who demonstrated some creative behaviours.

The questionnaire with stamped addressed envelope for reply was mailed to the parents of the focus students in February 1995 (see appendix 1). All parents responded. The questionnaire sought to establish the extent to

which parents of the focus students perceived in their child characteristics similar to those of creative gifted thinkers. The respondents were asked to indicate on a scale of 1 to 5, the extent to which each statement was relevant to their child — 1 being not at all relevant and 5 being highly relevant. There was also a section for comment.

4.9 Methodology — Conclusion

The data collection for this research project combined observation, conceptual field notes, anecdotes, informal interviews and discussion, questionnaire, and checklists. The checklists were Competency Evaluation (Figure 4.5), Family Characteristics (Figure 4.8) and Creative Traits (Figure 4.9) each based on the literature — Whitmore's (1980) checklist of Behaviour Characteristics (Figure 2.1) and Cohen's (1990) Inventory of Interests in Developmentally Advanced Children (Figure 2.5). The data were used to compile individual case-studies of four focus students. The focus students each came within the category of student which had first come to the attention of the researcher, primarily because of low motivation in class and high ability in life skills outside the school environment. The data enabled the researcher to identify commonalities in the students' environment, interests and learning needs.

5. Case-studies

This chapter details case-studies of the four students who were the focus of this research project. Each case-study is structured as follows:

a) background and general ability

b) observation of the students' motivation toward the traditional structured approach to teaching and to the technoliteracy approach

c) questioning of the students in relation to their perception of their family environment

d) parents' response to a questionnaire in relation to creative traits in the students

e) overview of informal discussion with other teachers associated with the schools

f) triangulation of data b, c, d and e for each student

g) interpretation of the data in relation to literature

h) summary

5.1 Case-study — Tim

5.1.1 Background and general ability

Tim is the only son in a family living on the property selected by his great grandfather. Tim's family have been part of their community for longer than anyone else and this is a source of some pride for Tim. His father and grandfather both attended the school at which Tim is currently a student, only the building has changed.

The researcher met Tim during his first year at school when he was age five years. This coincided with the researcher's arrival in the community and the start of a long association with the cluster of four rural schools. Tim was quiet and a little shy but very excited to be commencing school. As he had an older sister attending the school who was then in grade three, Tim was very familiar with school culture. The researcher was new to rural teaching but attention was drawn toward Tim from his first week at school. The researcher had previously been teaching for eight years in large suburban schools and had some experience of the range in ability which students may demonstrate. Based upon this experience it was apparent from observation that Tim's general ability was of a high standard.

Tim experimented with his name by commencing to write on the right hand side of the page. He understood that his name then became miT but this appealed to his sense of humour. When Tim commenced school he already understood the mathematical concepts taught at this level — that is, the language of spatial concepts — and could perform simple tasks in addition and subtraction using discrete materials. Any new concepts presented to him were absorbed quickly; it was as though he had no need of teaching, simply of exposure to concepts. He was always quietly pleased with new concepts; he would smile as he worked and occasionally ask for clarification. By contrast, if presented with tasks or problems that did not offer challenge he would quietly register discontent and lose focus.

Tim's particular talent or passion during his early years at school was for drawing. This researcher was impressed by the drawing Tim did on his first day at school and as a matter of routine the drawing was dated and filed. However, by the end of the first week the quality of Tim's drawing was such that the researcher drew it to the attention of the head teacher. Tim's sister who was in the classroom at the time remarked that Tim had been able to draw like that ever since he was born. At a later stage, the researcher spoke with Tim's mother who took the talent very much for granted and pointed out that Tim's father was also very good at drawing. She concurred with the opinion of his sister and stated that if Tim had been physically able to hold a pencil he would probably have been able to draw at birth. She stated that she could not remember a time when he had not been able to draw clearly recognisable images.

These early drawings were very similar to the images seen in the cartoons of daily papers and strongly suggested movement; for example, surfers riding the waves. In grade six at the time of this research, Tim's cartoons had developed to the 'He Man' variety showing great detail with kinetic energy appearing to burst from the drawings. He had also developed an interest in cars and extended his drawing talent to designing the bodywork of powerful, if somewhat futuristic racing vehicles. Again, these designs suggested pent-up energy.

In the middle years of his primary education Tim developed a passion for tennis. When formal research commenced it became apparent that Tim was as passionate about tennis as he was about drawing. He was not only a talented player but also took a deep interest in the history and economics of the game. In the questions he answered as part of the research he stated that his big wish for the future was to move to a place where he could get good tennis coaching.

During the three and a half years that lapsed between Tim's prep and grade one years, when this researcher was his class teacher, and grade six, the period during which this research took place, Tim had two other teachers. Each of these teachers had a very traditional approach to teaching and significantly, each reported that Tim had ability but did not extend himself. This characteristic was not apparent in Tim's classroom behaviour either in his early years, or during the technoliteracy project. During these periods the curriculum was designed to challenge his intellectual potential and he responded with enthusiasm.

Tim's mid year report just prior to this research project classified him as a straight 'B' student. However, during the period in which the research technoliteracy programme was conducted, it became apparent that the year six mathematics curriculum was well below his capability. On this basis the researcher (at that time temporary class teacher) advanced him to a year seven maths curriculum. Tim took on a changed attitude toward the maths periods. Instead of completing the required exercise in half the allotted time and then sketching until noticed by the teacher, he approached maths with high motivation and seemed to enjoy the novelty of being in the queue of students waiting to ask for clarification on a point. This is just one indication that Tim had been working in mathematics at a level somewhere below his true capabilities.

Spelling was taught in isolation at the school but the researcher extended Tim by adding a more challenging word especially for him each time he turned to his sketch pad. There was the familiar response from Tim, a quiet grin, setting aside the sketch and applying himself to the extra task. Tim had become accustomed to doing just enough to satisfy the teacher without extending himself, but given a challenge he was quick to rise to the occasion.

5.1.2 Tim and the technoliteracy approach

For Tim, the computer work using the software 'Linkway Live' offered the greatest challenge in the technoliteracy curriculum. This was because, although the task was language based, the particular skill was related to drawing and Tim had preconceived ideas about how a drawing should be. These ideas, however, were not compatible with the software options, which frustrated his inclination for perfection of detail. As Tim worked this researcher observed in him the following traits identified in literature (Figure 4.9) as being common in students of high intellectual (creative thinking) potential.

- *Experimentation* — as he attempted to mix colour on screen.
- *Perception and persistence* — as he eventually identified a pattern to

the numbering of the grey tones.

- *High personal standards but flexibility* — as he sought an acceptable alternative, when the software did not meet his demands for excellence.
- *Independence* —Tim remained oblivious to the other students standing around him offering suggestions. He did not object to their presence, but he pursued his own line of investigation. He did not ask for teacher assistance but did discuss the software limitations on one occasion.

In the unit which used slide film and audio tape Tim uncharacteristically took charge of his group, writing, designing and directing the whole production. He could not be described as bossy; he was quietly spoken and fairly 'laid back' but he set the course and the others to a large extent just went along with him. His body language gave the impression that this was something which offered a worthwhile challenge to his creativity and he threw himself into the production wholeheartedly. Using materials from the art room he created armour, sword and dagger, which would have done credit to many an amateur drama production with more sophisticated resources. Tim also identified locations beyond the school grounds, which he considered to be suitable background for the photography.

Working with the shadow puppets and overhead projector on non-verbal communication was also highly motivating for Tim. He used a fantasy theme and was just as deft in creating characters through this medium as he was when drawing. He had a simple plot in his mind using only one or two images but incorporating movement. He got his message across very effectively. Tim worked with the characteristic enigmatic smile at all times whilst pursuing the various challenges offered by the technoliteracy approach. The most remarkable feature of Tim's response to the technoliteracy curriculum was his motivation, which manifested as powerful creative mental energy. Tim was possibly the highest achiever of those who participated in the research programme.

5.1.3 Tim's response to questions

Tim responded to 16 out of 17 questions put to the students (Figure 4.2) related to family environment. Tim indicated that he spent most of his time with his parents, both helping on the farm and in leisure pursuits. Studies suggest that many creative children seek older company. This company can often include the mentor but from Tim's reply it is difficult to assess whether he has a mentor relationship with either of his parents. However, from observation

over several years it is the view of this researcher that Tim's parents are at least his role models.

In response to the questions relating to friendships, Tim does not mention anyone specifically but says he has, 'a friend or two, a few fences away'. From observation these friends are almost certainly Jake and Daniel who are two of the focus students in this study.

In response to the question about his family members, Tim drew a family tree which included both sets of grandparents. This highlights his penchant for visual representation and attention to detail. Only one other student included grandparents in response to this question. In the free comment section, Tim included the fact that the family have a tennis court, reinforcing the importance that tennis plays in his life.

When asked about his special ability Tim identified only tennis; he appeared to take his drawing ability for granted and has in the past indicated surprise that not everyone has the same skill.

5.1.4 Opinion from other teachers.

In discussion, Tim's regular class teacher referred to Tim's ability in drawing and tennis but stated that Tim did not give maximum effort in general class work. Although the teacher did not object to the research taking place in the school he did not like being asked to comment on students. He was one of several who decried the concept of the focus students being of high intellectual (creative) potential, as they did not meet his criteria of giftedness. In the opinion of this teacher, high intellectual potential is demonstrated brilliance in a particular field. The idea that underachievement may reflect a students' response to frustration is something he has difficulty accepting.

The specialist art–science teacher was also unimpressed by Tim's effort in class. When discussing his drawing ability she would really only comment on the fact that he did not make an effort with puppet making and papier mache. Is it possible that the minimal challenge offered by such a construction task may have accounted for Tim's lack of motivation?

		Relevant				Irrelevant
		5	4	3	2	1
1	Creative children sometimes resist closure on tasks; they may appear slow or unmotivated.			✔		
2	Creative children may have difficulty doing tasks which require a quick conclusion.					✔
3	Creative children may have a well developed spoken vocabulary but be poor spellers.			✔		
4	Creative children may experience positive feelings from hard work.	✔				
5	Creative children may be optimistic about their ability to achieve goals.	✔				
6	Creative children may have a keen sense of purpose and direction.		✔			
7	Creative children may be very sensitive to human concerns.				✔	
8	Creative children may have a great deal of physical and mental energy.	✔				
9	Creative children may demonstrate resistance to structure and tradition.					✔
10	Creative children may demonstrate a preference for older company.	✔				
11	Creative children may have a keen sense of humour.	✔				
12	Creative children may be flexible.		✔			
13	Creative children may set themselves very high standards and/or goals.	✔				
14	Creative children may demonstrate curiosity about anything and everything.					✔
15	Creative children may show initiative.		✔			
16	Creative children may demonstrate independence from an early age.		✔			
17	Creative children may have a retentive memory.					✔
18	Creative children may adopt a mentor.			✔		
19	Creative children often come from high energy families.		✔			
20	Creative children often have parents who value high achievement.	✔				

Figure 5.1 Tim's Parent's responses to the parent questionnaire.

Figure 5.1 shows that Tim's parents identified 12 out of 20 statements relating to creative traits as being highly relevant or fairly relevant to Tim. The number of positive responses is not as high as that of other students in the study but as referred to previously, each of these students is very individual. Also it should be noted that there may be some discrepancy in the parent response to the questionnaire. For example, to statement 9 'Creative children may demonstrate resistance to structure and tradition', Tim's parents gave the

lowest rating of 1 — not at all relevant.— commenting that Tim does not like to be different to his peers. However, in the section for 'other comment' they stated that he did not like following routine. This latter seems to be more relevant to the concept of structure and routine than to a comparison with peer group. If this is accepted, it raises the number to 13 out of a possible 20 positive responses which suggests significant support for the hypothesis that Tim may identify as a student of high intellectual (creative thinking) potential, as opposed to being identified as a student of just average ability.

Tim's parents made a further comment identifying the significant interest which Tim had in drawing, his attention to detail and his use of drawing as a medium to 'unwind'. They noted that he sketches several pages every day. In an informal interview with Tim's mother she commented that he could become quite anxious if a given event was likely to preclude him from drawing. They mentioned tennis as a sporting interest but did not elaborate to the extent that they had for drawing.

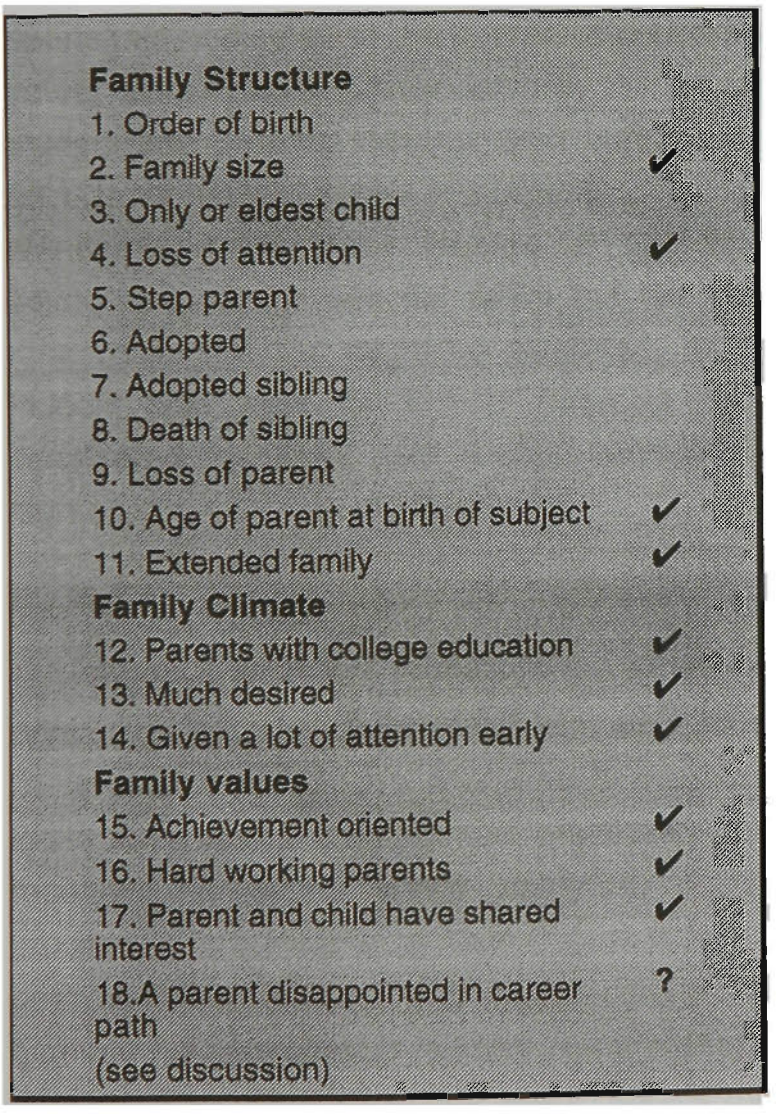


Figure 5.2 Family Characteristics Checklist — as they relate to Tim

The checklist of family characteristics (Figure 5.2) indicates the factors

which Tim has in common with other studies. His social environment includes many of the characteristics found in studies by Rimm and Lowe (1988) and Delisle (1992). For example

- Tim's grandmother, who lived nearby on the same property, had died.
- Tim was the only boy (much desired) in a farming family where the property has passed from father to son for three generations.
- Tim lives in an extended family.
- Tim has a shared interest with one parent.
- Tim has achievement-oriented parents.

5.1.6 Triangulation of the three responses

Parents, student and teachers each focus upon different aspects of Tim's talent or skill but all indicate to varying degrees that Tim has exceptional ability in both tennis and drawing. As Tim lives in an isolated environment it is difficult to draw comparison with a peer group but his class teacher, a keen sportsman, indicated in the course of conversation that Tim was an excellent young tennis player. Observation by the researcher and comments from the student and parents indicate such creative traits (Figure 4.9) as a positive attitude, optimism, sense of purpose, physical and mental energy and high standards. Tim's class teacher at the time of the intensive research, acknowledged the specific talent but did not concur with the view of the researcher that Tim might be classified, as some literature suggests, as a student with high intellectual (creative thinking) potential. The teacher considered that Tim's 'lack of effort in class' disqualified him as a student of high ability.

5.1.7 Tim — interpretation and discussion

In terms of Atkin's (1994) theory on the preferred learning style, Tim is primarily a left brain learner but with significant right brain attributes. That is, he is essentially serious and likes a measure of organisation. In tasks he looks for a basis of logic and practicality and at times during the current research he demonstrated analytical traits, which suggests left brain processing in the model of Atkin (Figure 2.7). At the same time, he prefers fluid open activities (choice) and design-centred tasks. He has a keen sense of humour, he can express himself visually and takes a holistic view of the task at hand. These are attributes which Atkin's model assigns to the right brain (Figure 2.6).

Bacon (1982) found in a study similar to the one reported here that

deficits in academic capability are closely related to preferred learning style. Sisk (1984) suggests that school emphasis on conformity stifles independent creative ability. This is relevant to Tim. His enthusiastic response to the technoliteracy approach suggests that, to a large extent, his independent creative ability had been stifled by the existing traditional curriculum.

Sisk (1984), Alsop (1992) and Delisle (1992) suggest that limitation in output can be due to a lack of challenge from the curriculum. Alsop cites cases where children as pre-schoolers were alert, curious and possessed a thirst for knowledge, had approached school eagerly but within a year or two at school had poor motivation. Observation of Tim identifies such characteristics. For example, a limited output when working in a traditional curriculum and loss of the early motivation demonstrated in his first year at school but evidence of strong motivation when offered challenge in the technoliteracy curriculum.

Green (1986:43) refers to the 'complacent underachiever'. He suggests that an easy going student avoids risk and emotional intensity because these are not conducive to his personal value system. Green further suggests that in some instances students may be selective achievers (p24) — that is, they are willing to accept a challenge and can achieve success but only in areas which particularly interest them, or in which they perceive their own talent. These statements are relevant to Tim. 'Complacent underachiever' is an apt description of Tim within the traditional curriculum environment. He is not a person who demonstrates strong emotion or a penchant for risk taking. However, he demonstrated a willingness to accept challenge both in his early school years, when he was motivated by the prospect of what he thought school offered and later, by the challenge offered by the technoliteracy curriculum. Within the latter he perceived the opportunity to utilise his interest and talent in drawing through the 'Linkway Live' computer activity. This aptitude for the visual arts could also be applied to the overhead projector and the photographic slide–audio units which, as a new medium, he could approach with a fresh and open mind whilst still drawing upon the existing talent.

Inadequate curriculum content and low intellectual stimulation and challenge are among the five major causes of underachievement identified by Whitmore (1980:189). These descriptions are relevant to the school environment with which Tim interacted. For most of his school life he had worked within a very traditional curriculum. This does not present a problem for many students but for Tim and others like him, who need high intellectual stimulation and challenge and freedom from routine, such a classroom

environment represented significant limitation. As a result Tim became complacent and did not strive beyond the set curriculum with which he was able to deal in a fraction of the time allotted. It would appear that this school environment was inadequate for Tim's learning needs in terms of motivation, challenge and curriculum content .

5.1.8 Summary

This researcher sensed in Tim's personality an element which led to him being included in the focus group and ultimately to being identified as a student of high intellectual (creative thinking) potential. Other teachers, however, would give him credit for nothing more than an ability to draw and play tennis. A close teacher–learner relationship in the first two years of his school life, along with other contact in his middle years through school cluster group days, convinced the researcher that Tim had high intellectual potential. In the light of this study the hypothesis that Tim was more than a B grade student appears to be justified. At the very least he has a significant number of traits commonly present in gifted and/or talented adults, as identified by Rimm and Lowe (1988).

Tannenbaum (1993) asserts that in children we can seek only indicators of potential, as developed talent can only be identified in adults. For Tim these indicators of high potential are

- divergent thinker — particularly reflected in his drawings and the technoliteracy curriculum
- experiential learner
- responsible behaviour
- resistance to structure — for Tim this is unspoken resistance
- preference for older company — for Tim this is his parents
- sense of humour — for Tim this is quite pronounced and often expressed through his drawing
- flexibility
- high personal goals
- initiative
- independence
- curiosity
- passion

Tim's preferred learning style (Figure 2.6 and Figure 2.7) appears to indicate no particular preference for right or left brain learning. Through the technoliteracy approach he was able to satisfy the balance of left and right in the following ways. The right brain preference was met by the fluid nature of

the guidelines, offering freedom and choice — that is,

- control over the learning situation
- opportunity to satisfy his sense of humour
- opportunity to give full reign to his talent for visual expression.

The left brain preference was met through the essential need to be practical, logical and organised in the individual approach to each unit of the technoliteracy curriculum.

5.2 Case-study — Jake

5.2.1 Background and general ability

Jake is the eldest child and only son in a farming family. Although the family has lived in the district for many years they are regarded by the locals as comparative new comers, as their forefathers were not of the district.

The researcher met Jake during his first year at school but was not actually teaching at Jake's school. The association arose because the four schools in the cluster met on a fortnightly basis for sport. There was something about Jake which drew the researcher's attention; he appeared self conscious and was poorly co-ordinated, yet there was a magnetism about Jake. Two years later the researcher transferred to Jake's school as head teacher but it was still another year before they worked together. By that time he was in grade four. In the interim, observation indicated that Jake was a low achiever, and his parents were concerned about him.

After working with Jake for about a term it was realised that although he had some specific difficulties, he was in fact a highly intelligent boy with general knowledge well above that of most of his peers. If his deficit could be encapsulated into one specific attribute, it would be that Jake seemed to lack rhythm. This affected everything, his speech delivery, reading, and most physical activity.

Jake's 1993 school report stated that although he was creative and his transactional written work was of a high standard, part of his mind appeared to work faster than the other, creating obvious difficulties for him. It was virtually impossible for Jake to learn to play the recorder, for instance, as his brain and his fingers appeared to be out of sync. His piano teacher reported the same difficulties. A private educational consultant from whom Jake's parents sought advice noted that Jake appeared to scan words quicker than he could read them, but was able to gain meaning from the text even without reading every word.

The overall effect was that Jake was very tense in any situation where attention was focused upon him. However, when working on self-initiated, self-directed curricula, he produced work that demonstrated originality and knowledge and an ability for in-depth thinking and research. In the self-directed learning process Jake still needed support but in a teacher-directed curriculum he did not even begin to tap his full potential. As participating observer, this researcher became a facilitator of Jake's learning process.

Jake set himself very high, often unrealistic, standards yet still produced by far his best work when the task was self-directed. One example of Jake's work was a language project in which he chose geography as his host subject. Not long prior to this the class had read, *I am David* , (Holm 1963) as a serial. This is the story of a boy who travels through central Europe. Jake's story took the form of a travel story but he focused on countries with significant icons such as Paris and Egypt. For his pages he used the largest paper he could find in the art room. This presented problems in terms of working space and his own deficiency in dexterity but he informed this researcher that the significant icons he wished to draw, that is, the Eiffel Tower and the Pyramids required large paper if he was to do justice to the task. The art and geography components of his project were exciting; the language component was less so but this self-directed task demonstrated Jake's learning style, and his strengths as well as his weaknesses.

5.2.2 Jake and the technoliteracy approach

Many of the traits which frustrated Jake in the traditional approach to curriculum were still evident as he began to work independently in the technoliteracy approach. For example, he continued to set goals which were difficult, if not impossible, to achieve. When working with the overhead projector on non-verbal communication using shadow puppets most students chose subjects that required few items and possibly relied to some extent upon movement. Jake chose to depict an episode of the television comedy 'Mr Bean'. If he had chosen simply to depict 'Mr Bean' as a character, it would have been simpler but Jake wanted a particular episode which required a great deal of detail. It took him days to prepare his material, and inevitably there was insufficient room to put all the material on the screen at the one time. He conveyed the message 'Mr Bean' but not the fine detail of the episode. He was very disappointed and his body language said 'failed again'. However in this small project Jake had demonstrated

- task commitment
- creativity
- originality

- innate ability
- initiative
- independence
- distinctive work.

These are all traits identified in literature as attributes of high intellectual (creative) potential but had not been apparent in teacher-directed work.

During the project using slide film and audio tape, the students worked with a group. Interestingly, Jake's group consisted of three of the four focus students for this research. The greatest challenge for Jake in this unit was working with a group, even though the other two boys were his closest friends. The theme was easily agreed on, but there was a difference of opinion as to emphasis. The other boys saw a dragon, which was to rise from a nearby dam, as central to the production whereas Jake felt more effort should be put into the construction of a miniature model village. They also argued about the dialogue but in the end they had a very acceptable production. From observation, it is the view of this researcher that collaboration within a group of independent creative thinkers of any age would operate in much the same way. Co-operation and involvement with others on a project which was not teacher-directed, was a learning curve for Jake but one which he came through with his self-esteem intact.

In the live-to-air radio broadcast, Jake had very strong ideas as to the program content. He demonstrated leadership in planning and was a sound constructive critic during rehearsals. However, as the actual product (the broadcast) required skills that were not Jake's strengths — that is, writing, reading, and speaking — he found it less conducive to his preferred leaning style and consequently less satisfying when compared to the medium of video and photography.

Predictably, Jake set his sights very high for the 'Linkway Live' computer unit. His aim was achievable but enormously time consuming to create. As his time allocation on the school's one computer was one and a half hours per week, he became very frustrated. His project was on cars and he wanted the scanned images to travel along a highway. Jake could see the potential for the 'Linkway Live' medium but his limited dexterity impeded his production. Eventually he co-opted Daniel to work with him; Jake acted as the creator–designer of the product and Daniel as the technician. This worked very well for both of them, as Daniel could appreciate the creative work of others and was dissatisfied with his own efforts at that time.

The video production, which was to be sent to a sister school in the

Northern Territory, gave each student, alone or with a partner, an opportunity to produce and direct an individual segment. Jake chose to work alone and observation suggests that this was a conscious choice which enabled him to control his segment, about which he was quite passionate. He chose to make comparisons between the weather during May in the Yark valley, particularly cold and damp, and that of the Northern Territory. He was familiar with the Territory climate as he had travelled there with his family.

The best time to video the early mist as it sits in the hollows of the hills is early in the morning. So Jake had to convince his parents to drive him to school early, as opposed to catching the school bus and arrange for the teacher, this researcher, to be there to open up the school and assist with the camera work. Jake was the presenter and director for this piece; he knew exactly what he wanted to portray; he had the camera pan the surrounding hills and dwell upon the bare trees and thick layer of leaves on the ground. His segment included a close-up of the thermometer recording a very low temperature. Again Jake's work showed initiative, motivation, originality, sense of purpose and high personal goals, all traits of a creative student. Braggett (1994:35) argues that '...high natural abilities may show up through precocity or as a result of a facilitative environment...'. The technoliteracy curriculum appears to have provided Jake with the facilitative environment which was not a feature of his early school years.

5.2.3 Jake's response to questions

Jake's response to question 2 (Figure 4.7) 'Tell us a little about your family', included a timeline. Unfortunately Jake did not complete the timeline but it indicated the death of his best friend during pre-school years. In a later question he referred to the fact that his school had been closed down. These two responses — the death of his friend and the loss of his school — gave a good indication of the high level of sensitivity that characterises Jake. A high level of sensitivity is a characteristic of highly creative individuals, identified in literature. Although this particular question was not searching specifically for traits of creativity, it is interesting that Jake's responses have highlighted a trait attributed to creativity.

In a further response Jake claimed that he spent most of his time alone. However, the researcher was aware that Jake and Tim spent time together out-of-school. (Jake is one of the friends Tim referred to as 'living a few fences away'.) Jake's parents also refer to his friendship with Tim in the parent questionnaire. Jake indicated that he liked to spend time with his grandfather and to talk to his grandmother. Although Jake has some doubts about his

popularity, he did indicate that people may be starting to like him. This afterthought may have been related to the fact that he was by then working in the technoliteracy programme and possibly feeling better about himself. Finally, Jake claimed that he was good at finding out about cars.

5.2.4 Opinion of Jake's teacher

Informal conversation with Jake's teacher at school (b), where Jake had transferred, identified his special ability as innovative project designs. However, the teacher did not necessarily regard this as a positive trait and raised a doubt as to whether the work was all Jake's own. Jake had just presented a project on road trains and the information was mounted like billboards on a model of a road train. It was very large and did not fit easily into the teacher's display. The teacher was if anything amused by the suggestion that Jake may have high intellectual (creative) potential as nothing about his performance in the traditional approach to teaching and learning provided evidence for this.

5.2.5 Jake's parents' response

Jake's parents gave a very detailed response to the questionnaire. They described Jake as difficult to live with and referred to 'attention deficit disorder' (the teacher–researcher had previously been unaware of this diagnosis). They also described him as obsessive about things which interest him and identified his penchant for setting himself unrealistic physical goals. Jakes parents referred to his poor response to a traditional teaching mode and suggested that he was goal oriented and not at all flexible. They also identified his long memory, particularly for fine detail.

		Relevant				Irrelevant
		5	4	3	2	1
1	Creative children sometimes resist closure on tasks; they may appear slow or unmotivated.	✔				
2	Creative children may have difficulty doing tasks which require a quick conclusion.				✔	
3	Creative children may have a well developed spoken vocabulary but be poor spellers.		✔			
4	Creative children may experience positive feelings from hard work.			✔		
5	Creative children may be optimistic about their ability to achieve goals.		✔			
6	Creative children may have a keen sense of purpose and direction.		✔			
7	Creative children may be very sensitive to human concerns.	✔				
8	Creative children may have a great deal of physical and mental energy.		✔			
9	Creative children may demonstrate resistance to structure and tradition.		✔			
10	Creative children may demonstrate a preference for older company.				✔	
11	Creative children may have a keen sense of humour.	✔				
12	Creative children may be flexible.					✔
13	Creative children may set themselves very high standards and/or goals.	✔				
14	Creative children may demonstrate curiosity about anything and everything.	✔				
15	Creative children may show initiative.		✔			
16	Creative children may demonstrate independence from an early age.		✔			
17	Creative children may have a retentive memory.	✔				
18	Creative children may adopt a mentor.		✔			
19	Creative children often come from high energy families.				✔	
20	Creative children often have parents who value high achievement.		✔			

Figure 5.3 Jake's parents' responses to the parent questionnaire

Figure 5.3 shows that Jake's parents identified 15 out of the 20 statements relating to creative traits as being relevant to Jake. This suggests that Jake may identify as a student of high intellectual (creative thinking) potential, as opposed to being identified as a student of low ability.

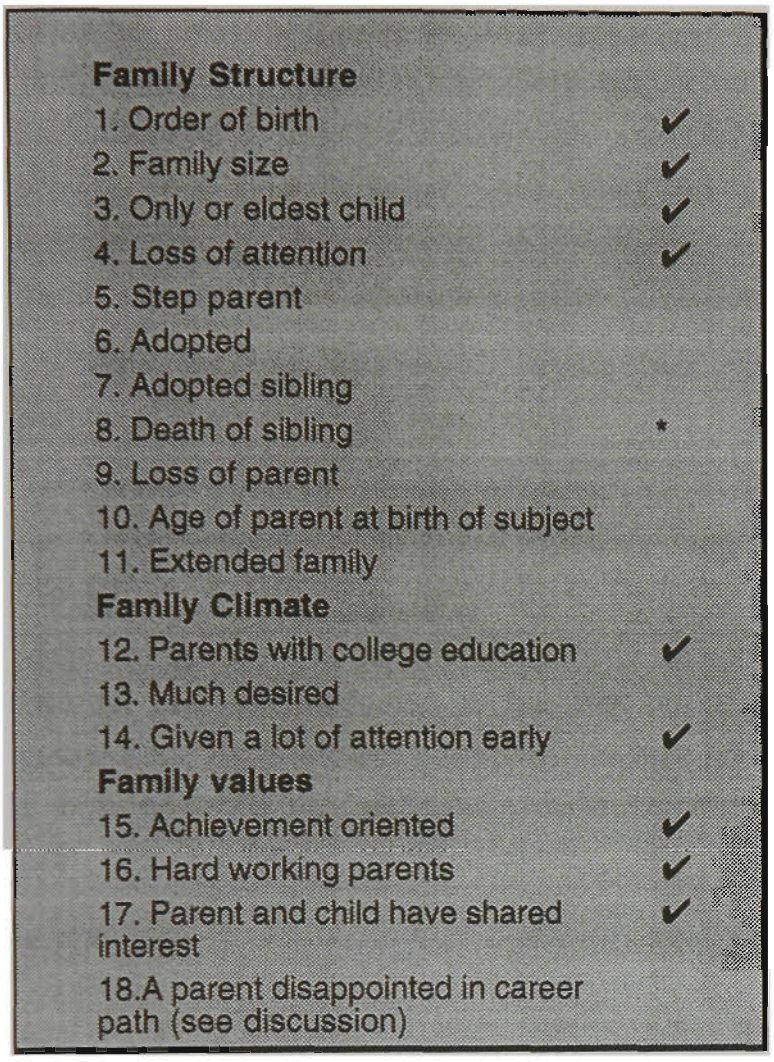


Figure 5.4 Family Characteristics Checklist — as they relate to Jake.

The checklist of family characteristics (Figure 5.4) indicates the factors which Jake has in common with other studies. His social environment includes many of the characteristics found in studies by Rimm and Lowe (1988) and Delisle (1992). For example

- Jake is the eldest (and only male sibling) in his family
- he has a small family
- he received a lot of attention early in his life
- he has a shared interest with a parent
- he has achievement oriented parents

5.2.6 Triangulation of the three responses

Jake, when asked about his special ability, suggested it was 'finding out about cars'. It may be that Jake was identifying his particular interest as opposed to his special ability. He indicated that his favourite subject at school was art and certainly the art (usually construction) component of his projects had always been significant.

In response to the question relating to positive feelings, Jake's parents replied, 'anything to do with motor vehicles' and reference to this interest

occurred several times in their response to the questionnaire, including 'finding unusual tasks to complete with a vehicle'. Jake's interest could be described as a 'passion'. Jake's parents also wrote: '... Jake has learned to provide his new teacher with what he wants. He does this without enthusiasm...'. This referred to Jake's teacher at school (b) who used a traditional structured approach in the classroom.

The teacher spoke of Jake's innovative approach to projects, in particular the project on road trains.

These three responses — parent, student and teacher — although each have a different emphasis, nevertheless suggest creative traits as identified by the literature including innovation, curiosity and passion. As participating observer the teacher–researcher would confirm this but anticipates that Jake's interest in motor vehicles is but the 'tip of the iceberg'. Substitute 'motor vehicle' for 'technology', a medium he was just discovering, and we may have a more accurate picture. Jake, who lacks dexterity, uses technology as a third arm.

5.2.7 Jake — interpretation and discussion

In terms of Atkin's (1994) theory of preferred learning style (Figure 2.7) Jake is visual–kinesthetic. That is, he learns and remembers by observing (noted by his parents) and by actively participating. His preferred thinking style (Figure 2.6) seems to be mostly right brain, but with some left brain. That is, his thinking is logical, fact-based, planned and detailed, but at the same time it is feeling based and has high energy. Herein lies the potential but for Jake; something seemed to block the realisation of this potential.

Green (1986:29) suggests a child may inexplicably feel that acceptance is conditional on his achieving a given goal. Fear of failure may inspire him but may just as easily paralyse him. This latter in particular was evident as Jake worked on the computer programme. Jake is a very intense young boy and, as stated earlier, he sets himself tasks which are self-defeating by virtue of the demands he places upon himself, either in terms of physical size or the technical challenge of any given project. One of his projects, not associated with the research, had to be brought to school in the farm trailer. Inevitably there was some damage in transit which distressed Jake greatly. Green quotes Taylor (1964) '...the underachiever was unrealistic in setting goals and thus perpetuated a sense of failure...'. Jake is a significant risk taker but is very susceptible to emotional intensity. He frequently sets himself up for failure.

Jake was a boy who often puzzled over abstract or esoteric issues but was required to conform during his years in the lower grades of his school. He

responded to a challenge and had a need for intellectual stimulation. Yet he repeated grade two at a time when he was setting himself unachievable goals in construction and was not content to produce stories appropriate to his physical capacity. All this led to social pressure and Jake developed a low self concept, which in turn was reflected in personality characteristics. If Jake could have been helped to achieve his high goals or encouraged to set himself a series of smaller goals, the result in terms of self-image during his early years at school might have resulted in less social pressure and been less detrimental.

Delisle (1992) argues that the underachiever has no control over his or her low performance, because of a lack of personal power. From observation it appears that Jake needs some support but more in the nature of reassurance than in terms of intervention. The technoliteracy approach, which was designed to address the individual needs of all students at the study site, motivated Jake and released creative traits. Because of his struggle to come to terms with himself, these traits had not been apparent in Jake, even to this teacher–researcher, until he began to work independently.

5.2.8 Summary

In the light of this study of Jake, both during the trial of the technoliteracy approach to curriculum and during the earlier action research, the evidence tends to confirm the researcher's hypothesis that Jake, originally identified as low achieving, in fact has many of the traits found in students of high intellectual (creative thinking) potential. The study also confirms that the particular social environment in which Jake is growing up matches that of students in similar studies, in particular those of Rimm and Lowe (1988) and Delisle (1992). This environment includes a family where children were given responsibility and freedom to indulge their curiosity, independence and initiative at an early age, but a school environment which did not encourage students to take charge of their own learning. Although Jake suffered no family bereavement, a significant factor identified by Rimm and Lowe, the fact that he included the death of his best friend at an early age in response to the question about his family, may be a contributing element in his underachieving behaviour.

Within the technoliteracy trial Jake's learning style and needs were better met by those media or tasks which gave rein to mental and visual processes. For example, Jake was confident, competent and at his most productive with the video and with the drama and photography media. These gave him opportunities to fully utilise his creative thinking ability and his talent

for design and construction. He was less comfortable with the overhead projector and shadow puppets which he found limiting in kinesthetic terms. This medium demanded dexterity which was not a strength for Jake. Similarly, whilst Jake was motivated by the live-to-air radio programme, it relied on reading aloud, writing and speaking, his weaker areas of skill, and he could not meet his own high expectations. Jake's response to the computer was particularly interesting as he was frustrated by his limited physical capacity to use it, yet was enticed by the potential it offered. In co-opting a willing collaborator (a focus student in this study) he was able to harness his creative thinking ability to the tool through a second person. This demonstrated flexibility, initiative and motivation, all key creative traits described by Renzulli (1985) and Sisk (1984). In most situations flexibility was not one of Jake's traits, as was noted by his parents in the questionnaire. However, Jake's problem solving approach to the computer as observed in the intensive study of the technoliteracy curriculum supports Tannenbaum's (1985) contention that in children only the potential may be identified as they are still developing.

Atkin (1994) contends that students should not work only in their preferred mode and that the reason for identifying the preferred mode is to guide the teacher–facilitator in programming to develop the whole brain. If the research site was still intact, programmes such as the live-to-air radio would be beneficial to Jake as the motivation is probably strong enough to eventually overcome the weakness in the necessary learning mode and more fully develop the skills of reading aloud, writing and speaking.

In broad terms, technoliteracy as a motivating strategy helped Jake to utilise the left hemisphere of the brain whilst giving full rein to the right hemisphere.

5.3 Case-study — Liam

5.3.1 Background and general ability

Liam is the third of four children in his family, the only male sibling. He is used to being treated differently from his sisters. During his first year at school, Liam demonstrated attention seeking behaviour and what appeared to be a low level of concentration within the classroom. The circumstances under which the researcher met Liam are identical to those which drew attention to Jake. Liam started in prep at the same school as Jake. The researcher at that time was teaching at a neighbouring school within the cluster and became aware of Liam at cluster sports gatherings.

It was apparent at the time of this early contact that Liam was an extrovert and that he possessed well developed gross motor skills. He could kick a ball with a greater degree of accuracy than is generally displayed by students in their first year at school, use a small hockey stick to 'dribble' the ball for a considerable distance and roll and tumble in early gymnastic exercises with confidence and skill. When the researcher later transferred to the school which Liam attended, it was apparent that these physical skills had developed in line with his natural growth.

At the time of the research, Liam was a grade five student with a 'bit of the devil' in him. Generally though he exercised discretion in his behaviour in class. That is, he was willing to participate in pranks with the school ring leaders, but not if it might be to his cost. Liam and his father frequently went on hunting trips, a shared interest, which from observation, Liam valued highly. Liam explained to the researcher that if a prank was afoot, he calculated whether participation might cost him a hunting trip and made his decision accordingly. This suggested he was really his own person and did not succumb to peer pressure. In a traditional structured approach Liam did as little work as possible in class but could produce a whole page of neat accurate maths in a short space of time, if it was to his advantage. Language work was more difficult for him.

Liam was in grade four by the time this researcher worked with him in class on a daily basis. However, the researcher was head teacher and, as such, a discussion had taken place with Liam's parents two years earlier when he was in grade two, to support his class teacher in her recommendation that Liam continue working at grade two level. This was recommended by the class teacher because, in her view, he had not progressed to a stage where it was considered he could cope with work at grade three level. Liam's parents, however, preferred that he be promoted to grade three, as they felt he would be 'too old' when he left school. This event confirms that Liam, at that time, was achieving at a level below expectation for his age and years of schooling.

When Liam commenced working with this researcher, it became apparent that he was a reluctant reader. He had acquired some traditional reading strategies, but these did not work for him. Liam predicted words within a story based on the initial sound but he did not seek meaning. So, for instance, 'please' and 'place' were equally acceptable predictions as far as he was concerned. This attribute within his learning style limited his progress significantly, and reflected his attitude that school curriculum had little relevance to the real world. A further difficulty which Liam experienced in the

language area was poor enunciation and this was reflected in his attempts at spelling as his introduction had been by a phonics approach alone. None of these learning deficits, however, in any way dampened Liam's self confidence. He always participated with enthusiasm in oral language activities and it was through this enthusiasm and an individual project that he did on firearms, that this researcher first became aware of the innate intelligence and leadership traits which he possessed. From time to time, if Liam happened to be listening to class discussions, he made mature and valuable contributions.[1]

5.3.2 Liam and the technoliteracy approach

Liam responded enthusiastically to the technoliteracy approach. His low level of language development hindered him in some instances, but he demonstrated determination and lateral thinking to produce some very creative pieces in collaboration with others.

Liam was keen to be involved in the live-to-air broadcast but his low literacy skills were a major impediment. After discussion with the researcher and his peers it was decided he would work on a film review. He had seen the movie *Jurassic Park* so, with the help of his mother, he wrote down everything he could remember. This took a great deal of effort on the part of everyone, especially Liam. With some help from a literate friend he committed the whole piece to memory; the amount of reading he did in the process probably equalled a whole year's work for him in a traditional setting. His final product was a very acceptable film review, which he and his friend decided to present as a discussion so that the friend's questions acted as a prompt for Liam's response. The radio programme, by its nature, required verbal communication and this appealed to Liam's learning style.

Liam was a highly motivated participant in the shadow puppet unit using the overhead projector. Although he did not really progress beyond the experimental stage, he demonstrated

- originality
- initiative
- willingness to experiment

He was equally motivated with the slide film and audio tape programme

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1 School (a) was closed following a change of government and although this was a set back for some, Liam, if anything, responded better in general terms to his new teacher who was a male and who was considered a good player in the local football team.

but again the final production was not especially noteworthy. However, the important outcome was the level of Liam's motivation and commitment; this was high with each unit and in complete contrast to his standard lack of enthusiasm for classroom activity.

Liam demonstrated little interest in working with computers. When he first used the authoring package 'Linkway Live' he stated quite unequivocally that he would rather be playing 'footy'. No one else was playing football at the time but it was his way of expressing his unasked for opinion. In spite of this, Liam was able to access 'Linkway Live' at the commencement of each session and made value judgments relating to the limitations of the software. Comments such as 'I'll just try...' (curiosity) and 'oh yeah, that'll do' (flexibility) are very much in keeping with his laid back attitude to classroom work. It was his body language that gave the researcher an incite to his underlying characteristics and ability. On one occasion, when the photograph he was working on distorted in colour, he squinted at it, made a quick mental assessment, flicked back to the source of colour, made a change and the picture returned to the way he had originally intended.

This particular understanding of the technology had not been observed in any of the other students, even though the colour distortion was something which occurred frequently. In this brief glimpse this researcher observed someone who knew about 'thinking on his feet'. It suggested that Liam could use the computer just as competently as any of the other students if he chose to, but Liam's preferred learning style was oriented towards gross motor activity and verbal communication. The high level of concentration and fine motor activity required for efficient production with the computer was not compatible with Liam's learning style.

Some other observations in relation to Liam's interaction with the computer included the ability to

- read all the menus correctly except for the words 'object' and 'option', which he confused at times
- accept the limitations of the software. He would change his original concept without irritation when the software could not produce the effect he had intended
- approach the task with a sense of humour. Some of his suggestions may have been considered to be lacking in good taste but demonstrated a keen sense of humour
- indirectly use his preferred visual–auditory learning style. Liam was much more motivated observing two other students working, than he had been when working on his own multimedia production. He

asked questions of the other students as they worked on their programme and offered suggestions which indicated lateral thinking.

These are traits considered to be indicators of creative thinking as identified in the literature reviewed by Sisk (1984) traits which had little opportunity to surface in the traditional teacher-centred approach, experienced by Liam for most of his school life.

5.3.3 Liam's response to questions

Liam claimed in question 3 (Figure 4.7) that 'Skippy', the family's pet kangaroo, was his favourite person in the family. From observation he may have responded differently on a different day. Liam lives in a close-knit family, and his father is his mentor and role model. When asked about his own abilities Liam suggested that he is 'best at shooting and driving'. When asked about his leisure time, Liam suggested he spends most of his time watching television. His mother concurs with the latter and suggests that this is another reason for his well developed oral language as compared with his reading and writing. However, whilst this may be true, this researcher, from several years association with the family, is aware that Liam spends a lot of time at weekends and during holiday periods helping his father on the farm, going on hunting trips and going to the football. This is consistent with the claim of Rimm and Lowe (1988) that creative underachievers have a preference for adult company. In the view of the researcher it seems likely that Liam watches television when adult company is not available.

In response to the question 'Who do you most like to play with at school' Liam reversed the question and nominated the students he would not like to play with. (He named the three other students in this study). This is not significant in itself as none of the students, parents or the researcher, knew who the focus students were at that stage of the study and observation had been conducted in the context of the whole class. One explanation could be that Liam is a strong personality who likes to be in charge, as do each of the students he named. It may be that Liam's statement has wider ramifications than simple preference of playmates. Could it be an early stage of political rivalry?

Liam nominated art and science as his favourite subjects at school. It should be noted, however, that the school Liam attends has no physical education specialist and therefore he has not yet been exposed to serious sport or physical training at school. In view of Liam's early indicators of physical skill this is an important consideration in identification of him as an underachiever of high intellectual potential. That is, he may not yet have been

exposed to the learning environment in which he is most likely to achieve at a high level, namely sport.

5.3.4 Opinion of Liam's teacher

As with the other case-studies, Liam's teacher did not object to the study but did not agree with the concept of an underachiever with high intellectual (creative) potential. Within the classroom Liam did not demonstrate academic skills and the teacher did not consider it worthwhile to discuss Liam in the context of this study. He did concede, however, that Liam had well developed physical skills and high energy levels. These traits are both recognised in the literature as likely to occur in the creatively gifted.

5.3.5 Liam's parents' response

Liam's parents identified 15 out of the 20 statements (Figure 5.5) as being highly relevant to Liam and the remaining five as relevant to a lesser extent.

		Relevant				Irrelevant
		5	4	3	2	1
1	Creative children sometimes resist closure on tasks; they may appear slow or unmotivated.	✔				
2	Creative children may have difficulty doing tasks which require a quick conclusion.			✔		
3	Creative children may have a well developed spoken vocabulary but be poor spellers.	✔				
4	Creative children may experience positive feelings from hard work.	✔				
5	Creative children may be optimistic about their ability to achieve goals.	✔				
6	Creative children may have a keen sense of purpose and direction.	✔				
7	Creative children may be very sensitive to human concerns.			✔		
8	Creative children may have a great deal of physical and mental energy.	✔				
9	Creative children may demonstrate resistance to structure and tradition.			✔		
10	Creative children may demonstrate a preference for older company.			✔		
11	Creative children may have a keen sense of humour.	✔				
12	Creative children may be flexible.	✔				
13	Creative children may set themselves very high standards and/or goals.	✔				
14	Creative children may demonstrate curiosity about anything and everything.	✔				
15	Creative children may show initiative.		✔			
16	Creative children may demonstrate independence from an early age.	✔				
17	Creative children may have a retentive memory.	✔				
18	Creative children may adopt a mentor.	✔				
19	Creative children often come from high energy families.	✔				
20	Creative children often have parents who value high achievement.	✔				

Figure 5.5 Liam's parents' responses to the parent questionnaire.

Two of the key factors in their view were obstinacy in the face of opposition and a great deal of physical and mental energy. In response to the question on resistance to closure of tasks, they reported that it is more difficult to get him started because he is thinking of 'weird and wonderful ways' to approach the task. Theorists might describe this trait as originality.

Liam's parents confirm that he shows a preference for older company and suggest that this is why he has a fairly well developed spoken vocabulary compared to his ability with written work. Liam's parents also confirm that Liam has a keen sense of humour (often at inappropriate times), that he sets

himself high standards, particularly in sport, and that he is very curious. 'Why' is his most commonly used word they suggest. They also indicate that he can be independent but likes backup and that he has a long and detailed memory. Observation by the researcher confirms that Liam's parents are goal-oriented, with high energy. These characteristics are identified in literature as indicative of students of high intellectual (creative thinking) potential.

The checklist of family characteristics (Figure 5.6) indicates the factors that Liam has in common with students in other studies. His social environment includes many of the characteristics found in studies of Rimm and Lowe(1988) and Delisle (1992). For example, Liam

- is the only male sibling
- has an extended family
- was much desired
- had a lot of attention early in his life
- has a shared interest with one parent.

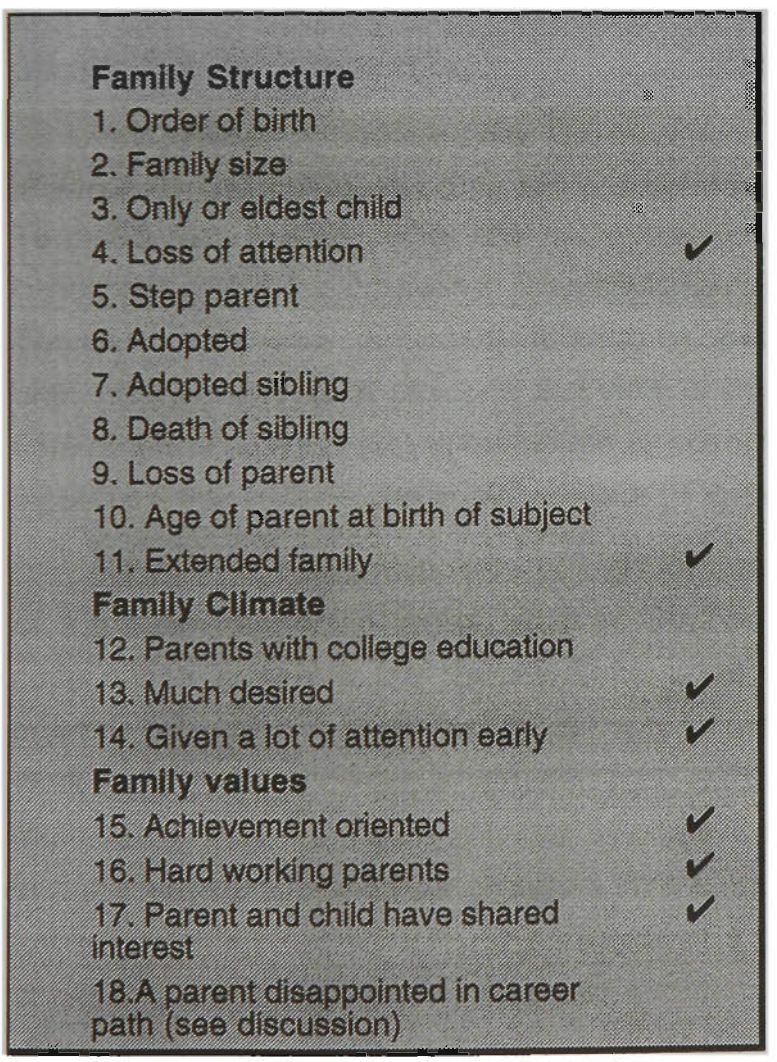

Figure 5.6 Family Characteristics Checklist as they relate to Liam.

5.3.6 Triangulation of the three responses

Liam nominated shooting and driving as his special abilities. His parents, in response to the question relating to interests (see appendix), replied 'anything to do with motor bikes and hunting'. Liam's teacher spoke of his physical skill and energy.

These responses from parent, student and teacher, although slightly different in emphasis, nevertheless indicate creative traits of 'moral courage' suggested by Renzulli (1992) and 'passion', suggested by Betts (1985). Other traits observed and identified by Sisk (1984) were alertness, charisma, curiosity, risk taking and external motivation.

5.3.7 Liam — interpretation and discussion

In terms of Atkin's (1994) theory on preferred thinking and preferred learning style, (Figure 2.6 and Figure 2.7) Liam is a right brain learner with some left brain learning attributes. That is, he is visual, intuitive and kinesthetic. He can learn by observation, listening, active participation and is not afraid to test his instincts.

Important in understanding Liam's profile as an underachiever of high intellectual potential is the view expressed by Braggett (1994) and Tannenbaum (1983), who are in agreement, that the term 'potential' is conceived within the context of the child's development. Liam's case supports Tannenbaum's view that many talents, by their very nature, cannot emerge until adult or near adult years. In the view of this researcher, Liam was, at the time of this study, too young for his gift or talent to be more than embryonic, as it seems likely to lie in the social domain (Figure 2.4).

Renzulli's (1986) definition of high intellectual potential rated motivation as a prerequisite whilst others, such as Gagne (1985), question this. Liam is a case which supports the Gagne view point, in that there is evidence of creative thought and brief flashes of the resultant product, as evidenced in his work with the live radio broadcast and with the 'Linkway Live' computer multimedia. There is also evidence of positive leadership traits when Liam is in the playground. However, there is little evidence of Liam being motivated toward anything measurable, or evidence of a clearly identified specific talent or gift at this stage of his development.

It was difficult to identify where Liam might fit into the pattern of a high potential underachiever, yet there was a strong sense of untapped potential when observing him. Identifying those particular traits which might suggest high intellectual (creative) potential has proved to be a challenge to the

hypothesis. Instinctively this researcher's attention was drawn toward Liam but identifying his qualities in the literature proved to be quite testing. It was in Cohen's (1990) 'interest inventory' (Figure 2.5) that a clue was found. The pattern of Liam's intellectual characteristics was identified in the 'control' theme. This includes interest in the outdoors, physical activities and objects of power.

Torrance (1985) suggests that non-intellective factors in students with high intellectual potential are important, including problem-solving experiences, curiosity, creativity, leadership, risk taking and a willingness to try new ideas. Such students, he suggests were weak in knowledge and reading, needed external motivation and seldom had broad exposure to books. In Liam's home the reading material consists of periodicals and papers with which Liam's father keeps abreast of rural industry. It would be fair to say that they are not a family who place great value on reading books. Chisholm (1978) argues that schools are hostile to skills which cannot be measured. Sisk (1984) suggests that this leads to failure in identifying and fostering talent and potential. Smilansky (1984) recommends a program of sensory bombardment and active participation. This is what the technoliteracy program provided for Liam.

5.3.8 Summary

At first impression it appears that Liam is the one student in this group least likely to be identified as being of high intellectual (creative) potential. However, the technoliteracy approach to curriculum revealed motivation and ability that had previously been unsuspected. This at least identified him as an underachiever — that is, a student working somewhere below his full potential, as opposed to being a student of low ability. Indicators of Liam's intellectual (creative) potential are subtle and not apparent within the traditional classroom environment. In the view of the researcher they may only ever be apparent to a teacher who knows Liam well and is also conversant with the concept of the underachiever of high intellectual (creative) potential.

Many of Liam's personality traits match those identified by Sisk (1984) and Renzulli et al (1995). Liam's high energy, keen sense of humour, independence, initiative, curiosity, flexibility, preference for older company and passion, are all indicators of high intellectual potential. Liam also possesses, even at this early stage, the interpersonal traits of charisma and compassion demonstrated through his interaction with younger students within the playground environment.

If school (a) which Liam attended had not been closed, the

technoliteracy approach would have continued and Liam's motivation toward school in a technoliteracy curriculum may have remained buoyant. The characteristics identified in Liam may yet be sufficient for him to ultimately realise his full potential.

5.4 Case-study — Daniel

5.4.1 Background and general ability

Daniel is the student with whom the researcher has had the least contact as he is younger than the other focus students and only worked in a direct teacher–student relationship for the period of the technoliteracy research programme. There has, however, been earlier and ongoing contact through the cluster schools' activities.

The researcher was in the last few weeks as the infant teacher at school (b) when Daniel attended the prep orientation programme. He appeared, at that time, to be a high energy student but was a little shy and nervous. During the following year the researcher moved to the neighbouring school but took music at Daniel's school on a fortnightly basis, in a music–sport exchange with Daniel's teacher. During this brief contact Daniel appeared to be mischievous, behaviour which seemed to be aimed at getting attention. This was understandable as he was the youngest male in a school which had become a one teacher school, and it was not easy to get attention when dominated by older and bigger boys. In subsequent years at cluster gatherings, he continued to present as a high energy person who enjoyed physical activity and who had a sense of humour which was sometimes inappropriate.

Daniel's family were alternative farmers producing yabbies for the restaurant trade. At the time of the research, Daniel's mother was director of nursing at the aged hostel in a small town 25 kilometres from the local community.

Being yabby farmers in some way set them apart from the traditional farming families of the community, although they were very involved with community life. This fostered a social environment in which Daniel was sometimes seen as a humorous figure by the other students who came from traditional farming families. Daniel was in no way disconcerted by the views of others. He had a very strong commitment to yabbies and brought one to school on 'Pet Day'.

At the time of the research Daniel was in grade four. He gave the impression of being a person with untapped potential but he was not

extending himself and had a tendency to challenge the teacher in a non-aggressive manner, as though wanting to have pressure exerted upon him before putting in a full effort. His body language frequently gave the impression that he had some secret joke to which only he was privy and there was a sense of repressed energy when he was in the confines of the classroom. Although he did as little teacher directed school work as possible he occasionally revealed his potential by a word or quick action, indicating a bright mind behind the facade.

In addition to yabby farming, Daniel is also quite passionate about the wider environment. His family are involved in the local landcare group and Daniel attempted to get a junior group going through the school. He also wrote to the local member of parliament on a landcare matter entirely of his own volition. He demonstrated high oral ability, extensive vocabulary and showed a sense of purpose and passion for his subject.

Daniel often did not work consistently during traditional lessons, but at the same time he demonstrated, in subtle ways, that he had ability beyond the level at which he was working. Daniel read at a level higher than that usually attained by grade four boys in rural schools. He also, from time to time, demonstrated skills in mathematics which were beyond that demanded by the standard commercially produced programme for grade four students used by his school. For example, although he frequently laboured slowly during maths sessions he could unexpectedly complete a worksheet in half the allotted time and present it with a look that suggested the task had just been a waste of time.

5.4.2 Daniel and the technoliteracy approach

For Daniel the technoliteracy approach was highly motivating. Apart from any other consideration it released him from his desk. His actual product from each unit reflected the fact that he was much younger than the other focus students but his high energy was reflected in his enthusiasm.

The unit using slide film and audio tape was perhaps the highlight for Daniel. He worked with the group which included two of the other focus students and participated in all aspects, carrying out tasks assigned to him by other members of the group. It was in the drama, however, that he excelled. From the outset he had identified the non-human character which was to rise from the dam in the school's old horse paddock, as the role he would play. He put a great deal of thought and planning into this role and truly made the role his own. The mental and physical energy was no longer repressed.

Daniel did not really get past the experimental stage with the overhead

projector unit working with shadow puppets, but he was very responsive. The concrete nature of developing the shadow puppets and the story simultaneously was highly motivating for him. As it was a whole school activity, he was also able to take on a leadership role with a younger group and this in itself was satisfying for him.

The computer unit using the 'Linkway Live' multimedia was a challenge for Daniel and one which he took time to come to terms with. He was not unfamiliar with computers, but creating his own programme was a new experience. From observation it was apparent that Daniel could perceive its potential and that he had the desire to absorb the intricacies. He was more than willing to experiment but he was constantly dissatisfied with the results in terms of content. He finally teamed up with Jake who was limited by poor dexterity and, between them, they produced a programme which met the high expectations of each.

Through Daniel's participation in the technoliteracy approach the researcher observed the following traits which are common in students of high intellectual (creative) potential. Daniel demonstrated

- independence — as he took control of aspects in each unit which he was able to make his own, such as the organisation of the character he played in the slide film and audio unit
- experimentation — as he attempted to harness the Linkway Live software, when creating his 'character' in the slide film and audio unit, and when working with the shadow puppets
- external motivation — as he enjoyed the arts and in his response to kinesthetic activity throughout the entire research programme
- leadership as he helped younger students with shadow puppets

5.4.3 Daniel's response to questions

Daniel nominated mathematics as his favourite subject and in response to the question 'Who do you most like to play with at school?' Daniel identified two students, both of whom are focus students of this research.

As Daniel is considerably younger than the other focus students it was not surprising that his answers were less detailed, particularly as these questions were part of the writing curriculum activity and he was not very interested. To the question inviting him to tell about his family, however, he gave more detail than for anything else. He stated 'we are yabby farmers' and 'Me and Emran (his brother) work on the farm'. The passion which Daniel had for this family business and lifestyle had been observed by the researcher and resounded in this simple statement.

5.4.4 Opinion of Daniel's teacher

In discussion, Daniel's teacher indicated that Daniel did not give maximum effort in general class work but that he did put a lot of effort into playing football. As with the other students the teacher did not accept the idea that Daniel might have high intellectual (creative) potential.

5.4.5 Daniel's parent's response

Daniel's parents identified 12 of the 20 statements relating to creative traits (Figure 5.7) as being relevant to Daniel. This is not a high percentage but Daniel is still very young. Delisle (1992) and Sungaila (1981) refer to the difficulty in identifying creativity in the young. They each assert that creativity takes time to emerge.

		Relevant				Irrelevant
		5	4	3	2	1
1	Creative children sometimes resist closure on tasks; they may appear slow or unmotivated.	✔				
2	Creative children may have difficulty doing tasks which require a quick conclusion.					✔
3	Creative children may have a well developed spoken vocabulary but be poor spellers.			✔		
4	Creative children may experience positive feelings from hard work.	✔				
5	Creative children may be optimistic about their ability to achieve goals.	✔				
6	Creative children may have a keen sense of purpose and direction.			✔		
7	Creative children may be very sensitive to human concerns.	✔				
8	Creative children may have a great deal of physical and mental energy.	✔				
9	Creative children may demonstrate resistance to structure and tradition.				✔	
10	Creative children may demonstrate a preference for older company.	✔				
11	Creative children may have a keen sense of humour.		✔			
12	Creative children may be flexible.					✔
13	Creative children may set themselves very high standards and/or goals.	✔				
14	Creative children may demonstrate curiosity about anything and everything.	✔				
15	Creative children may show initiative.		✔			
16	Creative children may demonstrate independence from an early age.			✔		
17	Creative children may have a retentive memory.			✔		
18	Creative children may adopt a mentor.		✔			
19	Creative children often come from high energy families.			✔		
20	Creative children often have parents who value high achievement.		✔			

Figure 5.7 Daniel's parents' responses to the parent questionnaire

In response to the question about a mentor Daniel's mother indicated that this

was relevant to Daniel but felt this may be due to environmental factors — that is, he does not have a lot of choice living in an isolated situation. If this is true it would tend to support the concept, that the high potential evidenced in these students is being nurtured by the social environment. That is, students have a higher level of contact with adults than with a peer group. Daniel's parents identified sport, building and construction, maps, music and drawing as his particular interests.

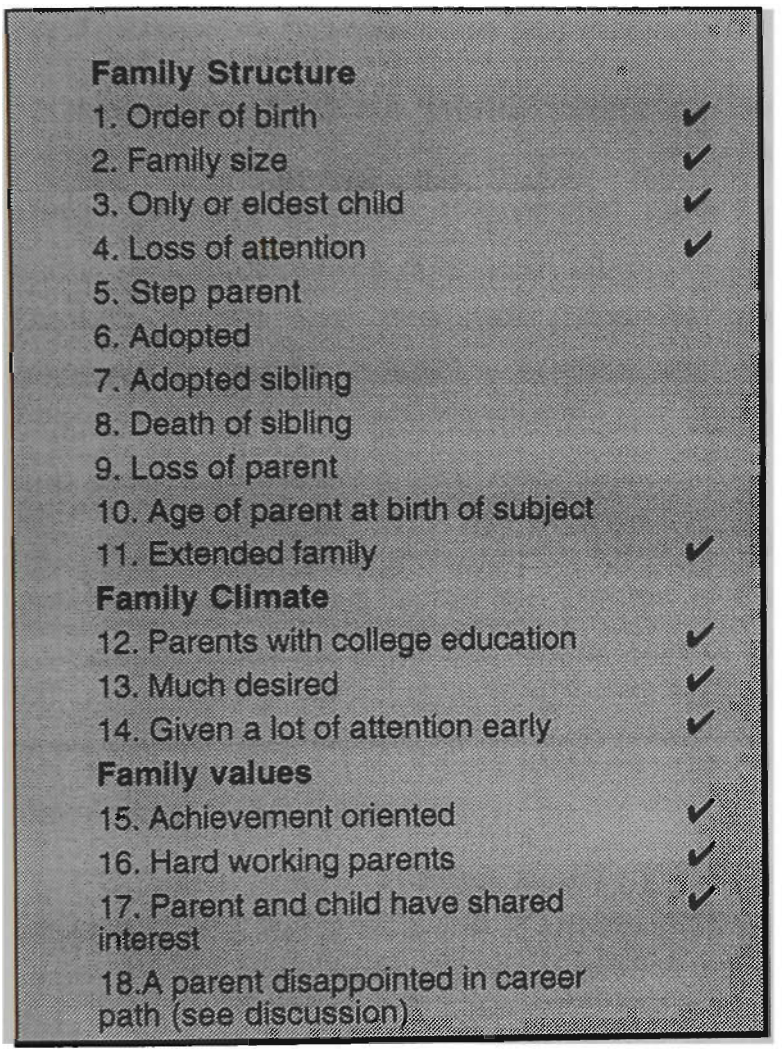

Figure 5.8 Family Characteristics Checklist as they relate to Daniel.

The checklist of family characteristics (Figure 5.8) indicates the factors which Daniel has in common with students of other studies. His social environment includes many of the characteristics found in studies of Rimm and Lowe (1988) and Delisle (1992). For example he

- is the eldest child in his family
- has only one sibling
- was much desired
- lost attention due to an ailing sibling
- has achievement oriented parents
- has a shared interest with his parents.

5.4.6 Triangulation of the three responses

Parent, student and teacher each focus upon different aspects of Daniel's developing talents and skills, but the one consistent factor is high energy. Observation by the researcher and the comments from the student and parents indicate creative traits including optimism, sense of purpose, physical and mental energy and high personal standards in activities beyond the classroom.

5.4.7 Daniel — interpretation and discussion

In terms of Atkin's (1994) theory on preferred thinking process and preferred learning style, Daniel is predominantly a left brain learner but with some right brain attributes (Figure 2.6). He is logical and fact based but at the same time incorporates right brain attributes of feeling and high energy. Given Daniel's young age, one must allow for greater development, and from observation, subtle indicators suggest that his thinking process may later include the lower left quadrant of Atkin's model. That is, planned, organised, and sequential learning components.

Braggett (1994) and Tannenbaum (1983) argue that the intellectual potential is conceived within the context of the child's development. This is particularly relevant to Daniel. In the view of this researcher Daniel is as yet too young for his gift or talent to be more than embryonic. However, his role in the family farming lifestyle may be considered a facilitative environment for the development of his potential.

Cohen's (1990) 'interest inventory' is pertinent to Daniel and as with other focus students it is the 'Control' theme characteristics which may be identified in Daniel, including interest in outdoor action, a passionate concern for the environment and a strong facility for masquerade and drama. These latter were very evident in Daniel's involvement with the technoliteracy approach to curriculum.

5.4.8 Summary

It has been difficult to be as certain about Daniel's intellectual (creative) potential when compared with other students of the study, but the researcher considers the 'grey areas' are simply due to the fact that Daniel is very much younger than the other three. He was included on the basis of Renzulli's (1992) belief that it is better to include an over large sample rather than risk a student with potential slipping through the net. The researcher observed in Daniel many traits identified by Renzulli (1992), Sisk (1984) and Sternberg (1991) as traits commonly occurring in creative adults. These include

initiative, curiosity, high personal goals, sensitivity, sense of humour, preference for older company and resistance to structure.

In addition, Daniel's social environment includes many of the characteristics in common with those of the participants in the Rimm and Lowe (1988) and Deslile (1992) studies of underachievers. These characteristics include the size of his family, having an ailing sibling when he was very young, being a much desired child and living in close association with other relatives.

It was noted through questioning, observation and interviews that the most commonly noted of Daniel's attributes was his high energy level. The technoliteracy curriculum provided Daniel with opportunity to explore the arts which satisfied his kinesthetic learning style. It enabled him to direct his energies into areas other than sport, possibly areas which he had not had the opportunity to explore previously.

5.5 Case-studies — Conclusion

Whitmore (1980) put forward the view that a student's acceptance by peers is a significant factor in the study of underachieving students. This could be a contributing factor for three of the focus students of this study.

Daniel's young age kept him low in the 'pecking order' of the schoolyard. This contrasted strongly with the standing in which he was held within his own family. In addition he suffered the social disadvantage of coming from a family of 'alternative' farmers in a district where broad acre farming was the tradition.

Tim, from observation, is a very private person, not greatly impressed by the peer pack. One would not describe him as unpopular but even his sporting excellence at tennis tended to place him to one side of the popular field of sporting endeavour (football) within his environment.

Jake could not be described as a popular figure; this is possibly because in any debate his high intellect and zeal in promoting his ideas made the average student ill-at-ease.

Liam is the exception here as popularity is not a significant issue for him as indicated in the case-study. He is his own person and he rides the 'social waves' as seems appropriate at the time.

Low motivation within the context of the traditional teacher directed curriculum was the key characteristic of each focus student in these case-studies. The research literature indicated that contrasting environmental factors at home and at school played a significant role in underachieving behaviour. Each student has a significant number of family characteristics in

common with the study of Rimm and Lowe (1988) and other characteristics identified in the literature as creative traits. However, as each student bore different characteristics from one another it was not possible to group all students and relate them to each researcher. For this reason each case-study must be considered individually.

Whitmore's (1980) research findings were relevant for each of the focus students. She found that complex environmental and personality interaction affect every student differently and are a contributing cause of underachievement. She suggests that it is these factors which more often cause underachievement than the student's inability to do better. It is possible that the loss of 'specialness' as described by Rimm and Lowe (1988), which existed in the early years of each of the focus students, could be such a contributing factor. Events such as the loss of a significant other due to death or serious illness, and lack of optimism within the family environment in relation to the future for farming and farming districts are events beyond anyone's control, which would affect the entire extended family.

Findings of Braggett (1994:35) and Delisle (1992) are reflected by each student in the current study. Braggett suggests that curriculum outside the normal school pattern may reveal previously unsuspected talent and interest and that an enriched background broadens learning especially where family communication is strong, and where children experience language from birth and are encouraged to interact with others. Each of the focus students comes from such a background and the learning that occurred within this environment may have nurtured the potential. Hence, it was not surprising that in the traditional teacher-centred classroom setting these students were unresponsive.

Delisle (1992) suggests that to assess the student only on the basis of academic performance within the school offers a very limited perspective. Underachievement can be a symptom of inappropriate curriculum. Observation indicates that the traditional curriculum design was a significant factor in the low motivation and academic achievement of Daniel and Jake and in the lack of challenge for Tim. In each of the focus students it was outside the school environment that evidence of high intellectual potential was first noted.

6. Interpretation and Discussion of Results

6.1 Introduction

The results presented in the last chapter indicate how the four underachieving boys who were the focus of this study responded to the opportunities provided by the technoliteracy curriculum.

This chapter reiterates the context of the study and considers its strengths and limitations as research. It relates the findings for the focus students, considered as a group, to the literature on underachieving primary school age students, and the research questions posed in chapter 3.

6.1.1 Context of the study

The literature review showed that students such as the focus students of this study are frequently found to have traits of high intellectual (creative) potential. This study set out to examine whether the intellectual energy demonstrated in their life outside the school could be achieved within a modified school curriculum.

Whitmore (1980), Rimm and Lowe (1988), Delisle (1992) and Braggett (1992) suggest that a high proportion of low achieving students, who later prove to have a high level of intellectual potential, are also highly creative. Observation of the focus students preferred learning mode and implementation of greater student autonomy in the learning domain, together with ideas promoted at the Melbourne conference of the 'Australian Reading Association' in (1994), encouraged the researcher to experiment with curriculum referred to in the study as a technoliteracy approach.

Cohen (1993) cited research undertaken in Alberta, Canada, which identifies leadership and creative or productive thinking as sub-categories of giftedness and described the creative thinker as one of the more difficult types of student to identify. The research suggested that:

> ...such students may have a high degree of general intellectual ability frequently masked by a reluctance to perform well on tasks requiring primarily convergent or conforming thinking...;

and that:

> Creative or productive thinking will only blossom in an atmosphere in which it is valued and enhanced.

This description matched that of the young boys whose attitude to school

work had been challenging this researcher for a long time and inevitably led to the question 'Were these students creative thinkers, and if so, why did they demonstrate low levels of motivation and achievement in school?'

Further searches of the literature revealed general agreement amongst researchers that creativity is represented by more than one factor within an individual. Just what these factors are, their confluence and interaction, is a matter for debate. But they include the characteristics summarised in Figure 6.1.

Student demonstrates	Tim	Jake	Liam	Daniel
Resistant to tradition and structure	✔	✔	✔	✔
Friendliness	✔	✔	✔	✔
Preference for older company	✔	✔	✔	✔
Sense of humour	✔	✔	✔	✔
Flexibility			✔	✔
Retentive memory	✔	✔	✔	✔
High personal goals	✔	✔	✔	✔
Curiosity	✔	✔	✔	✔
Originality	✔	✔	✔	
Initiative	✔	✔	✔	✔
Passion	✔	✔	✔	✔
Independence	✔	✔	✔	✔

✔ denotes child displays characteristic

Figure 6.1 A checklist of creative traits

Figure 6.1 shows, for the students as a group, the creative qualities they were perceived to posses by the teacher–researcher.

The general notion that the focus students might have high intellectual potential (creative thinking–leadership traits) became central to the intensive study. If it was the case that the focus students were imbued with such creative traits, it might be assumed that they would respond positively to a curriculum which gave greater scope than the conventional one to demonstrate their creativity; such proved to be the case.

6.2 Strengths and limitations of the study

6.2.1 Strengths of the study

The teacher–researcher had a long standing interest in the issue and had identified certain types of students who typically underachieve in the classroom. Having questioned the existing curriculum and its relevance to real life as perceived by the students, the researcher then considered where

the strengths of these students might lie. This led to action research and experimentation with different types of curricula and a different approach to learning and teaching. Following success in promoting independent learning with the students, the researcher turned to the literature, seeking studies that identified students of this particular type. From this strong base was established the intensive study upon which this thesis is based.

As the classroom teacher the researcher worked with the students on a daily basis, participating in and observing the 'highs and lows' of their lives, in the fullest sense. Pivotal to the researcher's full knowledge and understanding of the students and the issue has been the access to data, available because of trust between the community and the teacher–researcher, the long time residence in the locality of the teacher and extensive literature reviewed to gain understanding of the students' behaviour patterns. In addition there was systematic collecting and recording of data in the tradition of teacher–researcher Kohl (1977).

The interest in and questioning of the technoliteracy curriculum by many parents at the school, ensured self searching by the researcher and justification of both the process and literacy value of the technoliteracy approach. Thus the strengths of the study are

- extensive review of literature
- in depth knowledge of the students and community
- systematic collection of data
- triangulation of data

6.2.2 Limitations of the study

The research may be criticised for the absence of an identifiable control group.It should be remembered that this research originated as action research in which the whole group of 22 students worked on the technoliteracy curriculum. The majority of students in the group who were already achieving and motivated prior to its introduction, continued to exhibit positive learning behaviour. The exceptions were two female students who were generally unmotivated and who remained so. The technoliteracy approach did not change their learning behaviour. Both were fairly new to the school and were not used to thinking for themselves. They and their parents prefered a curriculum that required identifiable right / wrong answers. The parents considered that a teacher-centered curriculum was measurable and therefore preferable. The students who became the focus of the intensive study stood out from the rest of the group because their level of motivation

increased dramatically compared to that displayed in the conventional classroom situation.

The intensive research project was conducted in one school with only four students. Although this was a fairly high number given the small school population, it is too small a sample to suggest more than indicative findings. There would have been greater validity to the study if it had been replicated in a neighbouring school.

The fact that the researcher was also the teacher was a limitation in itself, as it was difficult to 'capture the process' of the students' work in some instances, even though field notes were taken daily and acted upon. For example, the two younger focus students did not complete the student questions. These were part of the writing curriculum and they had not completed by the end of the lesson. It was not possible to have them complete at a later time as the thrust of the research was to have all data collected in a natural classroom environment. This would have been lost if the two students had been asked to finish at another time.

An important limitation is the isolation of the researcher and the dependence upon her word. There were few other professionals with whom to discuss students' characteristics and traits, as other teachers had different interests and the school was too remote to have frequent contact with university supervisors.

The young age of the students is a further limitation. Tannenbaum (1983) suggests that only the 'potential' of young students can be ascertained, since much of the talent and ability of young students will not emerge until near adulthood.

The limitations have been addressed to some extent through

- the long term close contact and consequent empathy, between the researcher and the community
- triangulation — that is, involvement of parents, students and to some extent other teachers in identifying traits, interests and preferences

6.2.3 Conclusion

In research of this nature claims can be supported by evidence, but the level of proof cannot be positively established. This study provides evidence based upon the researcher's experience as a teacher, whilst evidence as to the characteristics of the focus students is supported by data from parents and other teachers. Claims made for the effectiveness of a technoliteracy curriculum in motivating and consequently improving the performance of the

focus students is based upon observation and carefully recorded conceptual field notes taken by the researcher.

6.3 The research questions

In chapter 3 the research questions were identified. These are now discussed in turn with a view to explaining and interpreting the findings for the focus students as a group.

6.3.1 How can the enigma, of bright minded students with low academic achievement in a rural school be explained?

The four focus students are from farming families where everyone contributes to the work–lifestyle in one way or another. These young boys are vital to the viability and long term growth of the family farm. Many young people from such backgrounds can drive a utility as soon as their feet reach the pedals. As rouse-abouts in the shearing sheds, they know what to do and, importantly, when to do it. They know about birth and death from firsthand experience. Some help to 'pull' calves using chains and winches; others can use a rifle to put an animal out of pain if necessary. During a field trip in the local area early in the study, it became apparent to the researcher that boys who demonstrated low motivation and performance in the classroom, possessed special skills and knowledge of their environment. Skills such as testing an electric fence with a blade of grass to determine if it was safe to climb over, and identifying a dead animal by odour, long before it was in view. Critical to the out-of-school intellectual development of these students is the value placed upon their contribution to family life. Little wonder then, that the traditional curriculum in school is tame by comparison with real life.

Initially all students at the school appeared to have the same environmental background. However, different family structures and family climate, different gender and position in family, all served to develop different innate personality and intellectual characteristics. Therefore, the manner in which each student engaged in life and the learning situation was correspondingly different.

The focus students stood out from the others because

- they were unmotivated low achievers
- they demonstrated high intelligence and skill when away from the school environment
- the family characteristics were similar to those identified in the literature as creative thinker–producers.

This has been shown individually in the case-studies, in the next section

discussion is undertaken for the group as a whole.

Family Structure	Tom	Jake	Liam	Daniel
1. Order of birth		✔		✔
2. Family size	✔	✔		✔
3. Only or eldest child		✔		✔
4. Step parent				
5. Adopted				
6. Adopted sibling				
7. Death of sibling				
8. Loss of parent				
9. Age of parent at birth of subject				
10. Extended family	✔		✔	✔
Family Climate				
11. Parents with college education	✔	✔		✔
12. Much desired	✔	✔	✔	✔
13. Loss of attention	✔	✔	✔	✔
14. Given a lot of attention early	✔	✔	✔	✔
Family values				
15. Achievement oriented	✔	✔	✔	✔
16. Hard working parents	✔	✔	✔	✔
17. Parent and child have shared interest	✔	✔	✔	✔
18.A parent disappointed in career path (see discussion)				

Figure 6.2 Comparison of focus students as a group on family environment characteristics.

Figure 6.2 shows how the students compare on different characteristics related to family structure, family climate and family values. Under the heading family structure the focus students did not score highly — this section includes adoption or step family. All the focus students were living with their natural family. However, three students were in a two sibling family, thus matching the family size comparison and two were the eldest in their family, thus matching the order of birth comparison. Perhaps more importantly two students were the only male sibling in their family. Rimm and Lowe (1988) do not highlight this factor and whilst it may not be particularly significant in many urban families, the situation is very different for farming families. This factor gave them status in the family. Three students interacted within an extended family. In Tim's family the grandparents lived in the original homestead whilst Tim's immediate family lived close by on the same farm. Daniel's grandparents lived quite close to his immediate family and there was an extended family structure. Liam's extended family made up most of the

community in which he lived, so he was surrounded by aunts, uncles and cousins wherever he moved in his local environment. Only Jake did not meet this particular characteristic of family structure but even for him the data indicated that his grandparents played an important role in his life. There is then evidence of some similarity in family structure between students of the current study and those of Rimm and Lowe (1988).

The student's family climate and family values reflect a higher proportion of findings of Rimm and Lowe (1988) — events such as birth, death, or serious illness, and these whilst still at the pre-school stage of development. Each student of the present study lost 'specialness' due to an event involving another family member. Rimm and Lowe found particular significance in the notion of 'specialness' which they suggest comes to children whose birth is greatly desired. They noted that one difference between the eminent gifted achievers of earlier studies and the underachievers of their study was that the underachievers lost their sense of 'specialness' for some family reason.

The focus students may have had a sense of 'specialness' during the first few years of life, as they were all males born into the sub culture of a farming family, where male children are highly valued. Each may also have experienced a loss of that 'specialness' to another family member. Tim, the only son in the family, may have felt displaced at age four by the long illness and eventual death of his grandmother, who was part of the extended family. Jake, the eldest and only son in his family, had to accommodate a baby sister at an early age. This little girl proved to have a more easy-going nature than did Jake. Daniel, the eldest male in his family, also had to accommodate a new sibling and may have felt displaced as the sibling was not only another male but also seriously ill from birth. Liam, although the third child in his family, is the only son and a high level of attention was directed toward him in his infancy, but he too may have lost a sense of 'specialness' to some extent by the arrival of a baby sister. This loss of 'specialness' may represent trauma and result in underachievement as suggested by Whitmore (1980).

With regard to family values, all students came from homes characterised by achievement oriented parents who had similar expectations of their children. Each family provided early enrichment and in each instance there was a shared interest between the student and at least one parent. The parents of the focus students were recognised within the community as being of high energy, all were regarded as a vital resource to the small community in which they lived. The evidence for this is demonstrated in responses to the parent questionnaire (see Appendix 1) and observed over the years by this researcher.

Questionnaire responses indicated that each family encouraged their children to aim high, set goals and work toward them, but not at the expense of everything else. A shared interest with a parent is a factor in the Rimm and Lowe study and each of the boys in this study shared an interest with his father beyond the daily work of the farm. For Tim this was tennis, for Liam it was hunting and for Jake and Daniel the common interest was in landcare.

Rimm and Lowe showed that eminent achievers had parents who espoused positive feelings in relation to their careers. On the other hand, parents of underachievers modelled frustration rather than satisfaction with their careers. This factor was deemed too intrusive and not included in the parent questionnaire for the current study. However, farming in most parts of Australia had been unrewarding for many years because, as reported in the media, climatic conditions and the economy had been unfavourable to rural industry. Many families who had farmed the same property for generations despaired of their sons being able to make a living from the property. Therefore, even though the parents were achievement oriented, of high energy and took an active role in community life, it is possible that the climate within the home may have lacked optimism and one or more parent may have felt frustrated by their career opportunities.

Rimm and Lowe found that the education level of parents in their study was similar to that of the eminent achievers in that all had a college education. In the current study, three of the four students had one or more parent with a university degree. The issue of optimism within the home may have been compounded by this, as the mothers of three students were practising teachers or nurses. In each case these professions, when pursued in a small country town in Victoria, offered little reward in terms of conditions and advancement opportunities.

These observations indicated that there are many characteristics in the home environment of the focus students which corresponded with the findings of Rimm and Lowe.

6.3.2 A comparison of the literature on behaviour characteristics of under achieving students in the classroom, with the focus students of this study.

Whitmore (1980) identified 20 behaviour characteristics commonly found in underachieving students. She suggests that if a student exhibits ten or more of these characteristics further evaluation should be conducted. The range of difference in behaviour characteristics demonstrated by the focus students made identification difficult in the early stages of the intensive study. However Whitmore's (1980) table, confirmed identification of the focus

students and established Daniel as a student who could justifiably be included. He had not previously been identified, possibly because as one of the youngest in the multi-age group his level of maturity tended to camouflage the characteristics.

	Tim	Jake	Liam	Daniel
1. Daily school work frequently poorly done or incomplete		✔	✔	✔
2. Large gap between oral and written work		✔	✔	
3. Superior understanding and retention of concepts when interested	✔	✔	✔	✔
4. Excellent general knowledge	✔	✔	✔	✔
5. Highly imaginative and creative	✔	✔	✔	✔
6. Poor test performance		✔	✔	
7. Achieving at or below grade level expectations in basic skills	✔	✔	✔	✔
8. Persistent dissatisfaction with work accomplished		✔		✔
9. Avoidance of new activities to avoid imperfect performance	✔			
10. Evidences self criticism and perfectionism		✔		✔
11. Shows initiative in pursuing self selected assignments	✔	✔	✔	✔
12. Wide range of interests and special expertise	✔	✔	✔	✔
13. Low self-esteem, tendency to withdraw	✔	✔	✔	✔
14. Show sensitivity in perception of others and life in general		✔	✔	✔
15. Tends to set unrealistic expectations		✔		
16. Dislikes practice work, drill or memorisation	✔	✔	✔	✔
17. Unable to focus concentration and effort on tasks			✔	✔
18. Poor attitude to school			✔	✔
19. Easily distracted			✔	
20. Difficulty in peer relationships		✔		
Total	**9**	**16**	**15**	**14**

Figure 6.3 Comparison of behaviour characteristics

Figure 6.3 shows the behavioural similarities and the differences in the students as a group. Initially the research tended to highlight the differences more than the commonalities. For instance Figure 6.3, (2) 'A gap between written and oral work', shows that neither Tim or Daniel demonstrated this characteristic. However, the similarity between the two students was not easy to identify as Tim's work was consistently of an acceptable standard in both

domains, whereas Daniel's work was consistently sub standard. This presented the dilema of two students each demonstrating the characteristic of consistentcy in their written and oral work, which identified them as having a common trait according to the Whitmore inventory. Yet their attitude toward school work and their work standards could not have been more diverse.

Figure 6.3 indicates that the students as a group shared eight characteristics of the 20 identified by Whitmore. Yet all but Tim had 14 or more of the characteristics identified on Whitmore's table. Only Tim had less than ten, the critical number suggested by Whitmore and two characteristics, 14 and 17 not included for Tim, might be applied but to a lesser degree.

Butler-Por (1993) and Zilli (1971) suggest that inappropriate teaching methods, which fail to maximise intellectual development or meet the need for freedom of choice in thinking mode and learning experiences, may result in student underachievement. Atkins (1994) asserts the importance of tapping into the student's preferred thinking and learning style.

Observation indicated that factors relating to the school environment may account for the poor motivation and consequent low level of academic performance of the focus students, when compared with their potential ability as demonstrated in action beyond the classroom. Behaviour characteristics identified in the focus students within the home environment demonstrate a significant difference from those at school as indicated in Figure 6.1. This table shows that characteristics of the focus students are similar to those reported in the literature on creative underachievers. Attention must be drawn to the use of the descriptor 'underachiever' as opposed to 'low achiever.' This is important in understanding the focus student, as 'underachiever' is a term advocated by Braggett (1992) Delisle (1992) Rimm and Lowe (1988) and Whitmore (1980) to differentiate between students who cannot perform — those of low ability — from those who could, but do not perform — underachievers.

A plausible explanation then for the enigma of low motivation in bright minded students is conflict in relation to their sense of self worth. Within the context of the family environment the students were respected as contributing members of the working team with a sense of responsibility and a measure of control. However, in school the traditional teaching–learning methods were inappropriate for these particular students, lacking cognitive challenge and resulting in poor motivation and underachievement.

6.3.3 In what ways did the introduction of a technoliteracy curriculum which emphasizes self-directed learning, influence the motivation of the students?

The technoliteracy approach to teaching and learning essentially gave students control of their own learning and this had a significant influence upon their level of motivation.

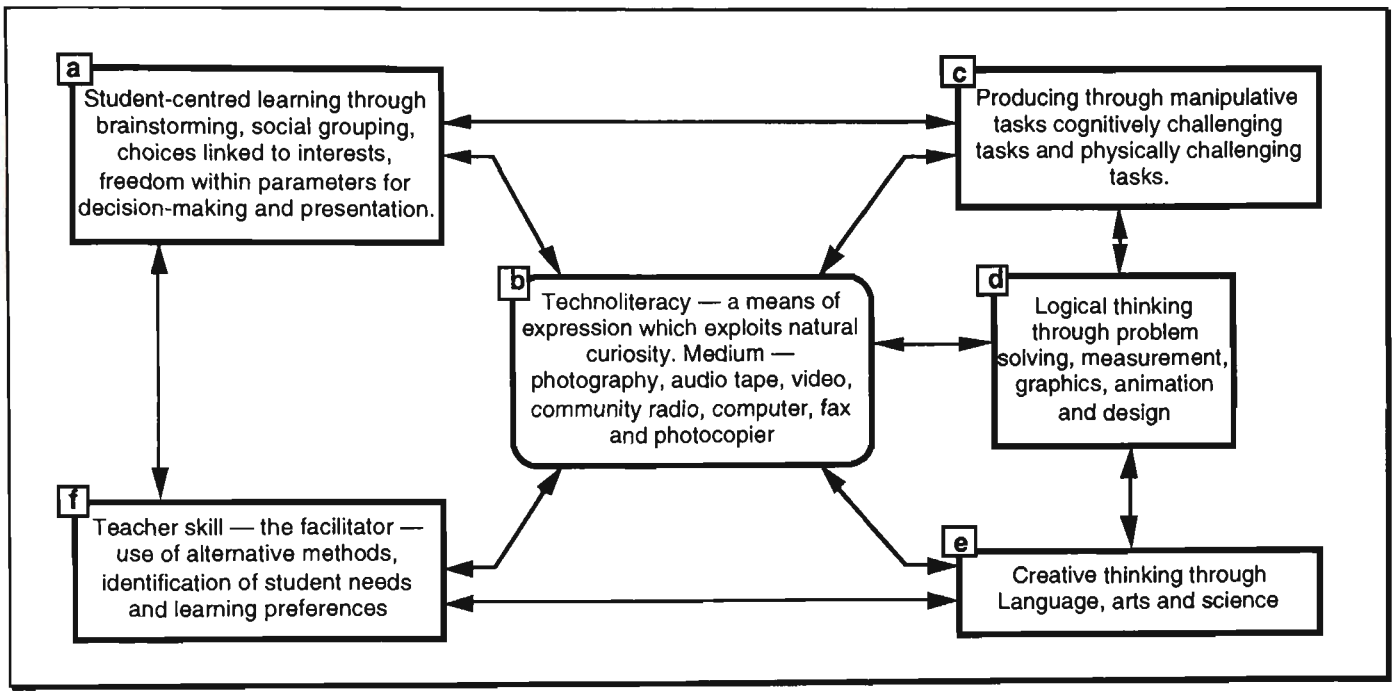

Figure 6.4 Motivation Development Chart

Figure 6.4 is a graphic representation demonstrating the process involved in the technoliteracy approach as it related to this research. It was developed to show that the technoliteracy approach to motivation of underachieving students, was a confluence of influences. The double arrows demonstrate that each factor was dependent upon the existence of others. Technoliteracy, whilst being central to the research, was reliant upon the existing knowledge, interest and talent of the students and the flexibility of the teacher within the learning environment. The perimeter cells of the graph may be related individually to the central cell or may be considered collectively in relation to the central cell. The intended outcome of higher motivation may be seen in Figure 6.5.

In Figure 6.4 cell (a) shows that technoliteracy grows from what the student brings to the learning situation. Each unit of work was based upon the students' ideas, interests, preferred social–working group and within the parameters of the unit, freedom to design and present a product.

Cells (c, d and e) identify the cognitive factors which were part of what the students brought to the learning situation — that is creative and logical thinking, physical and manipulative skills and desire for challenge. These factors have been identified separately on the chart as they are each a distinct

and different cognitive factor and existed in each of the focus students to varying degrees. Liam and David the two younger students, were still stongly influenced by the manipulative and physical tasks providing they were cognitively challenging. Tim was more influenced by those equally challenging tasks which were founded in logical thinking, whilst Jake was influenced to some extent by logical thinking but more so by creative thinking. Jake liked to think, talk and demonstrate his task and seek unlikely solutions.

Cell (f) shows the teacher's role as facilitator, which in itself was cognitively challenging. The teacher looked first at what the student could bring to the learning situation — interests, skills and preferred learning mode — then at the methods needed to enable the student to reach a given learning objective. Although each student had different needs and interests it was found that technoliteracy, which was purely the means of expression, enabled students to attain individual learning outcomes. The challenge of researching, interpreting and expressing self-selected content, provided the motivation that was needed for students to engage their fullest potential in the learning situation.

Braggett (1992) asserts that curriculum outside the normal school pattern may reveal previously unsuspected talent and interest. The level of intellectual talent demonstrated by students as a result of the technoliteracy curriculum was not unsuspected; the talent was hibernating. Once students saw real purposes for speaking, writing, reading and listening through the technoliteracy programme, the result was classroom work which was deeper, richer and much more considered. The product of each unit, which often took only a few minutes to present, represented in some cases many weeks of concentrated effort in production. Students who previously had rarely entered the library area voluntarily, would spend considerable time researching material for their presentation. One student was heard to complain that the library contained 'nothing recent'. Such observations had not been noted before. Technoliteracy stimulated within the students a need for quality of content. It did more than motivate them to participate; they were also motivated to produce at a much higher standard than previously.

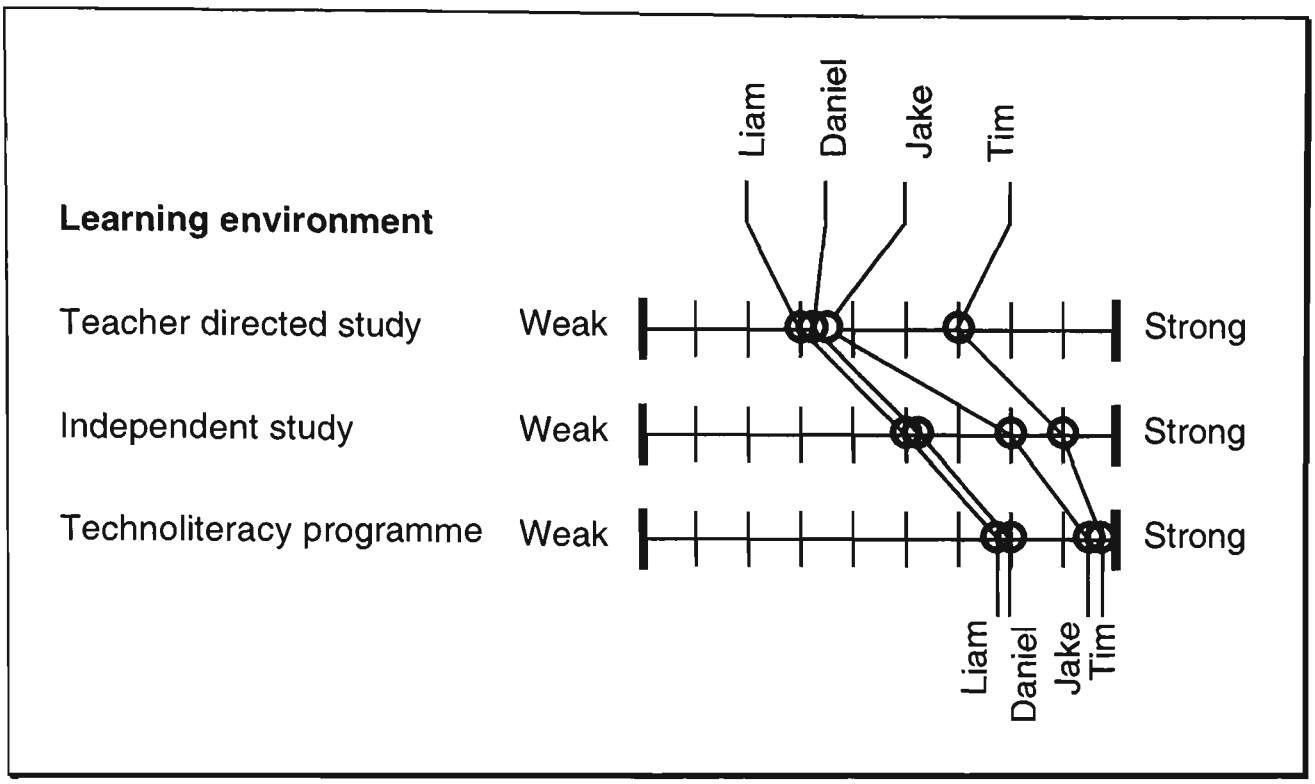

Figure 6.5 Comparison of student motivation in different learning environments

Figure 6.5 shows a summary of the perceived motivation of the focus students in terms of the traditional teacher-centred curriculum, independent research project work and the technoliteracy curriculum. The chart was constructed on the basis of evidence from other teachers and from the researcher's observations. The chart indicates that students' motivation on curriculum tasks was higher when they were working independently or within the student-centred technoliteracy curriculum. This suggests that the traditional teacher-centred curriculum, which requires convergent or conforming thinking, was not compatible with the learning needs and creative character of the focus students and may have masked high intellectual (creative) potential.

The introduction to this chapter drew attention to the essence of the research. That is, that students who first appeared to be low achievers were demonstrating symptoms recognised in the literature as indicators of high intellectual potential - specifically, creative thinking and leadership.

Delisle (1992) suggests that underachievement can often be a symptom of inappropriate curriculum, whilst Zilli (1971) found that two of the major causes of underachievement were inadequate curriculum content and a school atmosphere low in intellectual stimulation and challenge.

Whitmore (1980) supports these views, suggesting that traditional teacher-centred methods are inappropriate for the student who is capable of formulating his or her own hypothesis. She suggests that learning habits and skill may be improved if teachers utilise imaginative curriculum and teaching

methods and create a climate without threat which encourages freedom of expression. Whitmore makes it clear that the teacher, as agent for change, has an important role in reversing underachievement.

The student-centred focus of the technoliteracy approach resulted in learning outcomes which were well considered and richer than anything produced by these students previously.

6.3.4 How can the effects of the self-directed–technoliteracy curriculum on the motivation of individual students be explained?

Rowe (1993) puts forward the case for computers as a motivating tool and suggests they promote self-esteem and consequent cognitive development through a sense of mastery over one's environment. This is a simple but sound explanation of the effects brought about by the wider use of technology in the technoliteracy curriculum.

Sisk (1984), Betts (1985), Green (1986) and Delisle (1992) are among many researchers who identify the importance of student self-esteem in motivation. In their opinion high self-esteem and high achievement are intrinsically linked. Green asserts that the student's sense of self is influenced by the conditions to which they are exposed. The school environment created by the technoliteracy approach gave the students a strong sense of self, opportunities to set their own goals and leadership commensurate with their age and intellectual maturity.

	Tim	Jake	Liam	Daniel
Control	✔	✔	✔	✔
Mastery	✔	✔	✔	
Action–movement	✔		✔	✔
Power	✔	✔	✔	✔
Rules–order		✔	✔	✔
Adventure–exploration			✔	
Independence	✔	✔	✔	✔
Getting attention			✔	✔
Experimentation	✔	✔	✔	

✔ denotes child displays characteristic

Figure 6.6 Interest Inventory 'control theme variation' as demonstrated in focus students as a group.

Figure 6.6 shows that the focus students as a group demonstrate many characteristics identified by Cohen (1990) as factors critical to the intellectual growth of students with creative–thinking and leadership potential. This has

been discussed individually in the case-studies.

The technoliteracy curriculum gave the students scope for independence, action, adventure and experimentation — some of the factors identified by Cohen — and opportunity to use their initiative, originality and curiosity — further traits of the creative producer–thinker as described by Renzulli (1992) and Sisk (1984) in Figure 6.1.

Technoliteracy changed the learning environment which was fundamental to the focus students' heightened level of motivation. They were challenged by the curriculum and given sufficient freedom to set their own goals and pursue them. They learned the benefit of co-operation, could give and receive constructive criticism and make value judgements. They gained satisfaction from ownership and a sense of goal achievement which enhanced their self-esteem in the context of the classroom. This changed their underachieving behaviour and revealed their true academic potential.

The effect of a changed school environment may be demonstrated through Jake and Daniel — in particular how control of their own learning kept alive their unconscious goal of higher achievement. Each was frustrated by a different personal deficit and each exercised their creative thinking ability to harness the skill of the other to overcome this deficit. Daniel, one of the youngest in the class, could not command the respect at school which he enjoyed at home. However, he had some skill with the computer and this became his collateral. Daniel was seeking sophisticated content for his programme but could not satisfy his high personal demands, whilst Jake was frustrated by limited manipulative skills. With Jake as director and Daniel as technician a joint computer programme was produced; this partnership satisfied in each of them their need to be in charge. As a duo they created a product which met the high standards of each. The freedom to work alone or link up with another student, to solve the problem in their own way, kept these students motivated and their success enhanced their self-esteem.

The effect of the technoliteracy approach was a school environment in which the student's potential could reveal itself. Promoting self-esteem and motivation equal to that which had previously been demonstrated only in the context of the family environment.

7. Conclusion

The lifestyle of a functional farming family appears to create in the developing young of that family, characteristics which include high self-esteem and an independent thinking–learning style. Such an environment was not complemented by the traditional teacher-centered approach to education, which was the style of the school that the focus students attended. As a result, the students were nurtured in home and school environments which both conflicted and combined to develop the characteristics of high intellectual (creative) potential but low motivation toward scholastic achievement.

The study has shown that the technoliteracy curriculum enhanced the students' motivation and level of performance at school, demonstrating within the school environment motivation and interest towards academic tasks, similar to that which previously had been displayed only within the family farming environment.

Why was this so?

The literature suggests that self-esteem lies at the heart of the issue. The environment of an integrated work–family lifestyle, developed in the focus students a high level of independence and self-esteem from an early age. By contrast, the school environment tended to demand that the students be non-contributory, passive recipients of instruction imparted by the teacher, with little regard for the interests of the students as individuals. Whilst this style may be satisfactory for some students it was not appropriate for the focus students who, this study suggests, are of high intellectual potential.

Although this research has pinpointed the negative effect of a traditional approach to teaching and learning on these particular students, the research in no way apportions blame to other teachers. Teachers are also individuals, with their own culture and values. It is an unfortunate fact of life that a mismatch sometimes occurs between protagonists, whatever their field of endeavour.

7.1 What has this research contributed?

The contribution this research makes to the study of underachieving students is the recognition of students from farming families as a 'special population' or sub-group as identified by Sisk (1984). The teacher–researcher identified a special development pattern in students from farming backgrounds, and the relationship between this development pattern and

underachievement as opposed to low achievement. This is particularly important to students from similar backgrounds to those of the focus students and may also be relevant to students from quite different backgrounds whose learning needs are not met by an existing curriculum.

The original observation from the earliest stages of the action research which preceded this study, was that:

> **Boys from farming families who contribute to the labour force of that farm and who have knowledge, skills and talent relating to their farm life, tend to have poor academic skills and low motivation within the school environment.**

After some experimentation with different curricula, the first observation was followed by a second that:

> **Boys from farming families who have high intellectual potential perform less well in a traditional approach to education.**

The study draws together several intellective and non-intellective links which impact upon the students' motivation and consequent academic performance. They are

- a link between preferred learning and thinking style and self-esteem
- a link between self-esteem and underachievement
- a link between underachievement and high intellectual potential.

The research has established the success of a self-directed approach which provides an educational environment (in this instance a technoliteracy approach), conducive to successful experiences and consequent elevated self-esteem. An environment in which all students may achieve their ultimate potential in intellectual development and in which underachievement would, at the very least, be greatly reduced as a factor in educational outcomes.

7.2 Issues for further research

The validity of the present research could be enhanced by extending the same study to other rural primary schools. A further domain for research would be a focus on females from farming families where there are no male siblings.

Many students in the wider forum who appear to be working below their potential might benefit if their behaviour characteristics were assesed using Whitmore's (1980) checklist. In recent months the researcher has become aware of several parallels which may be drawn between those students identified as having 'Attention Deficit Disorder' (A.D.D.), a condition related to

classroom behaviour and currently treated medically, and the characteristics which first drew attention to the focus students of this study. The researcher has no expertise in the area of A.D.D., but it may be possible to overcome some of the symptoms by use of a self-directed interest-based curriculum such as the technoliteracy approach. In the wider world of the 'nineties' child so much is targeted at catching their attention through sensory bombardment; is it then so surprising that some students find it difficult to focus attention on matters which are not artificially stimulating?

Whatever educational diagnosis we assert as teachers, the paramount goal must be to provide the appropriate educational environment for individual students, not simply to assign them a label. As this thesis has demonstrated, such an environment can make a difference to student motivation and achievement.

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Appendix 1: Statements put to parents

The parent questionnaire listed 20 statements which were put to the parents of the four focus students in this study. These statements relate to creativity and are drawn from concepts raised in Renzulli (1992) and Sisk (1984).

They were asked to rate their child on the following scale of 1 to 5 for each of these statements.

1 — completely irrelevant
2 — not sure
3 — occurs sometimes
4 — fairly relevant
5 — highly relevant

1. Creative children sometimes resist closure on tasks; they may appear slow or unmotivated.
2. Creative children may have difficulty doing tasks which require a quick conclusion.
3. Creative children may have a well developed spoken vocabulary but be poor spellers.
4. Creative children may experience positive feelings from hard work.
5. Creative children may be optimistic about their ability to achieve goals.
6. Creative children may have a keen sense of purpose and direction.
7. Creative children may be very sensitive to human concerns.
8. Creative children may have a great deal of physical and mental energy.
9. Creative children may demonstrate resistance to structure and tradition.
10. Creative children may demonstrate a preference for older company.
11. Creative children may have a keen sense of humour.
12. Creative children may be flexible.
13. Creative children may set themselves very high standards and/or goals.
14. Creative children may demonstrate curiosity about anything and everything.
15. Creative children may show initiative.
16. Creative children may demonstrate independence from an early age.
17. Creative children may have a retentive memory.
18. Creative children may adopt a mentor.
19. Creative children often come from high energy families.
20. Creative children often have parents who value high achievement.

Appendix 2: Questions put to student

These questions were put to students as part of one week's language work, a few each day. The students wrote their responses informally and were aware that it was part of the research. The questions were based on the work of Rimm and Lowe (1988) and Delisle (1992) they relate to family structure, family climate, family values, self concept and personal preferences.

1. W ho are the members of your family ?
2. Tell us a little about your family.
3. Who is your favourite person in the family?
4. Who do you spend most of your time with when you are at home?
   - Is there an adult that you enjoy being with.
   - Do you do things you enjoy with an adult?
   - Do you talk about interesting things together?
   - W hat sort of things do you do with your parents?
5. Do you have grandparents living close to your home?
   - Do you have other relations living close to your home?
6. Does your family do things with relations sometimes?
7. Do you have a friend near home?
8. What sort of things do you do together?
9. What do you think makes your family special?
10. Who do you most like to play with at school?
11. Do you have a big wish about your family?
12. Do you have jobs to do at home?
13. Which of your parents would you ask if you wanted a favour?
14. Do you like maths and science things best or reading writing things best?
15. What kinds of things do you like to do most?
16. Would you say most people like you?
17. Do you think these are the best questions to give people a good idea about your family?

    If you think there are some other important things about your family, you may like to write them here.

Appendix 3: First letter to parents

RMB3610
Euroa 3666
July 20th 1994

Dear

As you may be aware during term two I spent some time with students at Merton Primary School, introducing them to a new computer program. This is related to work I am doing at the Victoria University of Technology, looking at rural children and the use of computers for the purpose of collecting information to be used in the research.

The university's ethics committee requires that written permission be obtained for all research involving human subjects and for this reason I am writing to seek your permission to observe your child / children, to record my observations and to use the information collected in writing a thesis. If you are willing to give this permission would you sign the form below and return it to school as soon as possible.

Regards

Shirley Herbert

I / we———————————————————————————

give permission for Shirley Herbert to observe our child / children

name(s)———————————————————————————

for the purpose of gathering information relating to the use of technology in education. I understand that this information will be used in writing a thesis

signed ———————————————————————————

Appendix 4: Second letter to parents

Willowra School
via Alice Springs
N T 0872
November 15th
1995

Dear

You may recall that last year I was doing some research through the Victorian University of Technology and you were good enough to give your permission for_____ to take part. I was seeking particular attributes and responses from the students and finally narrowed it down to four, of which _____is one. I am now in the writing up stage and would appreciate it if you could find the time to complete this questionnaire.

I had intended to be finished by now but the work here is very demanding and my pace has slowed. Hope all continues to go well at Merton, I often think about you all and in particular my years at Yarck.

Best wishes for the festive season.

Regards

Shirley Herbert

STUDENT NAME _____

OVERVIEW

SEE SUPPORTING EVIDENCE

GENERAL INDICATORS-CHIP.(children of high intellectual potential)

General abilities identified by classroom teacher

Weak |----|----|----|----|----|----|----|----|----| Strong

Special ability, as reported by:-

Student _____

Parent _____

Teacher____ _____

Task commitment

Teacher-directed study. Weak |---|---|---|---|---|---|---|----|---| Strong

Independent study. Weak |---|---|---|---|---|---|---|----|---| Strong

Using Technology Weak |---|---|---|---|---|---|---|----|---| Strong

* O/head projector unit Weak |---|---|---|---|---|---|---|---|---| Strong

(Shadow puppets).

* Dramatised story unit Weak |---|---|---|---|---|---|---|---|---| Strong

(slide film & audio tape).

* Computer Unit. Weak |---|---|---|---|---|---|---|---|---| Strong

* Video unit Weak |---|---|---|---|---|---|---|---|---| Strong

*Live Radio unit Weak |---|---|---|---|---|---|---|---|---| Strong

Interests & Hobbies?

_____

_____

Attention Seeking behaviour?

_____

_____

Environment factors

Mentors _____

Responsibility at home?

_____

_____

Do parents value school achievement

_____

High energy family involved outside home

_____

Creative traits evaluation criteria

The student demonstrates	
Resistance to structure and tradition	
Friendliness	
Preference for older company	
A sense of humour	
Flexibility	
A long memory	
Curiosity	
Sensitivity	
High personal goals	
Originality	
Initiative	
Independence	

Technology Evaluation Criteria

The student demonstrates	
Can demonstrate skill with technical equipment	
Apples knowledge purposefully	
Can discuss and demonstrate own programme	
Can assess software in relation to own product and make suggestions for improvement.	
Incorporates use of own experience	
Work is distinctive	
Explores technology freely	
Demonstrates confidence in the learning situation	

Appendix 6: Sample hard copy of students' work

Focus students writing for the slide–audio production.

This is a transcript of the audio tape and was the students first attempt at writing for performance. They adopted a holistic approach, the catalyst being the available settings. ie. the school dam (from whence the dragon arose), a disused church opposite the school (for the king's palace), the school pony paddock (for the journey).

The Two Brothers

by Tim, Daniel and Jake

Narrator and Tom played by Tim

Dragon and David played by Daniel

The King played by Jake

Troll and lizard man played by Brock

[Opening music]

King: Right, I'm sending you two brothers to capture the dragon.

David & Tom: Okay.

Narrator: So the two brothers set off.

Tom: I'll go looking for food David.

David: Okay, Tom. Ahhggg! Something got me; I'll have to fight it.

Narrator: David did not know it was tree monster. David killed the tree monster.

David: Whew that was hard work.

Tom: Didn't find any food David.

Narrator: David and Tom were in a swamp when something grabbed David.

David: Ahhgg something has got me again.

Narrator: R-o-a-r, David and Tom fought the swamp monster and killed it.

Tom: Now where do we go David.

David: Look over there; there's a set of ice.

Tom: Let's follow it.

Narrator: David and Tom followed and cornered the dragon.

David: Now let's kill it.

Narrator: David and tom caught on fire, they grabbed the dragon.

Tom & David: Ahhgg!

Narrator: The dragon couldn't swim and drowned.

Tom: Let's go home.

Narrator: Suddenly a troll jumps out.

Tom: David, hit him with your super axe.

David: Okay.Boing!

Narrator: The troll had a sword as well.

Troll: R-o-a-r, r-o-a-r

Narrator: There was a big fight and David got killed. So did the troll.

Tom: Poor David I'll bring him back to life.

David: Y-o-w-e-e!

Narrator: So David and Tom made camp. While they were sleeping some thieves stole the food but David tried to stop them. There was another fight. David and Tom caught the leader and brought him back to the king.

King: I've decided to chop off your head with the super axe.

Lizard man: No! please I'll do anything ...

King: Die!

Narrator: David and Tom lived in peace the lizard man and the dragon didn't.

[Closing music]